Costs and outcomes of sexually transmitted infections control programmes: How can local decision-making in England be better informed?

by

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Abstract

Sexually transmitted infections (STIs) can cause ill-health and life-long disabilities including infertility. Previous research has highlighted limitations in the evidence base. This thesis aimed to identify and develop approaches for understanding the costs and outcomes of STI control programmes to inform local decision-making in England.

A systematic review assessed economic evaluations of STI control programmes which demonstrated wide heterogeneity in approaches evaluating costs and outcomes. Interviews with sexual health decision-makers showed that considerations of broader outcomes for economic evaluations were often overshadowed by immediate budget pressures. Including costs relevant to local areas was identified as important. Interviews with academic health economists and public health researchers highlighted challenges and provided recommendations particularly around the need to understand decision-makers' objectives when developing economic evidence. An early costing model was developed to illustrate the costs associated with three care pathways for STI screening. The model demonstrated the complexity of current care pathways and highlighted that accessing services online bears the lowest cost but also the lowest net monetary benefit. The research developed key recommendations in relation to a range of methods to examine the value of sexual health interventions to inform future research in this area.

Declaration

This is to certify that:

I. This thesis comprises only my original work towards the Degree of Doctor of Philosophy;

II. Due acknowledgement has been made in the text to all other material used;

III. The thesis is fewer than 80,000 words in length, exclusive of tables, figures, references and appendices.

Sonja Charlotte Margot Bloch

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Publications to date

The PhD has resulted in the following research outputs:

In press

- **Bloch SCM,** Jackson LJ, Frew E, Ross, JDC. Assessing the costs and outcomes of control programmes for sexually transmitted infections: a systematic review of economic evaluations. Sexually Transmitted Infections. Published Online First: 02 March 2021. doi: 10.1136/sextrans-2020-054873.
    - Based on Chapter 4.

Papers planned

- **Bloch SCM**, Jackson LJ, Frew E, Ross, JDC. Challenges and opportunities developing economic evaluation methods for public health programmes: a UK qualitative study with researchers in health economics and public health.
    - Based on Chapter 6.

- **Bloch SCM,** Jackson LJ, Frew E, Ross, JDC. Public health decision-makers' perspectives on approaches to economic evaluation for sexually transmitted infection control programmes.
    - Based on Chapter 5.

- **Bloch SCM,** Jackson LJ, Frew E, Ross, JDC. Care pathways of screening for sexually transmitted infections: An early economic model and disaggregated cost-analysis.
    - Based on Chapter 7.

Conference presentations

- **Bloch SCM,** Jackson LJ, Frew E, Ross, JDC. *Public health decision-makers' perspectives on approaches to economic evaluation for sexually transmitted infection control programmes*. Poster session presented at: STI & HIV 2021 WORLD CONGRESS, 14-17/07/2021, Online**.**

- **Bloch SCM,** Jackson LJ, Frew E, Ross, JDC. *Challenges and opportunities with developing economic evaluation methods for public health programmes: a UK qualitative study with health economists*. Poster session presented at: iHEA 2021 Congress, 12-15/07/2021, Online**.**

- **Bloch SCM**, Jackson LJ, Frew E, Ross, JDC. *Control programmes for sexually transmitted infections: How to support local decision-makers in resource allocation*. 3 Minute thesis presentation: Institute of applied health research 2021 PGR Development Week, 21-25/06/2020, University of Birmingham; Awarded 2nd prize.

- **Bloch SCM**, Jackson LJ, Frew E, Ross, JDC. *Qualitative interviews with sexual health decision-makers to understand their priorities for economic evidence*. Presentation at: Institute of Applied Health Research qualitative researchers lunch, University of Birmingham; 06/2021, Birmingham.

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Table of contents

List of figures

List of tables

Nomenclature and frequent abbreviations

Health economics

- Cost-benefit analysis, CBA – Form of economic evaluation, which assessed the costs and benefits in monetary units.
- Cost analysis – Analysis of the costs involved in a health programme, care pathway etc.
- Cost-effectiveness analysis, CEA – Form of economic evaluation, which assessed the costs and benefits in natural units.
- Cost-utility analysis, CUA – Form of economic evaluation, which assessed the costs and benefits in utilities.
- Economic evaluation – Assesses the costs and benefits (outcomes) of a health programme or drug.
- Economic evidence – Is generated when conducting an economic evaluation and can support decision-making processes.
- Incremental cost-effectiveness ratio, ICER – Divides differences in costs and outcomes and functions as a decision rule.

Public health and sexual health

- Control programmes/ interventions – Focus on the screening and testing of the general population or high-risk groups to detect STIs.
- Online postal self-sampling, OPSS – A service user orders a self-sampling kit via an online SHS and tests themselves with the self-sampling kit.
- Screening – To test individuals who do not have symptoms for an infection.
- Self-sampling (kit) – A service user does take a sample by themselves to be tested for an STI.
- Sexual health services, SHS
- Testing – To identify an infection within individuals who show symptoms.

Sexually transmitted infections and HIV

- Chlamydia infection caused by *Chlamydia trachomatis* bacteria.
- Gonorrhoea infection caused by *Neisseria gonorrhoeae* bacteria.
- HIV caused by the *Human immunodeficiency* virus.
- Sexually transmitted infections, STIs – There are a number of STIs. The focus in this thesis are chlamydia, gonorrhoea, syphilis, and HIV.
- Syphilis caused by *Treponema pallidum* bacteria.

Stakeholders in England for sexual health decision-making

National decision-makers:

- British Association of Sexual Health and HIV, BASHH
- British HIV Association, BHIVA
- Faculty of Sexual and Reproductive Healthcare, FSRH
- Department of Health and Social Care, DHSC
- National Health Service, NHS
- National Institute for Health and Care Excellence, NICE
- Public Health England, PHE now UK Office for Health Improvement & Disparities (OHID) and Health Security Agency (UKHSA). This thesis was started in autumn 2018. Responsibility for sexual health services transitioned to UKHSA in summer 2021. Therefore, the main designation utilised throughout this thesis was PHE.
- Terrence Higgins Trust, THT

Local decision-makers:

- Local authorities, which are represented by Directors of Public Health
- Local commissioners of sexual health services
- Local providers for sexual health services, including hospital trusts (also called NHS trusts) or private providers

CHAPTER 1
Introduction, thesis aims, and outline

1.1. Introduction

Sexually transmitted infections (STIs) can cause ill-health and life-long disabilities including infertility. The health consequences of acquiring an STI are a medical and psychological burden not only on the individual patient but also on society. In England, approximately 468,000 diagnoses of STIs (including chlamydia, genital warts, genital herpes, gonorrhoea, syphilis, and human immunodeficiency virus [HIV]) were recorded in 2019 and STI diagnoses have increased annually by 5% since 2017 (Mitchell et al., 2020). Neglecting the prevention and control of STIs has the potential to result in a significant economic burden. It is estimated that between 2016 and 2017, the treatment of STIs cost the English National Health System (NHS) £374 million (PHE, 2021). Programme costs for controlling the spread of STIs, including online based screening for STIs utilising self-sampling kits, are frequently assumed to be cost-effective but current evidence is limited.

This thesis aimed to identify and develop approaches for understanding the costs and outcomes of STI control programmes to inform local decision-making in England. This opening chapter introduces the context of decision-making for sexual health services (SHS) in England and presents the currently available economic evidence.

1.2. Sexually transmitted infections (STI) control programmes

For the detection of STIs, control programmes focus on the screening and testing of the general population or high-risk groups. Theoretically, testing and screening are two distinct terms. ‘Screening’ generally relates to individuals who do not have any symptoms, and for some STIs such as chlamydia, the majority of those infected may not realise that they have the disease (Mylonas, 2012; Raffle and Gray, 2007; Gilbert et al., 2001). In contrast, the term ‘testing’ is generally used to identify an infection amongst those individuals who present for medical attention with symptoms (Mylonas, 2012; Gilbert et al., 2001).

Currently, both testing and screening are frequently used terms in studies, but they are often used interchangeably, without a clear differentiation. This might be because the situation in sexual heath is complex, as due to stigma, people might ignore or down-play symptoms. It seems that in a number of studies, there is no strict separation between the two terms which is why this research project includes both (Llewellyn et al., 2013; Elwy et al., 2002; Cohen et al., 1999). The aim was to ensure that all relevant information is incorporated when considering the most relevant method for collecting cost and outcome data of STI control programmes. Further explanation of STI control programmes is given in Chapter 2.

SHS provide a number of services including the prevention and treatment of STIs to improve and maintain the population’s sexual health. The commissioning of these services is typically divided between national and local health authorities and varies between countries and local contexts (WHO, 2010).

Increasing timely uptake of STI screening and testing is a key public health aim and is reflected in a series of performance indicators by the UK Department of Health and Social Care (DHSC) in terms of the number of chlamydia diagnoses in 15 to 24 year olds (DHSC, 2013, 2016). Through appropriate testing and screening, an infection can be detected earlier, which will therefore lead to better treatment outcomes, prevent possible complications, as well as reduce the onward transmission of the infection (DHSC, 2016). Further information on the indicators can be found in Chapter 2, Section 2.6.6. In England, responsibility for sexual health is spread across the healthcare sector and local authorities. For example, the NHS is in charge of HIV treatment whereas screening for STIs including HIV is commissioned by local authorities.

1.3. Changes in decision-making in England for sexual health services (SHS)

Over the past years, SHS have been subject to substantial changes: prior to 2012, SHS were commissioned by the NHS via primary care trusts (PCTs) mainly in the form of centralised genitourinary medicine (GUM) clinics (Robertson et al., 2017; PHE, 2013). Since 2013 following the 2012 Health and Social Care Act, in England, many responsibilities for sexual health and additional public health responsibilities have been transferred to local authorities (PHE, 2013; Robertson et al., 2017). Besides GUM services, local authorities commission additional SHS from their budget for public health. These include sexual health advice, promotion and prevention as well as contraception services (Robertson et al., 2017). Some SHS are not commissioned by local authorities including the treatment of STI sequelae, such as pelvic inflammatory

disease (PID), which is paid for by clinical commissioning groups (CCGs). Services for abortion as well as treatment for HIV are covered by the NHS (PHE, 2013).

The main requirements of this new way of commissioning SHS at the local level following the changes in 2012 are stated in the Framework for Sexual Health Improvement in England by the Department of Health (DoH) – now DHSC. These include that local authorities must meet the needs of their local population in the provision of SHS. A key and unique feature of SHS is that they should be characterised by “open-access sexual health (STI and contraception)” (DHSC, 2013, p.7). This means that service users can access services irrespective of where they live and do not require a GP referral. The DHSC describes the provision of SHS as complex due to its wide ranging dimensions including prevention, treatment, and consultancy services as well highlighting the diversity of service providers (DHSC, 2013). In England, SHS are provided by a variety of entities and organisations such as pharmacies, general practice, acute hospitals, community services as well as the independent, non-governmental, and charitable sectors (PHE, 2013).

1.4. Budget pressures

Since the changes in commissioning of SHS, budgets for sexual health programmes are no longer managed at the national but at the local level (Robertson et al., 2017). Although public health budgets are theoretically ring-fenced, these budgets have experienced reductions. In addition, definitions of ‘public health services’ can be wide ranging (Robertson et al., 2017). In reality this means that SHS have faced increasing financial pressures and have needed to compete for funding with a range of other

services, which are also managed by local authorities (BMJ, 2017). As a result, a number of local authorities have cut their budgets for sexual health programmes (PHE, 2017a). Simultaneously, there is a growing demand for SHS and the number of diagnoses of STIs has risen (Robertson et al., 2017; BMJ, 2017).

As pressures on local health budgets grow, there is a need to find the most cost-effective ways to promote good sexual health, carry out STI screening and testing, and treat infections. The solutions for preventing transmission of and infection with STIs should not only focus on the effective prevention of STIs but also on being cost-effective[1].

1.5. Economic evidence for sexual health control programmes

SHS like other public health programmes are complex in nature. They act on several levels of healthcare service provision including prevention, screening, and treatment. The aims of such interventions often reach beyond healthcare making the evaluation challenging (Edwards, Charles and Lloyd-Williams, 2013). For the purpose of this thesis and on the basis of the nature of SHS, STI control programmes can be described as complex interventions because they involve interlinked services of care and are provided by multiple organisations (Payne, McAllister and Davies, 2013). Standard approaches for economic evaluation of public health interventions have been scrutinised for neglecting aspects beyond health outcomes (Edwards, Charles and Lloyd-Williams, 2013; Lorgelly et al., 2010; Weatherly et al., 2009).

[1] Cost-effective interventions in a public health context refer to good value for money (Drummond et al., 2015).

Economic evaluations are defined as assessing both the costs and outcomes (also called benefits or consequences) of health technologies, programmes, and similar courses of action, which are compared with possible alternatives and the alternatives' respective costs and consequences (Drummond et al., 2005).

A range of limitations associated with standard approaches for economic evaluations have been highlighted by previous research. For standard economic evaluations the general outcome measure utilised is quality-adjusted life years (QALYs)[2] (Uthman et al., 2018; Audisio et al., 2016; Bailey et al., 2016; Grauvogl et al., 2015). These standard economic analyses often do not take into account the complexity of the context in which local decisions are made and fail to consider aspects of equity in the evaluation (Williams and Bryan, 2015; Cookson, Drummond and Weatherly, 2009). It is crucial to understand this to reflect the changes from national to local decision-making in health promotion and disease prevention, and the associated change in allocation of resources (Walensky, 2009). Moreover, previous research has highlighted the small existing base of robust evidence to inform many public health programmes, for example economic evaluations in relation to the outcomes of STI screening programmes (Jackson et al., 2014).

Traditionally, economic evaluations have been a basic requirement for introducing new pharmaceuticals (Drummond et al., 2015). However, during the last two decades, greater pressures on budgets as well as changes in decision-making processes have

[2] A QALY is a general measure of a person's or group's state of health. The benefits are expressed as lengths of life and to reflect the person's or group's quality of life, they are adjusted accordingly (NICE, 2019a).

resulted in an increased need for economic evaluations in a public health context (Drummond et al., 2015). Evidence on cost-effectiveness supports applications for funding, reimbursement as well as overall decision-making (Drummond et al., 2015).

Although evaluations in health economics are used to inform decision-making at the national level, present economic evaluations are rarely considered by local decision-makers (Brousselle and Lessard, 2011; Williams et al., 2008). Various reasons for this have been suggested such as the complexity of the methods, and their accessibility as well as time constraints (Eddama and Coast, 2009; Chen, Ashcroft and Elliott, 2007). Several studies show that decision-makers prefer an emphasis on overall value, acquisition of costs, burden of disease, and affordability in the evaluation of public health programmes. In addition, they aim to address aspects of equity (Eddama and Coast, 2009, 2008; Chen, Ashcroft and Elliott, 2007; Drummond et al., 2003).

The situation described above in relation to budgetary pressures, the lack of robust economic evaluations of public health programmes, and the requirements of public health decision-makers demonstrate the need to explore and develop suitable methods for economic evaluations in this area, and particularly for sexual health programmes. This research needs to also consider aspects relating to applicability and feasibility in the context of decision-making responsibilities for sexual health control programmes.

1.6. Aims and objectives of this thesis

This research project aimed to develop approaches for evaluating sexual health programmes which particularly relate to the screening and testing of STIs in different

settings to produce evidence that is meaningful for local decision-makers. The research focused on SHS in England and not on the UK as a whole due to the differences in commissioning of services among the different home nations. This thesis concentrated particularly on one aspect of SHS which is screening and testing for the most common STIs in England. The main STIs tested and screened for in this context are chlamydia, gonorrhoea, syphilis, and HIV.

The research had four main objectives:

1. Critically appraise the economic evidence used to inform local decision-making in relation to screening and testing interventions utilised to control STIs;
2. Identify decision-maker priorities for the development of economic evidence for STI control programmes;
3. Analyse the views and recommendations of heath economists and public health researchers for the development of economic evidence for local sexual health decision-makers;
4. Develop a case study, working with a local provider, to examine how an economic evaluation of a STI control programme could be designed to meet the needs of local decision-makers.

This thesis aimed to answer the following research question:

How should economic evidence relating to control programmes for sexually transmitted infections be developed and collected so that it is meaningful for local decision-makers?

In this thesis, meaningful evidence refers to evidence that is useful for local decision-makers who are responsible for the commissioning and provision of SHS.

1.7. Approach and design

This research used comprehensive methods to achieve its objectives. An overview of the methods is presented in Figure 1.1. The thesis began with setting the scene on the most recent research and literature on STIs (Chapter 2) and economic evaluations (Chapter 3). A range of qualitative and quantitative techniques were then adopted, divided into four overarching phases: a systematic literature review (Phase 1), interviews with decision-makers in sexual health (Phase 2), interviews with researchers in health economics and public health (Phase 3), and a case study of an early economic model (Phase 4).

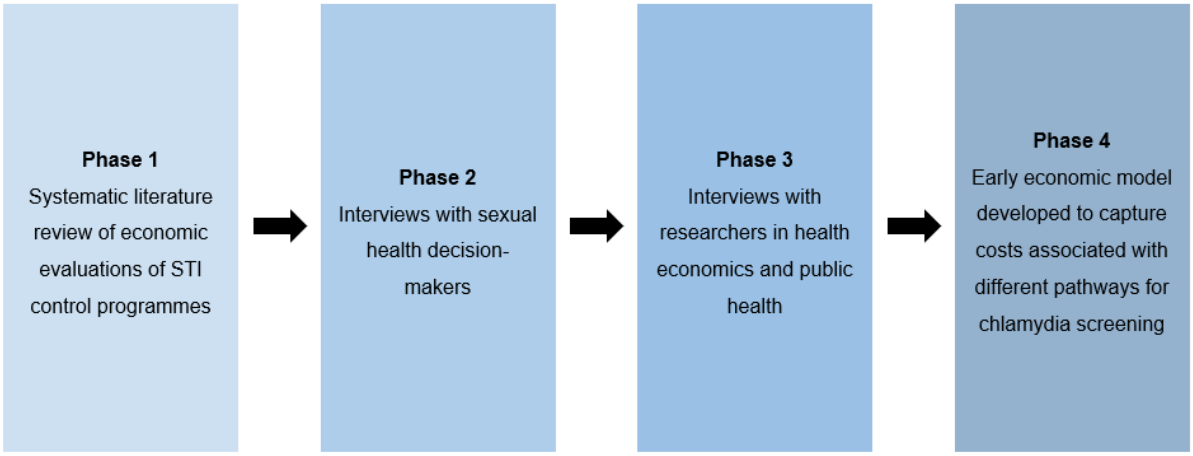

Figure 1.1. Empirical research plan.

Notes: STI, Sexually transmitted infection

Table 1.1 provides an overview of the objectives of the thesis and how these correspond to the main research phases.

Table 1.1. Thesis objectives and corresponding method

Objectives	Method
1. Critically appraise the economic evidence used to inform local decision-making in relation to screening and testing interventions utilised to control STIs.	1. Systematic literature review on economic evaluations of STI control programmes.
2. Identify decision-maker priorities for the development of economic evidence for STI control programmes.	2. Interviews with sexual health decision-makers.
3. Analyse the views and recommendations of heath economists and public health researchers for the development of economic evidence for local sexual health decision-makers.	3. Interviews with researchers in health economics and public health.
4. Develop a case study, working with a local provider, to examine how an economic evaluation of a STI control programme could be designed to meet the needs of local decision-makers.	4. Early costing model developed to capture costs associated with different pathways for chlamydia screening.

1.8. The corona virus pandemic and impact on SHS

This PhD aimed to explore methods for economic evaluations of sexual health programmes to inform local decision-making. The research for this thesis began during the onset of the corona virus (COVID-19) pandemic, which caused the first lockdown in England in March 2020. The pandemic had a profound impact on SHS. Face-to-face services were drastically reduced or closed down due to changes in healthcare professionals' capacity, i.e., due to re-deployment, as well as to limit the spread of the virus. SHS introduced phone services, which enabled the triaging of patients to face-to-face, online postal self-sampling (OPSS) or to phone consultation services (BASHH, 2021).

Data on STIs/HIV is routinely reported by Public Health England, which since 2022 became the UK Health Security Agency (UKHSA) and Office for Health Improvement and Disparities (OHID). This research began in 2018 and applies Public Health England or PHE to refer to this organisation. The reference data for STIs is from the year 2019 because from 2020 onwards the pandemic was present, which impacted SHS and therefore reduced screening and testing rates. This is why, to describe the epidemiology of STIs throughout this thesis mostly data from 2019 is used.

1.9. Outline of the thesis

Chapter 1 introduces the key concepts and rationale for undertaking the different elements involved in this thesis. The following chapters summarise the different research findings beginning with setting the scene on STIs, SHS, and health economic evaluations, followed by a systematic review, two qualitative studies, and an early costing model. The thesis ends with a final discussion chapter summarising all results and circling back to the overall research question and objectives of this thesis.

Chapter 2 provides an overview of the main STIs and HIV covered in this thesis. It defines sexual health, STI control programmes, and decision-makers for SHS. It also discusses the role of SHS, the new modes of delivering SHS, the decision-making process and recent changes in an English context as well as gives a local example of a SHS in England.

Chapter 3 summarises the main concepts and theories concerning economic evaluations and where these are placed within the discipline of health economics. It

provides the rationale for why economic evidence is needed for public health programmes and presents the main types of economic evaluations that are used in this area. It discusses the limitations of current approaches to evaluate public health programmes and highlights the uniqueness of SHS.

Chapter 4 presents a systematic review of economic evaluations, which assessed the costs and outcomes of control programmes for STIs. It discusses 33 economic evaluations of STI control programmes, their main study characteristics and methodology applied, and critically appraises the studies.

Chapter 5 describes interviews with sexual health decision-makers at the national and local level in England. It explains the interview method, ethical considerations, and theoretical underpinnings. The findings are presented as three main themes and then discussed highlighting the similarities and differences with previous studies in this area.

Chapter 6 presents the interviews with academic health economists and public health researchers in the UK. It discusses the current development of methods for economic evaluations of sexual health programmes and describes how the needs of local public health decision-makers can be considered in an economic evaluation. It presents specific recommendations on what to consider when developing economic evidence. The findings from the two sets of interviews are then contextualised in terms of how current approaches for economic evaluations may be improved to be more meaningful for local decision-makers in England.

Based on the decision-maker and researcher interviews, a case study was undertaken to examine methods to inform decision-making in a local area. An early costing model was developed to show a patient's care pathway when accessing STI screening and the associated costs, which is presented in Chapter 7. The pathway was exemplified by an asymptomatic heterosexual woman accessing chlamydia testing. Results on patient activity from a SHS are presented along with a cost analysis of three distinct pathways. The chapter discusses the results of the costing analysis and provides recommendations for sexual health decision-makers.

In Chapter 8, the final chapter of this thesis, the main findings from this research are discussed and synthesised to provide recommendations for future economic evaluations for STI control programmes. It describes the impact of this research on current literature, approaches for economic evaluations in a sexual health context, and how the findings may be utilised by decision-makers for SHS.

CHAPTER 2
Overview of STI control programmes and SHS

2.1. Introduction

This chapter sets out the context for this thesis by providing an overview about sexual health, STIs (chlamydia, gonorrhoea, syphilis and HIV) as well as their prevention and control. It describes the inequalities in health and vulnerable groups in relation to STIs. Further, it outlines the role of SHS internationally and the commissioning structures in England. Given the timing of this PhD research, the chapter then assesses how the COVID-19 pandemic impacted on service provision. Finally, a local example of a SHS is outlined to illustrate how the services are provided in practice.

2.2. Sexual health

This thesis focuses on SHS as part of public health. Therefore, it is important to firstly consider what is meant by ‘sexual health’. Good sexual health is defined by the World Health Organization (WHO) as:

> “A state of physical, emotional, mental and social wellbeing in relation to sexuality; it is not merely the absence of disease, dysfunction or infirmity. Sexual health requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe

> sexual experiences, free of coercion, discrimination, and violence. For sexual health to be attained and maintained, the sexual rights of all persons must be respected, protected, and fulfilled" (WHO, 2006, p.5).

The definition above shows that the term 'sexual health' is viewed holistically in combination with 'reproductive health and rights'. The rights aspect is a vital part of guaranteeing that every person's sexual and reproductive health needs are met, such as ensuring access to related information and services (Cottingham et al., 2010; WHO and UNFPA, 2010). In this thesis, 'sexual health' which also encompasses reproductive health is used as the main term throughout. The term 'reproductive health' often has a narrower focus solely on contraception. This, however, neglects the sexual health needs of younger or older generations which is why 'sexual health' is the preferred term (WHO, 2006). Recognising and adhering to the WHO definition, PHE defines SHS as "the provision of services around contraception, relationships, sexually transmitted infections (including HIV) and termination of pregnancy" (PHE, 2018a).

2.3. Sexually transmitted infections

STIs are a threat to human health and particularly to females and infants (WHO, 2018b). With more than thirty sexually transmissible parasites, bacteria, and viruses, the symptoms in infected patients vary from no symptoms, to mild or acute states (WHO, 2018b). The infections which are transmitted primarily by sexual contact can cause ill-health and life-long disabilities including infertility. The health consequences of acquiring an STI are both a medical and psychological burden not only for the individual patient but also for society as a whole (WHO, 2018b). In addition, the use of

antibiotics to treat many STIs and increasing antimicrobial resistance (AMR) puts additional pressures on decision-makers worldwide to find solutions to combat STIs (WHO, 2018a; PHE, 2014a).

There are four STIs most commonly tested for in the UK: chlamydia, gonorrhoea, syphilis, and HIV. These STIs and HIV were chosen as a focus for this thesis because they are the most prevalent and/or serious STIs in OECD countries (European Centre for Disease Prevention and Control, 2020a; b). A short description of the main characteristics of each infection is given in Table 2.1.

Table 2.1. Main characteristics of STIs

Infection	Description	No. of cases in England 2019	Sequelae in women*	Sequelae in men*	Screening/ Testing rate in England 2019
Chlamydia[1,3]	Caused by *Chlamydia trachomatis* bacterium	Women 126,067; Men 101,429; Total[4] 229,411	Cervicitis, urethritis, PID, chronic pelvic pain ectopic pregnancy, pre-term delivery, tubal factor infertility	Urethritis, epididymitis	1,339,931 chlamydia tests among young people (15 to 24 years), a 13% decline from 2015
Gonorrhoea (gonococcal infection)[1-3,5]	Caused by *Neisseria gonorrhoeae* bacterium	Women 19,191; Men 51,480; Total 70,936	PID, chronic pelvic pain ectopic pregnancy, pre-term delivery, tubal factor infertility	Urethritis, epididymitis	NA
Syphilis[1,3,7]	Caused by *Treponema pallidum* bacterium	Women 684; Men 7,272; Total 7,982	Primary syphilis (e.g., chancre); secondary syphilis (e.g. rash): tertiary syphilis (e.g. periostitis, arthritis, aortitis and meningitis)	Primary syphilis (e.g., chancre); secondary syphilis (e.g. rash): tertiary syphilis (e.g. periostitis, arthritis, aortitis and meningitis)	NA
HIV[1,6,8]	Caused by *Human immuno-deficiency virus*	Women 1,139; Men 3,000; Total 4,139 (UK data)	Opportunistic infections and cancers (e.g., *Mycobacterium tuberculosis*, Herpes simplex viruses); AIDS, premature death	Opportunistic infections and cancers (e.g., *Mycobacterium tuberculosis*, Herpes simplex viruses); AIDS, premature death	1,310,731 eligible persons were tested for HIV in SHS
All STIs (chlamydia, gonorrhoea, syphilis) and HIV[1]	-	Women 147,081 Men 163,181 Total 310,262	-	-	2,175,525 sexual health screens a 31% increase (from 1,657,425 in 2015)

*If left untreated.

[1](Mitchell et al., 2020); [2](Unemo et al., 2020); [3](PHE, 2020d)

[4]"Public Health England Centres (PHEC) providing internet services may offer consultations to people from outside their local area – this may cause an increase in the number of STI tests & diagnoses reported by the PHEC" (PHE, 2020c).

[5](Fifer et al., 2019); [6](PHE, 2020f); [7](Janier et al., 2021); [8](Deeks, Lewin and Havlir, 2013)

AIDS, Acquired immunodeficiency syndrome; NA, Not available; PID, Pelvic inflammatory disease

All of the above STIs can occur in both women and men and may be present in isolation or as co-infections (Fifer et al., 2019). Further, the stigma and shame associated with STIs can affect people's mental health and sexual pleasure (Hill-Tout et al., 2018). In women, infections of gonorrhoea and chlamydia are frequently asymptomatic, i.e. up to 50% of cases of endocervical infection with gonorrhoea in women are not associated with any symptoms (Unemo et al., 2020). It should be noted that co-infections, e.g. gonorrhoea in combination with another STI called *Mycoplasma genitalium*, are common and the co-infection may be the cause of symptoms (Fifer et al., 2019).

Chlamydia and gonorrhoea can lead to PID in women particularly if left untreated. This can be associated with sequelae, such as chronic pelvic pain, ectopic pregnancy, and tubal factor infertility through scarring of the fallopian tubes, ovaries, and womb. The probability for PID to occur ranges significantly between studies from 10% to 40% (de Wit et al., 2015; Andersen et al., 2006; Gift et al., 2002; Walleser, Salkeld and Donovan, 2006; Mehta et al., 2002). In pregnant women, infection with chlamydia or gonorrhoea may lead to abortion or pre-term delivery of the baby. New-borns infected with chlamydia or gonorrhoea may also suffer from neonatal conjunctivitis, low birth weight, and pneumonia.

Syphilis is caused by *Treponema pallidum* bacterium and occurs in three stages: primary, secondary, and tertiary. If left untreated it becomes a systemic infection resulting in chronic inflammation of various organs (Janier et al., 2021).

Chlamydia, gonorrhoea, and syphilis are bacterial infections, which are treated with antibiotics. Due to AMR, treatment of several STIs, especially of gonorrhoea has become more difficult in recent years (Wi et al., 2017). In the UK, the treatment for gonorrhoea was recently changed from dual therapy (ceftriaxone with azithromycin) to monotherapy with a higher dose of ceftriaxone (PHE, 2019b).

The human immunodeficiency virus lowers immune function in an infected person, thereby causing increased susceptibility of viral, fungal, bacterial, and parasitic infections. If left untreated, HIV can develop into the acquired immunodeficiency syndrome (AIDS) and may result in premature death. Due to the availability of effective

treatment with anti-retroviral therapy (ART), the infection can be regarded as a chronic disease rather than an acute STI (Deeks, Lewin and Havlir, 2013). Many STIs, including chlamydia and gonorrhoea, can facilitate the transmission of HIV (Ward and Rönn, 2010).

In England, approximately 468,000 diagnoses of STIs (including chlamydia, genital warts, genital herpes, gonorrhoea, syphilis, and HIV) were recorded in 2019 and STI diagnoses have consistently increased by 5% annually since 2017 (PHE, 2018b, 2019c; Mitchell et al., 2020). Chlamydia and gonorrhoea are most commonly tested for in the English context. Of all STI diagnoses, chlamydia accounts for nearly half (49%, 229,411 cases), followed by gonorrhoea accounting for 15% of all diagnosed STIs in 2019 (PHE, 2020d). Gonorrhoea noted the highest increase with 56,232 cases in 2018 vs. 70,936 in 2019 (26% increase) in England. Syphilis was ranked fifth in terms of the number of cases in 2019 (1.7% of all STI diagnoses) with a 10% increase between 2018 and 2019 (from 7,260 to 7,982 cases (PHE, 2020d).

In 2019, around 105,200 UK citizens were living with HIV (National AIDS Trust, 2020) and this included a 10% decline in new HIV diagnoses since 2018 (from 4,580 to 4,139 cases) (PHE, 2020f). Reasons for the reduction in incidence include expanded HIV testing, the early treatment of HIV to prevent the further spread, which is also known as Treatment as Prevention and the introduction of HIV pre-exposure prophylaxis (PrEP), which can prevent the transmission of the virus (Mitchell et al., 2020).

2.3.1. Economic burden of STIs

It is estimated that between 2016 and 2017, the treatment of STIs cost the English NHS £374 million (PHE, 2021). The acute costs of chlamydia, gonorrhoea, and syphilis infections should be differentiated from the longer term – also called lifetime – costs for HIV. As explained above, HIV can be classed as a chronic infection and people living with HIV can live nearly as long as people without the virus. An early diagnosis of HIV will result in £14,000 treatment costs per case, whilst a late diagnosis would be around twice as much. The costs associated with HIV lifetime medications are on average £280,000 and £360,000 per person (Ong et al., 2019; NICE, 2016), although drug price reductions associated with the increasing use of generic medications may lower these figures.

2.4. Health inequalities and STIs

STIs and other public health threats should be viewed in the context of the environment in which they are situated. Social or wider determinants of health influence the health status and this, in combination with some mistrust of healthcare institutions amongst some population groups, results in worse health outcomes (Honeyman et al., 2020; Marmot, 2004). The sections below highlight the importance of considering health inequalities when planning for the prevention and control of STIs. It describes the concept of health equity and provides an overview of vulnerable groups.

2.4.1. Health inequalities

> "Health inequalities are systematic, avoidable and unjust differences in health and wellbeing between different groups of people", (PHE, 2020a).

Factors influencing the risk of STIs include poverty and income inequality, education, discrimination, gender, sexuality, and geographical factors, which are interconnected (Hogben, Leichliter and Aral, 2020). Studies have shown that a lower socioeconomic status, which is determined by combining education, income, and occupation, impacts the acquisition and transmission of STIs (Marmot, 2004; Krieger et al., 2003). For example, the prevalence of chlamydia and gonorrhoea in the USA was found to be more influenced by racial disparities in income than race or ethnicity (Owusu-Edusei et al., 2013). Figure 2.1 illustrates the dimensions of health inequalities and their intersectionality considered by PHE.

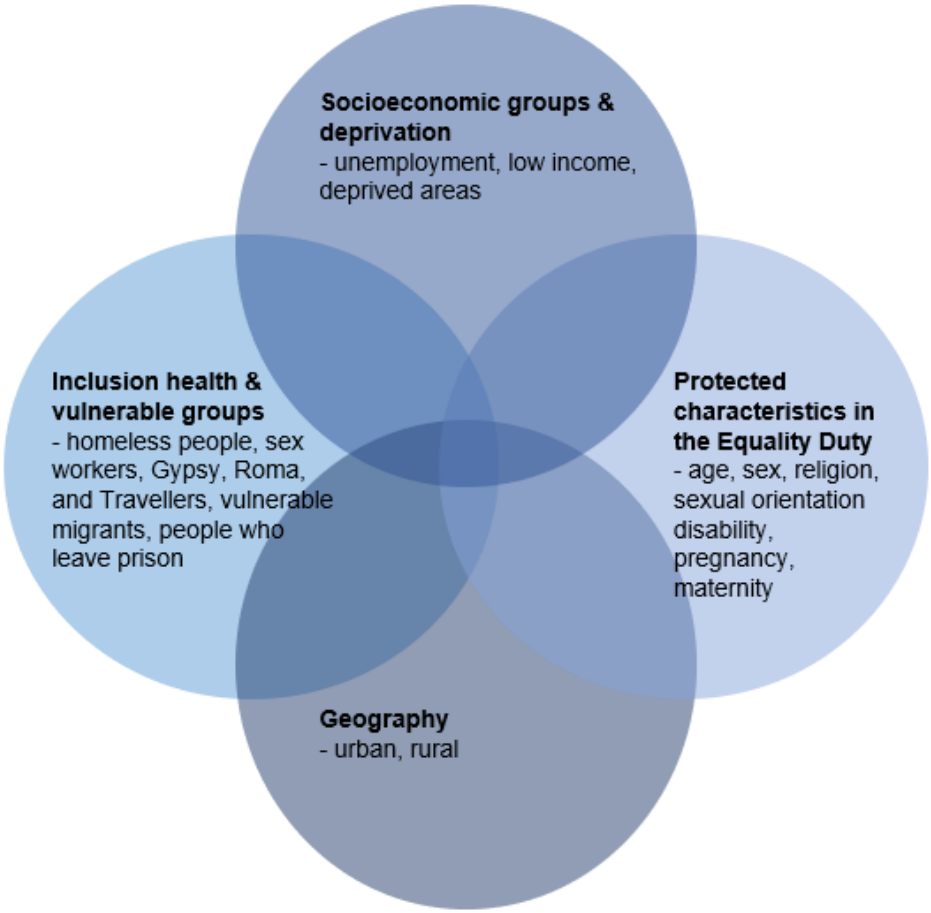

Figure 2.1. Overlapping dimensions of inequalities.

Notes: Adapted from (Public Health England, 2020a)

The four main dimensions are ‘Socioeconomic groups and deprivation’, ‘Protected characteristics in the Equality Duty’, ‘Geography’, and ‘Inclusion health and vulnerable groups’ (PHE, 2020a). All dimensions are crucial to consider when aiming to improve the health and wellbeing of a population and should not be viewed in isolation but rather intersectional. Vulnerable groups in relation to STIs are described further in the following section as these are of particular relevance for this thesis.

2.4.2. Vulnerable groups

Some population groups are more at risk of contracting a STI compared to others. Black ethnic minorities, men who have sex with men (MSM) and young people (15 to 24 years of age) are especially high-risk groups for STIs (Mercer et al., 2013). The UK DHSC also considers homeless people, lesbian, gay, bisexual and trans people, people with learning disabilities, survivors of sexual assault, those with a history of female genital mutilation, and sex workers as particularly vulnerable to contracting STIs (DHSC, 2013). The SHS in Bristol, UK, complements the list of high-risk groups by including sex worker clients as well as people with multiple partners or a partner belonging to one of the high-risk groups (Unity Sexual Health, 2017). This shows the diversity of at-risk population groups that should be considered when planning and delivering sexual health programmes. STIs are also more commonly found in urban rather than rural areas. This is because the population in urban areas tends to be younger and have an overall higher population density compared to rural areas (Mitchell et al., 2020).

In 2019, young heterosexuals aged 15 to 24 years, black ethnic minorities, and gay, bisexual and other MSM bore the greatest disease burden relating to STIs in England (Mitchell et al., 2020). The reasons for young people being at higher risk of STIs are multifaceted and include overall greater sexual activity (i.e., higher rates of partner change compared to older population groups) interest in exploring new experiences – both physically and mentally – combined with a low 'sexual competence' (Mercer et al., 2013; Wellings et al., 2013). Higher rates of chlamydia diagnoses in young women can be attributed to the English National Chlamydia Screening Programme (NCSP), which focuses on this group. Black Caribbean and Black non-Caribbean/non-African ethnicities in England report higher numbers of sexual partners, which may contribute to relative high rates of STIs in this population group (Mitchell et al., 2020). In 2019, people of Asian ethnicity registered the most significant proportional increase of STI diagnoses (Mitchell et al., 2020). Besides behavioural factors, ethnic minorities as described above do have a lower socioeconomic status compared to people of white ethnicity, which gives ethnic minorities an additional risk factor for acquiring STIs (Francis-Devine, 2020; Owusu-Edusei et al., 2013). This can be observed, for example, by looking at averages of distributional income among different ethnic groups, where ethnic minorities report a lower disposable income than their white counterparts.

HIV positive MSM report the largest number of STI diagnoses (chlamydia, gonorrhoea, and syphilis) in comparison to other men or women (Mitchell et al., 2020). According to a report in 2013, one in four British gay and bisexual men have never had an STI test and three in ten have never been tested for HIV (Guasp, 2013). Between 2015

and 2019 bacterial STI testing among MSM attending SHSs increased (Mitchell et al., 2020). However, the rise in diagnoses did not correspond to the rise of testing rates (PHE, 2020d). One assumption is that this may be associated with increased transmission due to high-risk MSM behaviours, e.g. condomless anal intercourse (Daskalopoulou et al., 2017).

2.5. Prevention and control of STIs

Health programmes cover three dimensions: prevention of disease, control of disease, and treatment. Within the first dimension, the prevention of disease, interventions can be targeted at the general population or at the individual (WHO, 2019b). In this thesis, the terms ‘prevention’ and ‘control’ programmes, and interventions are used to refer to the same public health initiative aiming to prevent and control infections and are therefore used interchangeably. The goal of these programmes and interventions is to reduce the incidence and spread of a disease and thereby its overall prevalence. There are three categories in the general prevention of disease: primary, secondary, and tertiary prevention (Centers for Disease Control and Prevention [CDC], 2017; WHO, 2019a;b). Primary prevention involves an intervention to try to prevent disease, e.g. vaccinations of the general population (CDC, 2017). Secondary prevention focuses on reducing the impact of a disease or injury that has already occurred, e.g., identifying chlamydia before it causes sequelae. Finally, tertiary prevention revolves around reducing the impact of an ongoing illness or injury that has lasting effects, e.g. the treatment of an infection to reduce the spread of STIs/HIV (CDC, 2017). In the UK, one example of a sexual health programme working with primary and secondary prevention

measures is the routine cervical screening for people between 25 and 64 years of age (NHS, 2019).

For the purpose of this thesis the terminology ‘sexual health programmes’ and more specifically ‘STI control programmes’ is applied. Sexual health programmes can achieve the control of STIs through a combination of prevention, screening and testing, and early treatment to reduce the incidence and prevalence of infections (Steen et al., 2009). ‘STI control’ is a public health outcome and should not be used interchangeably with ‘treatment of STIs’. STI control programmes provide a range of measures including methods of prevention such as condoms. Primary prevention is a part of STI control. Besides offering a means of prevention, primary prevention in this context includes referrals to clinical services as well as provision of information both within the setting of a clinic and outside, e.g., through involving community-based organisations to share information on STI prevention. Clinical interventions involve screening asymptomatic patients, managing STIs in patients as well as strategies for ensuring care for sex partners of people diagnosed with a STI/HIV (Steen et al., 2009). Primary prevention along with clinical interventions has the potential to control of STIs.

For the detection of STIs, control programmes focus on the screening and testing of the general population or high-risk groups. Testing and screening are two clearly defined terms. Currently, in the sexual health literature, both testing and screening are frequently used terms and are often applied interchangeably. In a number of studies, there is no strict separation between the two terms which is why this research project includes both terms, in keeping with other studies (Llewellyn et al., 2013; Elwy et al.,

2002; Cohen et al., 1999). The aim is to ensure that all relevant information is incorporated when arriving to a conclusion about the most relevant method for collecting cost and outcome data of STI control programmes.

2.5.1. Global initiatives for improving sexual health

The United Nations (UN) Sustainable Development Goals (SGDs) include specific targets for sexual health. In goal 3, targets 3.3 and 3.7 address HIV/AIDS and aim to ensure access to sexual and reproductive healthcare services (Inter-Agency and Expert Group on SDG Indicators, 2016). Based on the 2015 SDGs, the UN decided on two global initiatives to control STIs and HIV:

1. The Global Health Sector Strategy on Sexually Transmitted Infections 2016-2021 (WHO, 2016c).
    a. The strategy provides visions, goals, targets, guiding principles, and priority actions for ending the epidemic of STIs as a public health problem.
    b. With this strategy WHO highlights that STIs have a global impact on both individual sexual and reproductive health as well as on global public health.
2. The Global Health Sector Strategy for HIV 2016-2021 (WHO, 2016b).
    a. The strategy includes targets for the 2030 Agenda for Sustainable Development where the AIDS epidemic should be controlled as a public health threat.
    b. It outlines what countries need to do, how the health sector can contribute, and how WHO will support this process.

Currently, efforts to achieve the specific SDGs and the strategies are not sufficient to reach the targets and Goal 3 by 2030 (United Nations Economic and Social Council, 2021). According to a report by the UN's Secretary-General, in 90% of the world's countries access to essential health services, such as HIV treatment, is still disrupted due to the lack of resources and investments in the area (United Nations Economic and Social Council, 2021). This may have been further impacted by the COVID-19 pandemic.

2.5.2. Control programmes for STIs in England

There are several STI control programmes in the UK, which aim to increase overall population health. PHE categorises health interventions into three different levels: population level, community level, and individual or family or household level (PHE, 2018a). One example of a population level intervention are screening programmes, which target apparently healthy people to take part in testing for a disease or condition (UK National Screening Committee, 2018). The NCSP recommends that sexually active young women[3] aged under 25 years are screened for chlamydia annually or whenever they change their sexual partner, even if they do not have any symptoms (UK Health Security Agency, 2022; PHE, 2021a). Prior to 2021, the NCSP was focusing on all young people under the age of 25 to be screened for chlamydia with a clear aim to prevent and control the spread of chlamydia (Terrence Higgins Trust, 2021b). This has now shifted towards a more harm reducing approach of the infection by only screening women and girls. Further programmes to control STIs in the UK are

[3] Including people with a womb or ovaries, such as transgender men, intersex people, and non-binary people assigned female at birth.

described in Table 2.2. An example of a community level programme is the National HIV Testing Week targeting MSM and black African communities to encourage testing of HIV (PHE, 2019a). On an individual level, behavioural interventions, such as digital media campaigns are used to encourage safe sex practices and testing for STIs (Guse et al., 2012; Noar, Black and Pierce, 2009).

Table 2.2 Overview of STI and HIV control programmes in the UK

STI/ HIV control programme	Level	Target	Description
UK National Chlamydia Screening Programme (NCSP)[1]	Population	Young women aged 15-24 years	Opportunistic screening resulting in early detection and treatment of asymptomatic infections
National HPV Immunisation Programme[1]	Population	Girls and boys aged 12-13 years	Delivers HPV vaccination
Syphilis Action Plan[1]	Community	Healthcare professionals, specialty societies, service commissioners	Information on existing evidence, national guidelines and best practices
PHE's National HIV Prevention and Sexual Health Promotion Programme[2]	Population	Key population groups, geographical areas, and life stages	PHE delivers data, supports partners in implementing public health interventions
Sexwise[1]	Population	General public and healthcare professionals	Information on sexual and reproductive health
Protect Against STIs Use a Condom[1]	Population	Young adults aged 16-24 years	Encourages condom use and raises awareness of STI sequelae
HIV Prevention England[3]	Community	MSM, black African people, and gay men	Delivers national HIV prevention programme
National HIV Testing Week[1]	Community	MSM, black African people	Encourages targeted groups to get tested
Hepatitis B vaccination[4]	Community	MSM, people who inject drugs	SHS offer vaccinations to high-risk groups

[1](PHE, 2019a); [2](PHE, 2015); [3](Terrence Higgins Trust, 2021a); [4](Terrence Higgins Trust, 2022)

HIV, Human immunodeficiency virus; HPV, Human papilloma virus; MSM, Men who have sex with men; PHE, Public Health England; SHS, Sexual health service; STI, Sexually transmitted infection

2.6. Sexual health services

The subsequent sections present the role of SHS, their history in a UK context, recent developments in policies and technologies for SHS, and budget and financial pressures.

2.6.1. The role of SHS

Sexual health services provide several services including the prevention and treatment of STIs to improve and maintain the population's sexual health. The commissioning of these services is typically divided between national and local health authorities and varies between countries and local contexts (WHO, 2010).

The role of SHS in the UK includes both specialist (level 3)[4] and non-specialist (level 1 and 2)[5] SHS (MEDFASH and BASHH, 2014). Specialist SHS refers to GUM and integrated GUM/ sexual and reproductive health (SRH) services. Non-specialist SHS can include other SRH services, young people's services, OPSS services, termination of pregnancy services, and such non-specialist services can also be provided via pharmacies, outreach programmes, general practice, and in additional community-based settings (Robertson et al., 2017; MEDFASH and BASHH, 2014). SHS fall under the mandatory services to be provided by local authorities. The service specification by PHE and the DHSC states that services need to be:

[4] Level 3 refers to complex/specialist services (MEDFASH and BASHH, 2014).
[5] Level 1 refers to service provision for asymptomatic patients. Level 2 provides services for symptomatic patients (MEDFASH and BASHH, 2014).

"[…] open access sexual health services, including free STI testing and treatment, notification of sexual partners of infected persons and advice on, and reasonable access to, a broad range of contraception; and advice on preventing unplanned pregnancy", (PHE and DHSC, 2018).

Open access services mean that a person can access a SHS irrespective of their place of residence, age, gender, and without a referral by a general practitioner (GP), and indeed there is no requirement for registration with a GP.

Within England, there has been a move towards 'Integrated SHS', which refers to a combination of confidential, non-judgemental services such as testing for STIs together with family planning services (PHE and DHSC, 2018). For example, when a patient receives a contraceptive such as an intra-uterine device, the patient will also be offered testing for STIs such as chlamydia. An integrated service also includes health promotion and prevention activities including activities for behaviour change and those which aim to reduce the stigma associated with STIs/HIV and unplanned pregnancy (PHE, 2018a). The basic service specification for SHS does not include self-managed care, such as individual self-sampling and testing, but it may be a component of some services (see Figure 2.2) (PHE and DHSC, 2018). Self-managed care is defined as the service user being able to access certain health information and resources, e.g., condoms, pregnancy testing kits among others, without the need for a healthcare professional to be present. If self-managed care is offered, there must be support available to the service user in the case of need (PHE and DHSC, 2018).

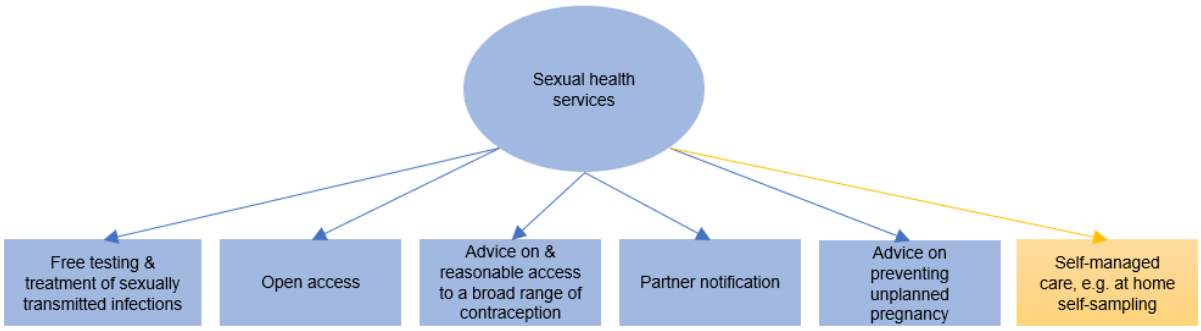

Figure 2.2. Sexual health services model.
Notes: In blue: Requirements for sexual health services. In yellow: Optional services.

SHS are also encouraged to promote testing and treatment for STIs and HIV. Health providers need to raise awareness that this is free of charge and does include free contraceptives and condoms (PHE, 2018a).

2.6.2. History of SHS in England

England has a long history of SHS provision. The Venereal Disease Acts (VDAs) laid out the foundations for control of STIs (Mohammed et al., 2018). In the beginning of the 1900s, syphilis and gonorrhoea were leading causes of death and infertility in the UK. The 1916 Royal Commission on Venereal Diseases was a direct response to the syphilis and gonorrhoea epidemics. It led to the VDA in 1917, which specified the need to provide “free, confidential, open-access STI clinics” (Mohammed et al., 2018, p.553). Whilst the epidemiology of the STIs has changed, the core principles of the 1917 VDA still guide SHS today. Additional initiatives, such as the teenage pregnancy strategy in 1999, improved the quality and access of SHS (Hadley, Ingham and Chandra-Mouli, 2016). In 2001, the first integrated strategy for sexual health and HIV was developed (Adler et al., 2002). Seven years later in 2008, the National Institute for Health and Care Excellence (NICE) introduced a quality standard for SHS to facilitate 48-hour

access to STI care. This entails that the moment a person contacts a SHS, they should be offered a point of contact within 48 hours (NICE, 2019b).

2.6.3. Responsibility for SHS and defining the decision-makers

As established in Chapter 1, in England, SHS are organised and commissioned by multiple governmental bodies and organisations including general practice, pharmacies, hospitals, community services and the non-governmental sector (PHE, 2013). Due to the changes introduced by the 2012 Health and Social Care Act, local authorities in England hold the main responsibility for commissioning of SHS (Robertson et al., 2017; PHE, 2013).

The characteristics of SHS at the local level are defined by Health and Wellbeing boards in each area (DHSC, 2013). In order to identify local health care needs in 2012 and in the future, the health and wellbeing boards conducted Joint Strategic Needs Assessments (JSNAs) and developed Joint Health and Wellbeing Strategies (JHWSs). These documents provided the basis for local commissioning executed by local authorities, clinical commissioning groups (CCGs), and the NHS Commissioning Board. The main requirement stated in the Framework for Sexual Health Improvement in England by the DHSC is that local authorities must meet the needs of their local population for the provision of SHS and that these services follow the characteristics outlined above (DHSC, 2013).

It is important to note that not all SHS are commissioned by local authorities, which means that the commissioning landscape is complex (see Figure 2.3). In particular,

although the local authority is responsible for services which aim to prevent, treat, and control STIs, the treatment of sequelae associated with STIs, such as PID, is the responsibility of CCGs, which are based within the NHS. CCGs are also responsible for abortion, sterilisation, and vasectomy services as well as psychosexual health services, gynaecology, and contraception for non-contraceptive purposes (PHE, 2013). SRH services provided by NHS England include treatment and care for HIV, contraception as additional services under the GP contract, opportunistic screening for STIs, prison health services, sexual assault referral centres, cervical screening, and specialist foetal medicine services (PHE, 2013).

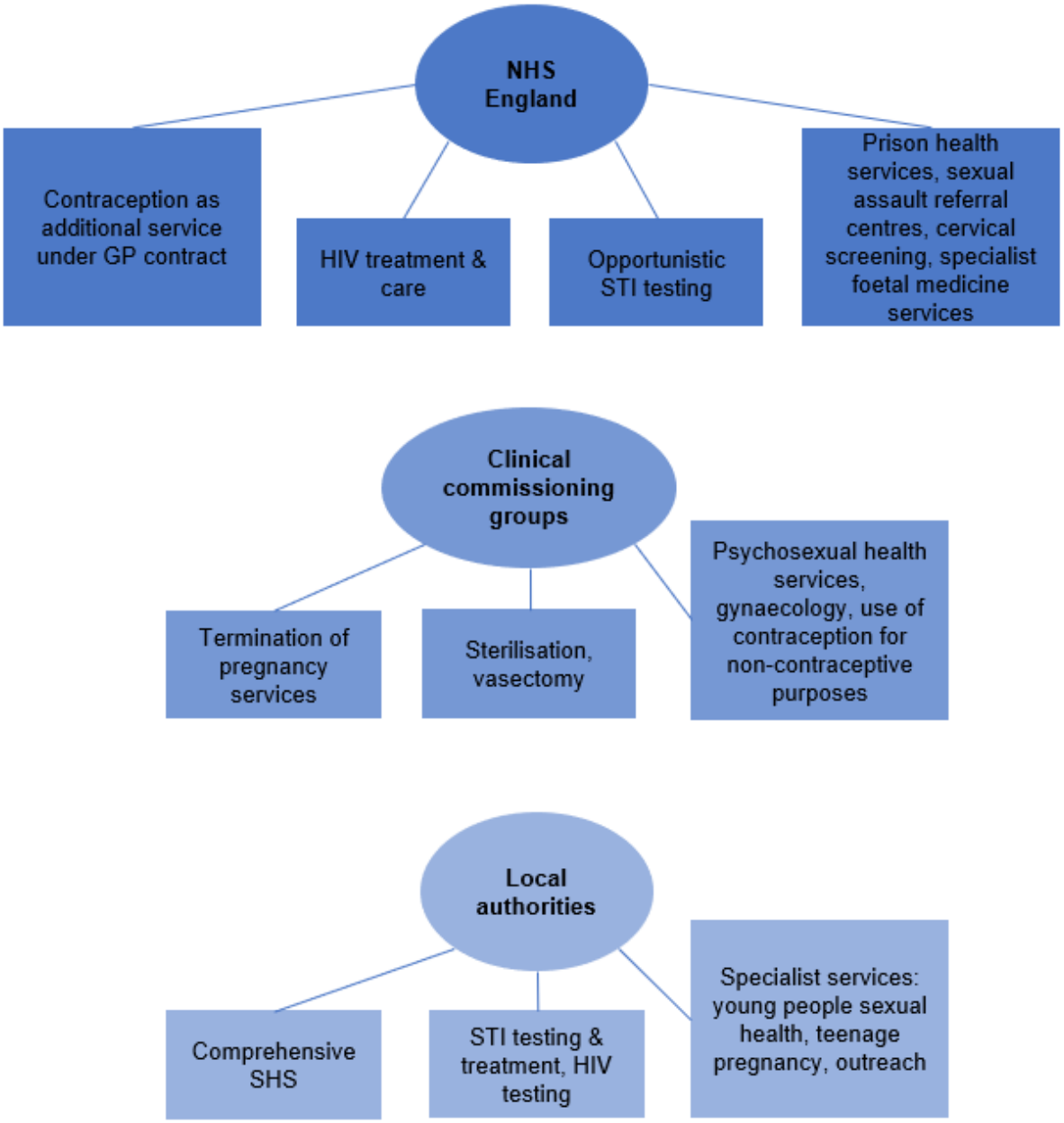

Figure 2.3. Responsibilities for sexual health services by decision-making level.

Notes: HIV, Human immunodeficiency virus; SHS, Sexual health services; STI, Sexually transmitted infection

Geographical variations in SHS provision

In addition, there are regional and local variations for SHS because even though services are mandated, local authorities can decide how the service is commissioned and ultimately provided (Robertson et al., 2017). For example, services can be fully integrated or delivered separately by different providers, e.g. by general practice, specialist services in hospitals, and by community services (PHE, 2013). This also entails decisions around which staffing model is employed, the number of clinics providing services and their opening hours (Robertson et al., 2017). England consists of 343 local authorities, which can be divided into four categories: county and district councils, unitary authorities, metropolitan districts, and London boroughs (Ministry of Housing, 2019). The heterogeneity in councils and local context, e.g., rural vs. urban populations, contribute to the local differences in SHS provision.

Notwithstanding the complexities outlined above and associated commissioning arrangements, there are advantages following the move of SHS from the NHS to local authorities. These include local authorities knowing the local context and needs of their population well, meaning that they can potentially provide more tailored services. There is also scope for the integration of services, such as linking SHS to wider public services including social services (BASHH, 2019; PHE and DHSC, 2018). A disadvantage may be that some local authorities could lack specific expertise in the commissioning of SHS (PHE, 2019d). More recently, there has been a movement towards collaborative commissioning between local authorities and the local NHS. Benefits for this collaborative approach include increased efficiency as well as improved patient experience and local partnerships (PHE, 2020c). In addition, since

July 2022, integrated care systems have been of interest (NHS England, 2022). Integrated care systems involve different organisations for health and care including the NHS and local authorities forming partnerships with the aim to deliver health and care services more cooperatively (NHS England, 2022). This will also lead to alignment of budgetary responsibilities within the system.

The recent changes in commissioning have highlighted the variety of decision-makers involved in providing SHS. These include national level organisations, such as NHS England and local level commissioners and providers, i.e. hospital trusts or private providers, such as Virgincare (Robertson et al., 2017). SHS providers do control budgets at the service provision level and therefore can decide on the allocation of funds. The healthcare system in England is funded publicly mostly from taxation. In general, healthcare is free at the point of use and usually accessed via GPs who are responsible for onward referral to other (sexual health) services and primary care medication (Cylus et al., 2015). However, most SHS patients directly self-refer and do not go through the GP referral route.

Guidance and quality assurance for SHS

For the production of guidelines and quality assurance the following organisations are relevant in the context of SHS: British Association for Sexual Health and HIV (BASHH), British HIV Association (BHIVA), the DHSC, the Faculty of Sexual and Reproductive Healthcare (FSRH) as part of the Royal College of Obstetricians and Gynaecologists, the Medical Foundation for HIV & Sexual Health (closed at the end of 2016), NICE, PHE (which changed to the UK Health Security Agency [UKHSA] and Office for Health

Improvement and Disparities [OHID] in 2021), and the Terrence Higgins Trust (BHIVA, 2016). To ensure standardised and high quality services, BASHH has developed a range of service standards (BASHH, 2019).

One key public health aim of the DHSC is to increase timely uptake of STI screening and testing is also a key public health aim (DHSC, 2013, 2016). Through appropriate testing and screening, an infection can be detected earlier which can therefore lead to better treatment outcomes, prevent possible complications as well as reduce the onward transmission of the infection (DHSC, 2016). BASHH and the Terrence Higgins Trust have argued that the broader impact of STIs should be taken more into account when planning and improving SHS (BASHH and Terrence Higgins Trust, 2020).

2.6.4. Commissioning processes

The commissioning of services is a cyclical process. For SHS, the commissioning cycle often begins with a JSNA conducted by the public health division in a local authority (DHSC and PHE, 2018; DoH, 2013). Based on this a service specification is developed. This is followed by a tendering process where interested providers can bid against the service specification. Once the best provider has been identified, the services are commissioned through either a block contract or through a locally agreed tariff. The latter may be based on an integrated sexual health tariff, which encompasses both GUM and contraceptive services or it may utilise the NHS Improvement's Payment by Results (PbR) tariff (DHSC and PHE, 2018; DoH, 2013). There have been recent developments in form of a proposal that routine tendering may

no longer be required if existing commissioning arrangements are acceptable (DHSC, 2022). However, it is unclear when this proposal will be implemented.

2.6.5. Budget and financial pressures

The local authorities' public health budget is currently ring-fenced. This means that the budget allocated to local authorities may only be utilised for public health services (DHSC, 2020). There are two dimensions for SHS on which the public health grant must be spent on:

1) STI testing and treatment and
2) contraception.

Non-mandated functions for SHS include the provision of advice, prevention, and promotion. However, there is no guidance on how the budget should be distributed across each public health domain. Budgets are mainly allocated for the seven mandated services[6] and the remaining budget can be used flexibly for the non-mandated functions, e.g. obesity and drug abuse prevention (DHSC, 2020).

The DHSC has reduced the public health grant by 8% in real terms from £2.7 billion to £2.4 billion in a five year period (2013/14 - 2017/18) and has recorded an additional decrease of 2.6% in 2019/20 (Robertson, 2018). In 2020/21, the public health budget was increased to £3.3 billion as a response to the COVID-19 pandemic (DHSC, 2020). Though it is not clear yet how this recent change has impacted on the budgets for SHS, it was SHS, which experienced the most significant decrease in public health spending

[6]The seven mandated services from the public health ring-fenced grant are: 1) Sexual health services - STI testing and treatment 2) Sexual health services – Contraception 3) NHS Health Check programme 4) Local authority role in health protection 5) Public health advice to NHS Commissioners 6) National Child Measurement programme 7) Prescribed Children's 0-5 services (DHSC, 2020)

throughout the 2013/14 - 2017/18 period. It has been argued that this reduction in spending for SHS, may be viewed as an indicator on prioritisation by the DHSC (Robertson, 2018).

SHS budgets are managed at a local level at a time when public health budgets have been under constant pressure (BMJ, 2017; Robertson et al., 2017). As a consequence, a number of local authorities have cut their budgets for sexual health programmes (PHE, 2017a). Whilst in 2013/14 total local authority spending on SHS was £668 million, in 2017/18 it was reduced to £572 million – a 14% reduction in real terms. Overall, 18 (12%) local authorities increased their total spend on SHS between 2015 and 2018, whilst 133 (88%) decreased it. In general, funding cuts were most visible for primary prevention, followed by secondary and tertiary prevention. In 2019, the King's Fund conducted an analysis of the changes in sexual health spending and found that there was variation between English local authorities. Specifically for STI testing and treatment services, 40 out of 151 local authorities have reduced spending by a minimum of 20% whilst 24 out of 151 local authorities have increased their spending on the same service by 20% or more (House of Commons Health and Social Care Committee, 2019). Simultaneously, there is a growing demand for SHS and the number of diagnoses of STIs has risen (BMJ, 2017; Robertson et al., 2017).

An inquiry by the Health and Social Care Committee into SHS concluded that current funding cuts to SHS could jeopardise the services' quality (House of Commons Health and Social Care Committee, 2019). The lack of prevention and associated consequences, i.e., sequelae of STIs, would be likely to result in increased costs to the

health system overall. There are other possible individual long-term effects from neglecting SHS, such as increases in infertility, increased use of antibiotics contributing to AMR, and these consequences could jeopardise other public health aims (House of Commons Health and Social Care Committee, 2019). Providers and commissioners also reported that continued funding cuts had resulted in services only offering a minimum service specification (PHE, 2019a).

Whilst SHS are a mandated service and therefore have some form of protection, the financial pressures may also be present for other areas of public health (Robertson et al., 2017). This raises the question as to whether less spending automatically means worse quality of SHS or whether there should be a threshold level for budgets delivering sexual health programmes. Nevertheless, the financial pressures also provide an incentive for innovation, and increased focus on efficiency which has the potential to improve productivity.

2.6.6. Monitoring of SHS

Further, the PHOF, developed by the DHSC and PHE, includes two indicators relating to SHS that are monitored at a national level. The indicators are “Percentage of HIV late diagnoses” (Indicator D07) and “Diagnoses for chlamydia among young people aged 15-24 years / 100,000” (Indicator D02). In 2019, the D02 indicator was expanded whilst keeping the original chlamydia indicator as D02a. The new D02b indicator is “New STI diagnoses (excluding chlamydia aged <25) per 100,000” (PHE and DHSC, 2019).

To support local authorities with understanding the value of resource allocation decisions, PHE developed benchmarking tools, such as the Spend and Outcomes tool or Fingertips tool. The first tool allows a local authority to compare their spending to another local authority however this is no longer updated (PHE, 2017b). The Fingertips tool consists of public health profiles with the aim of supporting commissioners to achieve the overall aims of public health and provide the option for benchmarking against the regional or national average (PHE, 2021b).

2.6.7. New service developments

SHS are evolving and new approaches to service delivery, e.g., for testing of STIs, are being developed. Point-of-care testing (POCT) can test a sample on site and provide results in less than an hour. This offers the potential for increased access to testing, reduced waiting times, and a faster and more precise treatment. POCT may also contribute to reduce the over-prescription of antibiotics and may thereby contribute to lowering AMR (Toskin et al., 2020; Turner et al., 2017; Zemouri et al., 2016).

Prior to the changes in commissioning, some population groups had specific barriers to engagement with SHS, which included lack of awareness about STIs and testing, stigma, and limited interaction with healthcare services (Jackson and Roberts, 2014; Dowson et al., 2012). This led to a focus to develop new modes of delivery for SHS which included primary care settings along with community based pharmacies, and online services providing self-sampling kits (PHE, 2014b). These new methods of delivery attempted to revolutionise and improve healthcare in this area (Jackson and Roberts, 2014; Dowson et al., 2012).

Community pharmacies are an important new development to improve STI control. Pharmacies can function as an outreach into the community to deliver condoms, screen for chlamydia and treatment, provide information on HIV, give sexual health advice, undertake pregnancy testing, and supply hormonal and/or emergency contraception (PHE, 2019e). A cross-sectional study assessing the commissioning of community pharmacies in 2014/2015 stated that 28% of pharmacies provided chlamydia screening services and 9% were commissioned to offer free condoms (Mackridge, Gray and Krska, 2017).

2.6.8. Online postal self-sampling services for STIs and HIV

OPSS services also called internet-based testing provide the opportunity for a person to order a STI test in form of a self-sampling kit to their home address free of charge (PHE, 2020b; Harding-Esch et al., 2017). Infections commonly tested for are chlamydia, gonorrhoea, syphilis, and HIV. Certain risk groups, such as MSM, can also be tested for Hepatitis B and C. The testing kit can be ordered directly via a SHS provider (website) or can be picked up from other providers, such as pharmacies. The person can take a sample themselves and then return the testing kit to the laboratory via pre-paid postal services. The service user is then informed about the test result via text message and if positive the service user will be invited to come to an appointment in a sexual health clinic (PHE, 2020b). There is a difference between self-testing and self-sampling, which is not consistently applied throughout the literature. Self-testing implies that the patient does the test themselves and would not need to send the sample to a laboratory in order to interpret the result (Harding-Esch et al., 2017; WHO, 2016a, chap.2).

Internet-based testing can increase the overall uptake of testing for STIs and provide an opportunity to reach a wider population and especially young people (Bailey et al., 2015). A meta-analysis found that self-sampling in Australia, Denmark, and the USA led to testing numbers being tripled and findings of positive cases being doubled (Ogale et al., 2019). In England, internet-based testing has contributed to a 7% increase between 2018 and 2019 in number of consultations at SHS (from 3,613,447 in to 3,852,121) of which 19% were conducted through the pathway of online screening (Mitchell et al., 2020).

Despite potential advantages, there are several possible barriers to accessing online services. For example, a person without a registered address will not be able to order a self-sampling kit. Another aspect is that current OPSS services require general, health, and digital literacy, which excludes population groups who have may have additional needs in this area, such as older population groups or people living with a disability (Henni et al., 2022; Honeyman et al., 2020; Office for National Statistics, 2019). Whilst patients perceive internet-based testing for STIs as more anonymous and convenient over in-clinic testing, service users may feel insecure regarding the accuracy of the test as well as about the possible absence of direct communication with a healthcare professional (Spence et al., 2020). In general, the online service may seem to reduce the economic burden on face-to-face SHS but the effectiveness and cost-effectiveness of these new modes for delivering SHS and for screening and testing STIs/HIV in particular needs further assessment (Kuder et al., 2015; Blalock et al., 2013).

As discussed in Section 2.4.1. on health inequalities, the social determinants of health influence a person's health status. In addition, they can also be attributed to unequal uptake of testing and surveillance of infections, such as HIV testing (Fakoya et al., 2018). In particular, a qualitative study found that black African people in England – whilst not representing a homogeneous group – would disagree about the anonymity of OPSS since they rarely live in a one-person household (Dodds et al., 2018). Nonetheless, the advantage of doing a test without having to enter a sexual health clinic has the potential to reduce stigma and increase autonomy.

Due to the barriers for OPSS, which can be addressed to some degree, it is recommended that SHS in pharmacies and online screening for STIs, whilst increasing accessibility for some population groups, should complement rather than replace face-to-face services in sexual health clinics (British Association for Sexual Health and HIV and Terrence Higgins Trust, 2020).

2.7. The impact of the corona-virus pandemic on SHS provision

In March 2020, the COVID-19 pandemic reached the UK and impacted on all levels of health, economy, and society as well as affected the epidemiology of STIs and the delivery of SHS (Whitlock et al., 2021). In order to reduce COVID-19 transmission, the UK government introduced rules to avoid unnecessary travel, to stay at home and to practise social distancing (first national lockdown: 23 March 2020) (Natsal, 2021). There were various queries about whether the pandemic may provide an opportunity to gain control of STIs and that there may be a decrease in sexual activity, as observed

by one study in Belgium (Baggs, 2020; Reyniers et al., 2020). Other questions raised were whether there would be a spike in demand and a spike in sequelae.

COVID-19 did impact on the accessibility of SHS, which worked at reduced capacity (if at all) resulting in lower numbers of people being tested for STIs and decreased surveillance (Ratna et al., 2021). More recent studies show that there was an overall fall in consultations within SHS, which again caused a decrease in the number of STIs being diagnosed (Nuffield Trust, 2021; Whitlock et al., 2021). Before the onset of the pandemic in England, around 239,000 consultations were conducted in January 2020 (Nuffield Trust, 2021). In April 2020, the number of consultations declined to 109,000. Internet based consultations increased significantly from 26% of total consultations in January 2020 to 44.5% in April 2020. Young people under the age of 18 in particular had fewer consultations (Thomson-Glover et al., 2020). SHS were still accessible, but there was lower availability overall, due to some closures of clinics and staff redeployment, as well as reduced availability of appointments (Whitlock et al., 2021; Turner, 2020). In order to continue to provide appointments, many clinics began to offer consultations via telephone or video channels. Cooperation with pharmacies helped clinics to send out some medication. Some OPSS services were still available but due to restricted postal services working with reduced personnel and limited laboratory capacity, the results of the tests often arrived later than usual and some services were temporarily suspended (BASHH, FSRH and BHIVA, 2020; Turner, 2020).

According to recent survey data by the British National Survey of Sexual Attitudes and Lifestyles (Natsal), around 20% of sexually experienced participants accessed SRH services at least once during the 4-month lockdown period from March 2020 (Dema et al., 2021), where sexually experienced is defined as a person having had at least one partner in their lifetime. One in ten people who tried accessing SRH services failed at their first attempt. Of these 82% managed to access at least one service by the second attempt. There were also 3% of both genders who needed services but did not try to access these (Natsal, 2021). As a limitation, the survey lacked baseline data for comparison, but the available data suggests that there was a continued need for SRH services. Further analysis on how COVID-19 did impact the service provision and patient care pathways for online screening of STIs is available in Chapter 7.

The hope that the COVID-19 pandemic would be a chance to regain control of STIs was countered by examples from Czech Republic, Denmark, Finland, and Italy reporting a subsequent rise in STIs following the trend from recent years (Bížová, Rob and Třešňák Hercogová, 2021; Heerfordt, 2021; Kuitunen and Ponkilainen, 2021; Latini et al., 2021).

In the UK, STI diagnoses decreased between January 2020 to June 2020. According to provisional data, the numbers rose again in June 2020 but were still below rates from the same period in the previous year (PHE, 2020e). There was a 30% reduction compared to 2019 in testing for chlamydia and a 35% decline in testing for HIV at SHS. The available data provide information on the reduced SHS testing and screening activity but not necessarily on the true incidence of STIs.

The FSRH, BASHH, BHIVA, and Terrence Higgins Trust developed guidance for healthcare professionals, providers, and commissioners on how to continue services for sexual and reproductive healthcare during the pandemic as well as on which services were essential to maintain (The Faculty of Sexual and Reproductive Healthcare, 2020). In addition, the three organisations representing SHS providers (BASHH, BHIVA, and FSRH) also called for fast stream introduction of online SHS across the UK (BASHH, FSRH and BHIVA, 2020).

2.8. The Birmingham sexual health service – A local example

One example of new initiatives for SHS can be found in the West Midlands of England. In Birmingham and Solihull a new city-wide sexual health system was developed in 2014/15, with services being provided by 'Umbrella' a partnership led by University Hospitals Birmingham with involvement from a number of community-based organisations, charities, and health service providers (Jewell, Campbell and Jaffer, 2017). The services are commissioned by the Birmingham City Council and Solihull Metropolitan Borough Council. The Sexual Health Needs Assessment for the city of Birmingham highlighted that there were high rates of infection amongst young people, and that there was a need to increase the accessibility of screening services (Birmingham City Council, 2013). The new sexual health system involved an integrated service model and a move away from care being delivered in centralised clinics to greater use of screening in GP surgeries, community pharmacies, and self-sampling services via the internet (Jewell, Campbell and Jaffer, 2017). It focuses on prevention rather than treatment of STIs and follows a 'hub and spoke' model with one main hub in the city centre and nine spoke clinics (Umbrella Birmingham and Solihull Sexual

Health, 2020). Around 169 pharmacies and 132 GPs in the area offer SHS. In 2016/17 the service conducted around 52,600 HIV and 27,600 chlamydia tests, which showed the need to increase screening for chlamydia. In the years 2018 to 2019, the SHS carried out 61,083 HIV and 84,408 chlamydia tests (Umbrella Birmingham and Solihull Sexual Health, 2018, 2020).

The Umbrella website offers information on SRH and free self-sampling kits to test for STIs to those with a registered address in one of the two constituencies. It had more than 1.4 million visits in 2018/19, which was an increase by 300,000 visits compared to 2016/17 (Umbrella Birmingham and Solihull Sexual Health, 2018, 2020). The testing kits can be delivered to the person's home or collected at a clinic or partnering pharmacy. This resulted in around 52,000 orders of STI self-sampling kits with a return rate of 59% in 2018/19 vs. 53% in 2016/17. There seem to be some barriers to returning self-sampling kits and a 2016 observational study found that heterosexual men and persons from more economically deprived areas were less likely to return the testing kits to the laboratory (Manavi and Hodson, 2017).

2.9. Conclusion

This chapter provided an overview on the STIs that are the focus for this thesis – chlamydia, gonorrhoea, syphilis, and HIV. It described the role of SHS as well as the commissioning structures and reported on recent changes in the provision of SHS along with associated challenges and opportunities. Further, studies on the COVID-19 pandemic's impact on SHS were discussed. Finally, an example of a SHS was presented showcasing an integrated service model and new modes of delivery.,

As pressures on local health budgets grow, there is a need to find the most cost-effective strategy to promote good sexual health, carry out STI screening and testing, and treat infections. The solutions for preventing transmission of STIs should not only focus on the effective control of STIs but also on their cost-effectiveness.

The question remains how can STI control programmes be economically evaluated and what are the available methods? An overview of economic evaluations for public health programmes, related concepts, and issues is presented in the next chapter.

CHAPTER 3
Overview of economic evaluations in public health interventions

3.1. Introduction

This chapter introduces the theory behind the main health economic concepts used throughout this thesis, with a particular focus on their application to public health programmes. It provides an overview of the different types of economic evaluations and health economic models. It addresses questions on how to measure costs and outcomes of public health interventions along with the limitations of traditional approaches. Finally, the chapter outlines the features that make economic evaluations for sexual health services unique.

3.2. What are economic evaluations and why are they needed in public health?

Economic evaluations ensure that the benefit gained from one intervention outweighs the benefit of the foregone alternative intervention (Williams, 1983). Therefore, judgements on both value and appropriate methods must be made.

Traditionally, economic evaluations have been a basic requirement for introducing new pharmaceuticals (Drummond et al., 2015). During the last two decades, greater pressures on budgets for healthcare as well as changes in decision-making processes

resulted in an increased need for economic evaluations in a public health context (Drummond et al., 2015). Evidence on cost-effectiveness supports applications for funding, reimbursement, as well as overall decision-making to ensure efficient use of public resources. In a public health context, cost-effective interventions mean good value for money and are not necessarily cost-saving (Drummond et al., 2015).

Public health programmes are complex in nature. They touch on several levels of healthcare service provision including prevention, screening, and treatment as well as often encompass aims beyond healthcare, which makes the evaluation of such interventions challenging (Edwards, Charles and Lloyd-Williams, 2013). In contrast to public health interventions, there is a large body of evidence and guidance for applied economic evaluations concerning clinical interventions, which are often evaluated via randomised controlled trials (RCTs). Further, there has been a growing recognition of the weaknesses of standard approaches for economic evaluation of public health interventions as they neglect effects beyond health outcomes, such as educational outcomes and equity (Edwards, Charles and Lloyd-Williams, 2013; Lorgelly et al., 2010; Weatherly et al., 2009). In addition, standard economic analyses often do not take into account the complexity of the context in which local decisions are made (Williams and Bryan, 2015; Cookson, Drummond and Weatherly, 2009).

It is crucial to understand that since the change in emphasis from national to local decision-making in public health as outlined in Chapter 2, the context for allocation of resources has also changed (Walensky, 2009). Moreover, previous research has highlighted the limited existing base of robust evidence to inform economic evaluations

in relation to the outcomes of STI screening programmes (Jackson et al., 2014). This shows the need for further research in the area.

3.3. Local decision-making and economic evidence

Although economic evaluations are used to inform decision-making at the national level, previous research has shown that economic evidence is rarely considered by local decision-makers (Brousselle and Lessard, 2011; Williams et al., 2008). For the purpose of this research, local decision-makers were defined as local health commissioners and local providers of health services including Directors of Public Health and Sexual Health Managers.

Several reasons for the low use of economic evidence in the local context have been suggested: such as the complexity of the method, its accessibility, as well as time constraints (Eddama and Coast, 2009; Chen, Ashcroft and Elliott, 2007). Previous research has highlighted that decision-makers prefer an emphasis on therapeutic value, distribution and acquisition of costs, burden of disease, and affordability within the evaluation of public health programmes. In addition, the decision-makers aim to address aspects of equity, an issue that is often neglected within standard economic evaluation approaches (Eddama and Coast, 2009, 2008; Chen, Ashcroft and Elliott, 2007; Drummond et al., 2003).

The above depicted themes on budgeting pressures, the lack of robust economic evaluations of public health programmes, and the needs of local decision-makers demonstrate the necessity to develop suitable approaches for economic evaluations

of sexual health programmes. This also needs to take into account the applicability and feasibility in the context of sexual health programmes.

3.4. Theoretical foundations and related concepts

Health economics applies the discipline of economics to the topic of health and consists of several paradigms of which economic evaluations, which is the micro-appraisal of health (technology) interventions, forms one part (see Figure 3.1) (Maynard and Kanavos, 2000). Economic evaluation consists of two main dimensions: the inputs and outputs of an intervention or policy change, also described as costs and consequences (Bailey et al., 2015; Drummond et al., 2015). There are challenges associated with the design of appropriate measures for costs and consequences of public health interventions. Appropriate measures are important as decision-makers increasingly rely on economic evaluations to support their decision-making. In the following paragraphs, key principles and core elements of economic evaluations are explained in short and related to the PhD research.

The central problem addressed through economics is resource scarcity (Morris, Devlin and Parkin, 2007). The basic assumption for economic evaluations is that a population has unlimited needs, but resources are limited. The concept of scarcity represents the difficulty in making choices on resource allocation (Morris, Devlin and Parkin, 2007). By conducting economic analyses decision-makers can be supported to make decisions concerning allocation of scarce resources. Resources do not only entail costs but also human resources, such as nurses and doctors, and other infrastructure. In today's context, with an ageing population and increasing demand for healthcare

services due to increased longevity and population growth, economic evaluations are becoming more and more relevant (Ferguson and Belloni, 2019).

There are three main principles serving as the basis for economic evaluation: *perspective*, *opportunity cost*, and *marginal analysis* (Drummond et al., 2015; Kernick, 2003). *Perspective* refers to the viewpoint from which the economic evaluation takes place, and this should be justified. This determines the scope for the costs to be considered, which can influence the result of an economic evaluation. For example, one could be looking at value for money from a societal vs. from a healthcare provider perspective depending on the aim of the health programme and evaluation (Morris, Devlin and Parkin, 2007). The second principle is *opportunity cost* which is based on the principle of choice. If one decision to invest in a particular intervention has been made, another opportunity for investment is missed (Drummond et al., 2005). In the context of this research project, the opportunity is to screen and test certain population groups for STIs and the associated cost means that local authorities cannot spend this budget on other programmes. The third principle as stated by Kernick (2003), is *marginal analysis*. This is where the costs and outcomes (also called benefits or consequences) of a health intervention are compared and there is an evaluation of whether there is an incremental benefit by investing in a programme. Using these principles, a decision on the most efficient intervention, which is an improvement compared to other alternatives, can be determined (Drummond et al., 2015; Kernick, 2003).

The following Figure 3.1 depicts main guiding principles of health economics (Drummond et al., 2015; Maynard and Kanavos, 2000). Due to the aims of this research project to focus on understanding costs and outcomes of STI/HIV control programmes the focus is on three main elements (highlighted in orange) out of the total eight health economics elements whilst accounting for interlinkages: (1,E) Micro-economic evaluation at treatment level – this includes not only treatment but also the control and prevention of infections through testing and screening. (2,D) Supply of health care – in this study, this relates to understanding which costs are important to decision-makers and how they would like these to be expressed. (3,H) Planning, budgeting, and monitoring mechanisms – this research focuses on the perspectives of decision-makers and their preferences in measures for economic evidence. It also addresses the question of which challenges do local decision-makers face when allocating budgets and on what (economic) factors are subsequent decisions based.

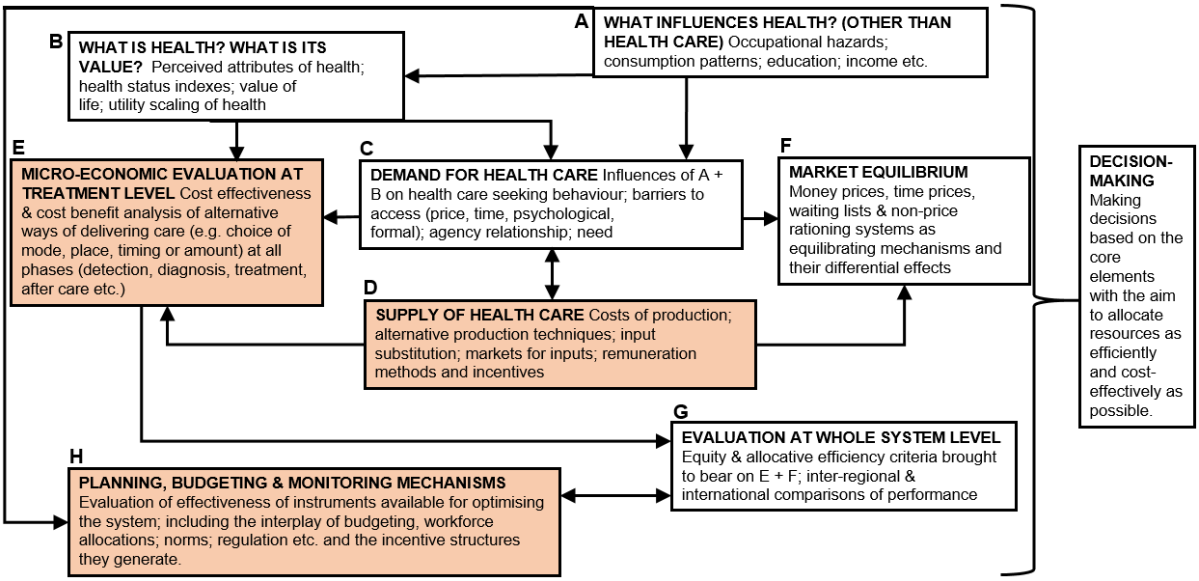

Figure 3.1. Main elements of health economics.

Notes: Adapted from: Maynard and Kanavos, 2000. Drummond et al., 2015.

3.4.1. Welfarism, capability approach, and extra-welfarism

There are two main theoretical approaches underpinning economic evaluations of health and healthcare interventions: *Welfarism* and *extra-welfarism* both having several definitions (Brouwer et al., 2008). Table 3.1 provides an overview of the two approaches, which are presented in the following paragraphs.

Welfarism

Morris et al. (2007) defined welfarism as: “the systematic analysis of the social desirability of any set of arrangements, for example … [an] allocation of resources, solely in terms of the utility obtained by individuals" (Morris, Devlin and Parkin, 2007, p.211). Underpinning principles of the approach are consequentialism, the compensation principle, and the pareto principle (Hicks, 1939, 1941; Kaldor, 1939). The latter entails that by increasing an individual’s welfare, overall society may also

gain irrespective of how the welfare is distributed. Consequentialism entails that the focus of an economic evaluation is on the chosen outcome rather than the processes. Kaldor's compensation principle describes that an intervention is beneficial as long as the people benefitting from the intervention can theoretically compensate for those who do not (Hicks, 1939; Kaldor, 1939; Morris, Devlin and Parkin, 2007).

The individual is responsible for maximising their utility and the choice is influenced by the ability to pay (Birch and Donaldson, 2003). The health outcome is measured in monetary values and the economic evaluation takes the form of a cost-benefit analysis. The aim is to maximise utilities, where utilities describe the preferences of an individual for any particular set of health outcomes (Drummond et al., 2015; Brouwer et al., 2008).

Extra-welfarism

In contrast to welfarism focusing on value judgements by the affected individual, extra-welfarism considers societal objectives from the decision-maker perspective (Culyer, 1981). Extra-welfarism builds on the capability approach (explained below). Both functioning and capability in relation to healthcare are of importance and are combined with individual utility. The latter is based on real world data where people are interviewed to find out their preferences (Morris, Devlin and Parkin, 2007). The defining characteristic is that traditional welfare is supplemented with further characteristics of well-being, i.e. freedom of choice and health state (Culyer, 1989, 1990). The overall aim is to maximise the benefit, in this case health (Brouwer et al., 2008).

Traditional welfarist economists generally criticise extra-welfarist economists for relying exclusively on health outcomes, which is the opposite of what the theory of extra-welfarism describes. In addition, a common agreement on the meaning of extra-welfarism is lacking (Birch and Donaldson, 2003).

Table 3.1. Welfarism and extra-welfarism

Approach	Welfarism	Extra-Welfarism
Underpinning principle	Consequentialism + pareto principle + compensation principle	Builds on welfarism and capability approach
Valuation	Individual utilities	Combining individual utility, e.g., with capabilities, functioning
Value judgements	Willingness-to-pay by individual	All members of society
Economic evaluation method	Cost-benefit analysis	Cost-effectiveness analysis, cost-utility analysis
Health outcome measure	Monetary values	Health gains, i.e., health related quality of life
Aim	Maximising utility	Maximising health

Capability approach

Amartya Sen's work on functioning and capability presents the theoretical foundation for the capability approach (Sen, 1982, 1993). In contrast to welfare economics, which bases evaluation of interventions on individual's utility, the work by Sen applies functioning and capabilities as a basis for the evaluation of such interventions (Coast, Smith and Lorgelly, 2008). Functioning consists of being in good health, well-nourished, and socially respected (Sen, 1982). Capability describes the way in which a person is able to execute these functions based on the individual's choice to do so (Sen, 1993). There are four main categories for evaluation - "well-being achievement",

“agency achievement”, “well-being freedom”, and “agency freedom” (Sen, 1993). The theory does not describe particular functioning and capability as it allows for adaptation to the context. However, this is also the reason why it has been criticised by other scholars working with capabilities (Richardson and McKie, 2005; Nussbaum, 2003). The capability approach provides a basic normative framework making it more applicable to the evaluation of healthcare interventions compared to other approaches (Robeyns, 2006). In Sen’s view, capability is related to distribution and equity issues (Coast, Smith and Lorgelly, 2008).

3.5. Types of economic evaluations

Economic evaluations are a comparative analysis of both costs and outcomes. The aim of economic evaluations is to ensure the efficient use of healthcare resources and to ascertain that the maximum total benefit is obtained from a finite set of resources (Drummond et al., 2015).

There are four main types of economic evaluations: cost-consequence analysis, cost-benefit analysis, cost-effectiveness analysis, and cost-utility analysis (see Table 3.2.) (Drummond et al., 2005). All measure costs in similar ways depending on the perspective applied (see Section 3.7.1) but the nature of how outcomes are expressed differ significantly (Drummond et al., 2015).

In order to compare the costs and outcomes of different interventions, an incremental cost-effectiveness ratio (ICER) is calculated, which functions as a decision rule (Drummond et al., 2005). The ICER shows the differences in costs divided by the

differences in outcomes, effects or utilities when comparing interventions. The importance here is that the outcomes are in the same unit, e.g., monetary values, life years gained. The ICERs are then compared to a cost-effectiveness threshold (CET) to make a decision on the value for money (Drummond et al., 2005; Towse, Pritchard and Devlin, 2002).

Another way to compare an ICER to a CET is to interrogate whether the incremental net monetary benefits are positive. Net monetary benefits include incremental costs which are equivalent to healthcare resources including expected resource savings (Laska et al., 1999). The intervention with the highest net monetary benefit is the most cost-effective. The measure is especially helpful when comparing multiple interventions. Although the cost-effectiveness may be straightforward to determine, alternative interventions should not be ruled out as the cost-effectiveness depends on the threshold (Drummond et al., 2015).

Table 3.2. Economic evaluation types

Type of economic evaluation	Paradigm	Valuation measure	ICER (Yes/No)
Cost-consequence analysis	No particular paradigm	Natural units of costs (monetary) and description of outcomes	No
Cost-benefit analysis	Welfarism	Monetary value assigned to both costs and outcomes	No (cost-benefit ratio)
Cost-effectiveness analysis	Extra-welfarism	Monetary units for costs and natural units (e.g., cases diagnosed, quality-of-life) for outcomes	Yes
Cost-utility analysis	Extra-Welfarism	Monetary units for costs and quality-adjusted-life years / disability-adjusted life years for outcomes	Yes

ICER, Incremental cost-effectiveness ratio

The general study design in which economic evaluations are often embedded are either within a trial design, a decision-analytic model or a hybrid design combining features of both. The first, entails that data is obtained from clinical trials (Drummond et al., 2015). The second, models the data using best available evidence. A hybrid study design obtains data from a clinical trial and extrapolates these with modelling. There are different checklists to assess the quality of economic evaluations, such as the guidance developed by Drummond and Jefferson (1996) or the list of criteria developed by Evers et al. (2005) (Evers et al., 2005; Drummond and Jefferson, 1996). The four forms of analysis are further explained below.

3.5.1. Cost analysis and cost-consequence analysis

There are complete and partial economic evaluations. A partial form of economic appraisal is for instance a cost analysis, which solely focuses on comparing costs of different interventions (Drummond et al., 2005). A complete economic analysis

presents both costs and outcomes. Cost-consequence analyses (CCAs) list costs and outcomes separately and provide the basis for a cost-effectiveness analysis (Drummond et al., 2005). It allows the consideration of all outcomes, but the valuation of which outcome is most important is left to the decision-maker. The analysis provides a disaggregated overview of all costs and outcomes but does not assess the costs and outcomes in the form of an ICER (Mauskopf et al., 1998). Therefore, it may be difficult to make a final decision on the value for money of an intervention.

3.5.2. Cost-benefit analysis

The cost-benefit analysis (CBA) is founded in welfare economics as discussed in Section 3.4.1 (Mishan, 1988). The outcomes are based on the willingness-to-pay for health interventions by the individual, which is one approach to hypothetically assess utilities (Edwards and McIntosh, 2019). Both costs and outcomes are measured in monetary terms. It is described as one of the broader forms of economic evaluations and the decision rule is governed by a cost-benefit ratio (Drummond et al., 2015). Methodological issues include the individual's ability to pay considering an economically wealthy vs. a poorer person and this may result in a biased allocation of resources towards interventions that favour the wealthy. Another limitation is the limited scope with assigning monetary terms to outcomes and the hypothetical nature of elicitation exercises (Coast, Smith and Lorgelly, 2008; Drummond et al., 2005). It is cognitively challenging for people to assign a monetary value to length and quality of life and this can lead to problems with recruiting participants within research studies (Coast, 2004).

3.5.3. Cost-effectiveness analysis

The main characteristic of a cost-effectiveness analysis (CEA) is that the outcomes are measured in the most appropriate physical units, e.g. blood pressure, or in natural effects, such as ‘years of life gained’, ‘number of cases, e.g. STIs diagnosed’ (Drummond et al., 2005). One outcome measure applied commonly is major outcomes averted (MOAs), which refer to sequelae of infections, such as disease PID or ectopic pregnancy for some STIs. However, it does not allow for comparability between different infections since the major outcomes are specific to each disease or condition (Adams and Turner, 2007). CEAs are based on the extra-welfarist approach and can support decision-making for treatment. This form of analysis lacks an overall main outcome, the outcomes are not weighted, and it does not support the decision-maker in how and what the most appropriate way to treat is. The decision is based on dominance or on a cost-effectiveness ratio (Drummond et al., 2005; Morris, Devlin and Parkin, 2007).

The concept of dominance describes the systematic comparison of different interventions to find out which one is most cost-effective (Drummond et al., 2015). For example, if screening women for chlamydia is less costly and more effective compared to screening men only, the strategy for women is dominant as it would improve both health outcomes and reduce costs. If the strategy for men only has additional costs and is less effective, it is dominated by alternative strategies. The recommendation is more complicated if screening men and women for chlamydia would provide additional health benefits but with additional costs. The decision rule to say whether this strategy

would be cost-effective depends on the value of what opportunities will be disregarded as a consequence (Drummond et al., 2015).

3.5.4. Cost-utility analysis

Similar to CEAs, cost-utility analyses are also based on the extra-welfarist approach where the consequences or outcomes of an intervention are combined with utility weights or preferences for health states (Drummond et al., 2005). In CUAs, utility is defined by health. The outcome measure is a QALY, which combines the life expectancy and quality of life of an individual. This results in health-related quality of life as the main outcome. QALYs allow for comparison across a wide range of long-term outcomes. Limitations of this outcome measure are further discussed in Section 3.7.3. In lower-middle income countries disability-adjusted life years or DALYs (averted) are used as a more common outcome measure for CUAs instead of QALYs (gained) (Drummond et al., 2015). DALYs are calculated as “the sum of the years of life lost due to premature mortality and the years lived with a disability due to prevalent cases of the disease or health condition in a population” (WHO, 2022)

3.5.5. Cost-of-illness studies

Cost-of-illness studies (COIs), which were one of the early economic evaluations applied to health, are conducted from the perspective of the patient or person affected by the illness in question (Tarricone, 2006; Rice, 2000). They commonly take a broader approach to costs including direct medical, e.g., mortality, morbidity, disability, and other disease characteristics, and non-medical as well as indirect costs, such as productivity losses and societal costs. Further cost categories are presented in Section

3.7.1 (Jo, 2014; Rice, 2000). Direct non-medical costs are for example health insurance and vocational rehabilitation expenditures (Rice, 2000). The adverse effects of illnesses are expressed in monetary terms and the outcome expresses the total societal burden caused by a particular disease (Byford, Torgerson and Raftery, 2000; Rice, 2000). COIs similar to CCAs or to a cost analysis can provide a basis for economic evaluations, such as CEAs and CUAs, due to the detailed assessment of costs associated with the adverse health outcome (Jo, 2014). Criticisms of the approach include the fact that high expenditure does not necessarily equate to inefficiency. The generated health outcomes through an intervention are omitted in COIs, which means that it cannot be determined whether the expenditure is inefficient or not (Byford, Torgerson and Raftery, 2000).

3.6. Economic models in health

Economic models are often employed to make predictions, e.g. about the epidemiology of an infection and associated resource use to inform decision-making processes (Squires and Boyd, 2019; Barton, Bryan and Robinson, 2004). They can compare all appropriate options and combine data from a variety of sources to extrapolate costs and outcomes. The models are termed decision models because they can synthesise the evidence to estimate costs and effectiveness (Squires and Boyd, 2019). They consider both the benefits and risks of a programme or intervention. The models are structured and depict clinical pathways and can allow for events to occur over time. The model data can originate either from clinical trials which may be enhanced by data from other studies, such as from cohorts or meta-analyses, from the literature, or clinic databases (Squires and Boyd, 2019).

There are different types of models. Three model forms – decision trees, Markov models, and individual sampling models – are further explained below. The models can be dynamic or static. Static models include a fixed rate of infection and reinfection rates, which are not influenced by the number of infectious people, whereas dynamic models consider the incidence of infection in their predictions (Drummond et al., 2015). For modelling of infectious disease epidemiology, such as STIs and HIV, it is recommended to apply a dynamic approach (Barton, Bryan and Robinson, 2004). It should be noted that decision analytic models are a simplification of reality and therefore the assumptions within the model should always be stated (Drummond et al., 2015). When assessing modelling studies for their quality, the Philip's checklist can be used (Philips et al., 2004).

3.6.1. Decision trees

Decision trees are a map of the patient pathway, which can consider pathways of infections as well as treatment (Barton, Bryan and Robinson, 2004). They begin with a root, which has one decision node (see Figure 3.2). The decision node has different branches representing the various strategies, which are to be compared. For each strategy, there is a series of chance nodes. The outcomes are at the end of each pathway and the last node of a pathway is a terminal node. For each next step in the pathway, transition probabilities are calculated. Decision trees are less appropriate to analyse long-term outcomes and are limited in handling reoccurring events.

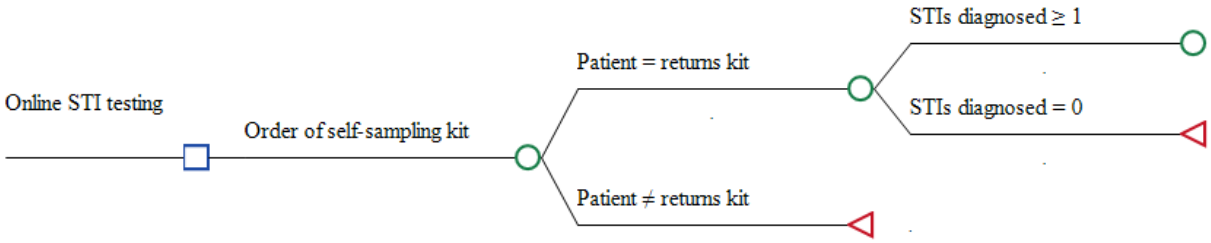

Figure 3.2. Decision tree of online screening for sexually transmitted infections.

Notes: The decision tree is incomplete. Square: root node; circle: chance node; triangle: terminal node.

STI, Sexually transmitted infection.

=, does; ≠, does not

3.6.2. Markov models

Markov models are applied when looking at disease processes, e.g. chronic diseases, evolving over a period of time (Sonnenberg and Beck, 1993). The time period considered within the model is referred to as the time horizon. In contrast to decision trees, Markov models can handle reoccurrence of events and depict patients staying in a specific state of the disease over time (see Figure 3.3). Life years gained or QALYs and long-term costs can be estimated (Sonnenberg and Beck, 1993). A cycle length is required to show how long a patient takes to go through the different stages of disease (Sonnenberg and Beck, 1993). The limitations of these models are that the patient history is not taken into account, the modelled population is assumed to be uniform, and that the risk captured by the model is assumed to be constant over time (Barton, Bryan and Robinson, 2004).

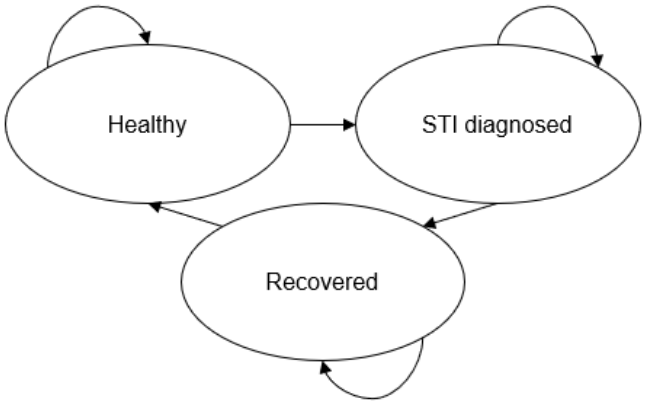

Figure 3.3. Markov model for screening of sexually transmitted infections.
Notes: The arrows indicate the possible transitions between the states.
STI, Sexually transmitted infection.

It should be noted that for modelling the cost-effectiveness of public health programmes, any recommendations for appropriate time horizons are lacking, and this is made more difficult due to the shortage of high quality evidence (Jackson et al., 2014; Lorgelly et al., 2010).

3.6.3. Individual sampling models

Individual sampling models, which have been described as discrete-event simulation (DES) or state-transition models, are models accounting for patient attributes by using a Monte Carlo simulation (Barton, Bryan and Robinson, 2004). The models are commonly dynamic models using DES and system dynamics (SD) to account for the risks of an individual becoming infected dependent upon the number of currently infected individuals. In a STI context, DES and SD models allow for reinfection of the individual as well as to consider the effects of partner notification (Barton, Bryan and Robinson, 2004). SD works on an aggregated level whereas DES illustrates the individual level (Roberts et al., 2006).

3.6.4. Validating a model

Economic evaluations contain uncertainty (Squires and Boyd, 2019). Therefore, it is common practice to assess the robustness of the result to assumptions made during the modelling process. There are four main types of uncertainty to be investigated: parameter, methodological, and structural uncertainty as well as generalisability (Squires and Boyd, 2019). Parameter uncertainty looks at the parameters applied in the model. Methodological uncertainty considers different perspectives, discounting, equity considerations or valuing of health effects. Structural uncertainty assesses the functional form of a model, i.e., that the pathways represent the reality. Generalisability relates to the extent to which the model results can be transferred and applied to another context. The different types of uncertainty can be assessed through sensitivity analysis, which may take the form of one-way, multiway, threshold, scenario, and probabilistic sensitivity analysis (PSA) (Drummond et al., 2015). Multiway, scenario, and PSA are more sophisticated forms of analyses compared to threshold or one-way sensitivity analysis. They account for the combined effect of parameter changes on the costs and consequences. A scenario analysis usually focuses on a base case (baseline data), best case, and worst case scenario. A PSA considers ranges for specified parameters and therefore can produce more realistic distributions of costs and consequences (Drummond et al., 2015).

3.7. Measuring costs and outcomes of public health interventions

As described in Section 3.2, public health programmes are not only delivered via health but also through community services (Edwards and McIntosh, 2019). In the context of SHS, prevention measures such as condom provision or being tested for STIs are

commonly accessible via pharmacies or other community organisations for specific vulnerable groups. Therefore, how costs and outcomes of public health programmes are measured differs from traditional healthcare programmes.

In the UK, NICE provides guidance on economic evaluations of health programmes and appraises health technologies deciding whether these are made accessible through the publicly funded healthcare system (Barton, Bryan and Robinson, 2004). The Institute has recognised that solely applying ICER and QALYs as outcome measures may not fully capture the overall benefits of public health programmes (NICE, 2014). Therefore, the agency suggests in the reference case to apply a societal perspective to incorporate broader costs and outcomes and alternative outcome measures such as life years gained, cases averted, or more disease-specific outcomes and CCAs. Non-health effects may also be included as an outcome – the underlying assumption being to maximise health status and health related functions (NICE, 2014). Criticisms of this guidance state that whilst adopting a societal perspective for public health programmes may be appropriate, it will make the comparability between public health programmes and clinical interventions more difficult (Lorgelly et al., 2010).

How costs and outcomes are generally measured is described in the sections below. As explained in Sections 3.4 and 3.5, this also depends on the perspective and type of economic evaluation applied.

3.7.1. Costing approach

The costing approach depends on what costs are of interest (Drummond et al., 2015). For example, costs can be accrued due to the consumption of other services or due to the treatment or intervention itself. As mentioned in Section 3.3, the first step is to define the perspective, i.e., from which viewpoint are costs to be analysed. This may be from the perspective of a primary care service, a hospital or health system or the patient or family perspective considered in a societal perspective (Drummond et al., 2015). The chosen analytic perspective therefore influences the methods for economic evaluation and is often determined by the decision-maker for whom the economic evaluation is conducted. For health services, the costs may range from inpatient days in hospital and outpatient visits to the health service. The societal costs can include the same costs from the health service but also extend to costs accrued by taking days off work and education (Drummond et al., 2015). The second step is to identify and measure the cost generating events where resources are used. In the context of STI screening, the cost generating events include the laboratory diagnostics, an appointment with the nurse, and the drugs for treatment of the infection. The resources utilised are then assigned a value. In this example it would be cost per laboratory diagnostic, cost per nurse appointment, and cost per drug for treatment.

The costs can be categorised into four types: direct medical, direct non-medical, indirect, and intangible costs (Rice, 1967). Three cost categories are generally associated with STIs: direct, indirect, and intangible (Hull, Kelley and Clarke, 2017). Direct medical costs are materials and services utilised when accessing SHS, for example a patient visiting a nurse to be tested for a STI. Indirect costs from a patient

perspective may be loss of time and from a societal perspective loss of production or pay, due to the person being affected by the STI, which are more difficult to measure. The third category are intangible costs, which are non-financial, and may consist of stigma, depression or pain, and anxiety attributable to the programme (Hull, Kelley and Clarke, 2017; Siegel, 1997; Rice, 1967). An overview of which cost category is considered within which perspective is shown in Table 3.3. The perspective aiming to be the most comprehensive is the societal perspective, which seeks to capture costs and outcomes beyond the ones directly accrued from the healthcare system (Drummond et al., 2005).

Table 3.3. Perspectives and cost categories

Perspective/Costs	Direct medical costs	Direct non-medical costs	Indirect costs	Intangible costs
Patient	✓	✓	✓	✓
Provider	✓	X	X	X
Societal	✓	✓	✓	✓

✓, Yes; X, No

Not only the chosen perspective but also the context, i.e., the healthcare system of the country where the programme is evaluated, has a significant impact on the costs considered. A good example is provided by comparing the healthcare systems of the UK and USA. The USA has an individual-based healthcare system, where from a patient's perspective a large amount of costs fall on the individual whereas in the UK, the publicly funded national healthcare system, covers most of the individual expenses (NICE, 2012; Rice et al., 2020).

3.7.2. Outcome measures

The outcomes of a health programme can be measured in several ways. This includes clinical outcomes, QALYs, and outcomes that go beyond the health of the individual, e.g., the quality of life of carers or broader wellbeing measures.

In CEAs, health outcomes are measured in natural units or clinical effects, such as number of gonorrhoea cases diagnosed, or number of patients cured from an STI. This form of outcome can also have an impact on people's overall quality of life and wellbeing. Measures of these effects include utility and QALYs or capability and willingness-to-pay (Torrance and Feeny, 1989; Donaldson, 1990).

Health-related quality of life measures preferences for attributes of health (Drummond et al., 2015). To assess the quality of life, time-trade off or standard gamble exercises are used. There are also disease-specific measures to describe specific attributes, e.g. the EORTC-8D index for measuring health characteristics for cancer, as well as generic measures, such as the EQ-5D or the SF36 profile to measure a general health profile of a person commonly applied in an outpatient and community setting (Rowen et al., 2011; Brazier, Roberts and Deverill, 2002; Brooks, 1996). Utility is a preference of a health state measured through these tools and has a range of zero to one. Zero represents death and one is one year in full health (Drummond et al., 2015; Torrance, 1986). The utilities are used to calculate QALYs. There are limitations associated with this measure, which will be further elaborated below. Nevertheless, QALYs allow for comparison of health benefits resulting from different health programmes and are

applied as a standard outcome measure by governmental organisations including NICE (NICE, 2014; Adams and Turner, 2007).

Discounting

When looking at costs and outcomes over a period of time, it is good practice to apply a discounting rate (Drummond et al., 2015). The rate is usually recommended by the country where the economic evaluation takes place, e.g. in the UK this is 3.5% (HM Treasury, 2018). Costs typically accrue at the start of an intervention and the outcomes especially in a public health context, often occur in the future (Severens and Milne, 2004). The discounting rate allows adjustment for costs and outcomes, which are incurred and generated over a number of years and sets the value to today's present value (Drummond et al., 2015). This is because people prefer to receive benefits in present time but pay for them later and therefore future costs and outcomes are discounted (NICE, 2020).

3.7.3. Limitations of economic evaluations for public health programmes

Public health programmes aim to increase health and to decrease health inequalities for specific populations. Standard economic evaluations address the health of the individual making it difficult to address the aims of public health programmes (Drummond et al., 2009). The standard approaches for economic evaluations also neglect to consider health inequalities in the evaluation process as the focus is on health maximisation rather than on how health is distributed (Lorgelly et al., 2010; Drummond et al., 2009). The methods have been developed for Health Technology Assessments and therefore fail to capture all the costs and outcomes, which are of

interest when evaluating public health programmes (Marsh et al., 2012). In the UK, there are specific recommendations for the economic evaluation of public health programmes, which also include recommendations to not only apply QALYs and MOAs as outcome measures as well as to consider a wider perspective to account for costs incurred by other sectors (NICE, 2014). More specific aspects in terms of the limitations of QALYs as an outcome measure for application in a public health context are outlined below.

The QALY limitations

When searching for economic evidence for public health interventions and especially for prevention programmes for STIs, QALYs are frequently used (Uthman et al., 2018; Audisio et al., 2016; Bailey et al., 2016; Grauvogl et al., 2015). A QALY is a general measure of a person's or group's state of health. The benefits are expressed as length of life and to reflect the person's or group's quality of life, they are adjusted accordingly (NICE, 2019a). A recent debate has taken place about the value of a healthy person's year and the anchoring of zero as being dead in a health state (Sampson, Parkin and Devlin, 2020). In a healthy person, the maximum QALY per year is one. If a person becomes ill, they may lose more than one QALY. This falls in line with the debate that it may not be necessary to assign zero to being dead as a baseline rather than to an alternative health state (Sampson, Parkin and Devlin, 2020).

Besides the valuation of health states, the QALY also neglects to address broader aspects of quality of life, which public health programmes aim to affect (Lorgelly et al., 2010). If an economic evaluation applies QALYs as the only outcome measure, it may

therefore miss substantial intervention effects. The overall aim of public health programmes is to address and reduce health inequalities (Lorgelly et al., 2010). Weighting of outcomes should be considered to account for different population groups but the standard approach to measure QALYs does not differentiate between different population groups. This means that irrespective of a person's socio-economic status, the QALY is the same, which has been criticised by several scholars (Cookson, Drummond and Weatherly, 2009; Weatherly et al., 2009; Kelly et al., 2005). Therefore, it is argued that there is a need for broader outcome measures besides QALYs including life-years gained, wellbeing effects and cases averted (Lorgelly et al., 2010).

3.7.4. Alternative approaches

As shown by previous research, equity and context are of importance to decision-makers when evaluating public health programmes. These are not addressed by standard economic evaluations presented in the preceding sections. Health economists are working on alternatives, such as the distributional cost-effectiveness analysis, where equity and distributional concerns of costs and outcomes are addressed (Cookson et al., 2020).

Return on investment (ROI) or social return on investment (SROI) followed by CBA is seen as a more pragmatic form of evaluation (Charles, Jones and Lloyd-Williams, 2019). ROI measures the investment efficiency. SROI, whilst accounting for all relevant stakeholders, assigns a created social value based on the results from different interventions. This result-based value is then compared to the resources which have been invested to implement the intervention. It is a helpful measure to understand the

efficiency and effectiveness of spending resources (money) (Charles, Jones and Lloyd-Williams, 2019). The method is mainly criticised for its subjectivity concerning the assumptions and lack of comparability.

Wellbeing and capability

As outlined in the sections above, standard economic evaluations are based on preferences (Marsh et al., 2012). There has been work on additional valuation paradigms to address the gaps of economic evaluations when applying these to public health programmes. These include for example the capability and subjective well-being (SWB) approaches as well as multi-criteria decision analysis (MCDA) (Marsh et al., 2012). The SWB and capability approaches allow broader aspects of valuation to be employed, which is more appropriate in a public health context. For further information on the capability approach, see Section 3.4.1. The SWB approach aims to compensate for the limitations of the capability approach, e.g., relying on expert opinion. It relies on self-assessment of wellbeing from people and measures how outcomes may effect this differently depending on individual experience (Marsh et al., 2012). The main characteristic of MCDA is that it incorporates a variety of outcomes generated from policies. By identifying evaluation criteria for different health interventions and combining this with a weighting of the overall scores, it allows for a wide-ranging evaluation of each intervention (Marsh et al., 2012; Romero, 1996).

3.8. What makes economic evaluations for SHS unique?

SHS are unique compared to other public health programmes. Patients can access any service regardless of their home address and without a referral from a general

practitioner. The services do focus on prevention and treatment of STIs but also address safeguarding issues, drug misuse and other aspects of life, which may impact a person's sexual health (DHSC, 2013).

As described in Chapter 2, the changes in commissioning for SHS in the UK resulted in different responsibilities for the commissioning of SHS across the health sector. Therefore, investments by one local authority in control of STIs via screening services may not be realised in monetary terms by the same commissioner. For example, when applying a CEA to evaluate the cost-effectiveness of screening services for STIs, the major outcome averted would be PID. However, although the local authority does commission the service for screening, the service for treating PID is commissioned by the NHS. Therefore, the benefits as described by the CEA would be realised by another commissioner in the healthcare sector. This is why outcomes beyond direct medical outcomes, such as productivity gains, should also be considered to highlight the overall benefits of SHS.

3.9. Conclusions

This chapter explained the relevance of economic evaluations in a public health context. It highlighted the main types of economic evaluations, described the various models applied in this area, and presented different methods for measuring costs and outcomes. The decision-making process concerned with using economic evaluations to inform public health programmes, and especially sexual health programmes, is complex and needs to be further explored. It is important to look at current economic evaluations to understand how programmes for sexual health are economically

evaluated. The next chapter presents a systematic review on economic evaluations of STI control programmes.

CHAPTER 4
Systematic review on economic evaluations of sexually transmitted infections control programmes

This systematic review has been published and this chapter is an extended version from the published review. All comments from reviewers were integrated into this chapter and the publication is attached in Appendix 4.1. In this chapter, all published economic evaluations for control programmes of STIs between 1999 to 2022 in OECD countries were reviewed. The methods and quality of studies are discussed, and future research needs are highlighted.

4.1. Introduction

Economic evaluations of public health interventions are complex in nature but essential to support efficient allocation of healthcare spending and the optimal commissioning of clinical services. One reason for this complexity is that public health interventions encompass aims beyond just health, such as equity and educational outcomes (Edwards, Charles and Lloyd-Williams, 2013; Payne, McAllister and Davies, 2013; Marsh et al., 2012; Lorgelly et al., 2010; Weatherly et al., 2009). In contrast to clinical healthcare interventions, public health interventions are often implemented in complex settings where there are multi-sectoral costs and outcomes (NICE, 2014).

Methodological guidance for economic evaluations in public health emphasises the importance of considering factors, such as: local decision-making processes; longer time horizons; broader costs and outcomes (Edwards, Charles and Lloyd-Williams, 2013; NICE, 2014, 2012); and adopting a societal perspective to include health and non-health costs and effects; as well as utilising different economic evaluation designs, depending on the needs of decision-makers (NICE, 2014, 2012).

In some countries, this contrasts to healthcare economic evaluations, for example in the UK, Belgium, Croatia, Czech Republic, Estonia, and Latvia a healthcare perspective for costs and outcomes is generally recommended (Swedish Council on Health Technology Assessment, 2015). Improving sexual health and the control of STIs and HIV is an important dimension of public health. STI and HIV control encompasses treatment, screening, and testing, which aims to reduce the incidence and prevalence of infections. Because STIs may be asymptomatic, screening for STIs is viewed as important to reduce onward transmission and thereby control the infections (Steen et al., 2009). As outlined in Chapter 2, young people are among the risk groups for STIs (Mitchell et al., 2020). For example, between 2018 and 2019, for people aged between 20 and 24 years there was a 28% increase in the number of gonorrhoea diagnoses (from 13,623 to 17,443 cases).

Very few systematic reviews of economic evidence in sexual health have been conducted (Bailey et al., 2015; Jackson et al., 2014; Shepherd et al., 2010). Initial scoping showed that there is a small existing base of robust evidence to inform economic evaluations in relation to the outcomes of STI and HIV screening

programmes as well as assessing new modes of delivery in a sexual health context. This includes economic evaluations for the delivery of online SHS and services provided in community settings, such as pharmacies (Bailey et al., 2015; Jackson et al., 2014; PHE, 2014b). This chapter presents a systematic review on economic evaluations of control programmes for STIs.

4.2. Aims and objectives

The overall aim of the systematic review was to understand:

How are costs and outcomes conceptualised in economic evaluations of control programmes for STIs targeting young people in OECD countries?

To guide the search of the literature and further analysis, the following sub-questions were developed:

i. What economic evaluations of STI control programmes have been published post 1999 in an OECD country context?
ii. What types of economic evaluation methods are being applied?
iii. How are the costs and outcomes measured, valued, and analysed?

The first objective for this phase of the PhD research was to critically appraise the economic evidence that could be used to inform local decision-making in relation to screening and testing interventions to control STIs. In order to meet this objective, a systematic review of literature in this topic area was conducted to investigate how previous economic evaluations have assessed costs and outcomes of programmes to control for STIs. Later sections of this thesis explore with decision-makers on whether

and how the available evidence is utilised. The review was designed to inform the empirical work (Chapters 5 and 6: Interviews with sexual health decision-makers and academic health economists and public health researchers) by developing an overview of the methods currently applied in economic evaluations of control programmes for STIs, and this was used to develop and inform the topic guide for these interviews.

4.3. Methods

The review followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for reporting and the UK Centre for Review and Dissemination (CRD) guidelines for methods (Moher et al., 2009; Centre for Reviews and Dissemination and University of York, 2009). The following sections describe the inclusion and exclusion criteria, search strategy development, data management and categorisation process as well as methods for quality assessment and data synthesis.

The systematic review began by developing a search strategy aiming to answer the research question. The search strategy involved three main search areas STIs, economic evaluations, and public health. The STIs (chlamydia, gonorrhoea, syphilis) and HIV were chosen as a focus for this review because they are the most common and serious STIs in OECD countries (European Centre for Disease Prevention and Control, 2020b; a; OECD/EU, 2016).

4.3.1. Inclusion and exclusion criteria

To narrow the focus and concentrate on the different components of the research question, findings from the database search were subject to the following inclusion and exclusion criteria. The criteria were developed in an iterative process in which they were applied to the search strategy and adapted accordingly.

Inclusion criteria

Studies were included if they met the following criteria: the study population consisted of women and/or men predominantly below 30 years of age who were at risk of or affected by one of the specified STIs (chlamydia, gonorrhoea, syphilis) and living in OECD countries; the focus was any intervention or programme to control STIs or HIV; and costs and outcomes were measured to inform an economic evaluation. The definition of young people was selected to include all those under the age of 30 to reflect definitions widely used in Europe and other OECD countries (OECD, 2021; European Commission, 2012). During the initial search, publications were not excluded on the basis of language. Due to resources constraints, studies in languages which were known by the author (English, German, French) were considered for review. Studies in other languages were excluded.

To be included, the study had to have a focus on a young population as a general group rather than be limited to specific population sub-groups, such as MSM, incarcerated people or school pupils, to ensure that findings were applicable to a broad population group. The population group in focus were young people below the age of 30 because they belong to a higher risk group concerning the transmission of and

infection with STIs. The reasons include that young people have, compared to other age groups, relatively high rates of sexual activity and tend to be more risky in their behaviour by, for instance, not utilising condoms to protect against STIs (Mercer et al., 2013). Studies on *Chlamydia trachomatis* were included although they may have not specified their population focus. This is because one of the main target groups of interventions for this infection are young people, e.g., for the NCSP (see Chapter 2.5.2).

Exclusion criteria

Studies were excluded if they did not focus on STIs but rather on their sequelae including ectopic pregnancy or pelvic pain. Further, studies were excluded if the setting was not an OECD country or if the study focus was not predominantly on young people. The study's focus had to be on the control (testing/screening) aspect of STI programmes rather than on the management of the disease, such as anti-retroviral treatment or PrEP for HIV. Studies were also excluded if different testing methods for diagnosis, such as individual vs. pooled specimen were evaluated. The process of deciding on the exclusion criteria was iterative and was discussed with the supervisors of this thesis.

4.3.2. Search strategy development

The search strategy was primarily based on the methods used by other systematic reviews in this research area (Althaus et al., 2014; Jackson et al., 2014; Gurung et al., 2018; Lin, Eder and Bean, 2018; Rönn et al., 2019) and focused on three main components: STIs, economic evaluation, and public health.

The selection of the seven databases was based on recommendations by Arber et al. (2018) for conducting systematic literature research of economic evaluations. The databases searched were MEDLINE, EMBASE, Web of Science, PsycINFO, NHS Economic Evaluation Database (EED), NHS Health Technology Assessment (HTA), and the Database of Abstracts of Reviews of Effects (DARE). In addition, the NICE online database was hand searched selecting the BASHH and NICE components as sources and applying the time limits of January 1999 to April 2019. The initial search strategy was developed for the MEDLINE database (accessed via Ovid). MeSH terms, truncation, and wild card symbols were adapted accordingly for the other databases. The reference lists of selected studies were also reviewed. After publishing the review, it was updated between April 2019 to May 2022 to identify any additional studies that had been published. The search strategies applied to the different databases can be found in Appendix 4.2.

Applied limits

Two main limits were applied in the database search: a timeframe from January 1999 to April 2019 and studies involving 'humans' only. In 1999, NICE was established to provide guidance for health and social care based on health and economic evidence and therefore stipulate a 'reference case' for methods for economic evaluations (NICE, 2019c; Rawlins, 2015). Several other countries followed with providing guidance for economic evaluations, such as the Netherlands and the USA (Zorginstituut Nederland, 2016; Honeycutt et al., 2006). In addition, the UK DoH developed its first strategy for sexual health and HIV in the year 2001, which was later also followed by other countries, such as Germany (Federal Ministry of Health and Federal Ministry for

Economic Cooperation and Development, 2016; Department of Health and Social Care, 2001). Further, new diagnostics for testing were introduced after 1999 with higher specificity and sensitivity, which increased the comparability of interventions after this date (Chernesky, 1999).

4.3.3. Data management

For management and categorisation of the references, EndNote referencing manager (version X9) was utilised (Clarivate Analytics, 2019). For the systematic selection of studies, the strategy recommended by the University of York Centre for Review and Dissemination was applied (Centre for Reviews and Dissemination and University of York, 2009).

4.3.4. Categorisation process to select the relevant studies

After applying the search strategy in all seven databases, the data was transferred to EndNote X9, and duplicates were removed. The records identified through the search strategy were categorised using a two-stage process as suggested by Roberts et al. (2002). First, there was a primary categorisation of papers based on screening the title, keywords, and abstract. This was followed by the second selection stage in which the studies were read in full and were further categorised in terms of the type of economic evaluation applied (study design). The identification and initial categorisation were performed by one author (SB) and two authors (LJ, EF) checked the selection process (screening, eligibility, and inclusion) to confirm the categorisation of studies. The first stage included categories from A to I, and the second stage further categorised studies identified as A and B to categories 1 to 5 based on the study design (see Figures 4.1

and 4.2). Any study categorised as C-I, and A2, A3, A4, A5 / B2, B3, B4, B5 was discarded. Reasons for exclusion included incomplete economic evaluations, focus on other STIs or a different target group. Studies classified as category A1 - a complete economic evaluation - were taken forward for data extraction and narrative synthesis.

A. The study presents an economic evaluation of a STI control programme targeting young people and therefore contains useful primary or secondary data on both costs and outcomes of the assessed intervention;

B. The study shows original data (primary research) on the cost and/or economic outcomes of STI control programmes of the target population (where economic outcomes are defined as QALY, DALY, HALY, monetised benefits, capabilities,?);

C. The study may have useful information, i.e., economic characteristics, targets young people but does not clearly belong to either category (A) or (B);

D. The study focuses on economic evaluations of control programmes for less prevalent STIs, e.g., genital warts or trichomonas vaginalis targeting young people or other risk groups, e.g. MSM without age specification;

E. The economic evaluation of STI testing and screening has no particular focus on young people, e.g., general population focus or other risk groups including methods of partner notification and prenatal testing;

F. The study presents an economic evaluation of tests and diagnostic tools for STIs;

G. The study is a systematic review of an economic evaluation of a STI control programme targeting young people;

H. Based on title/abstract/keywords it is not clear whether the study may contain useful information of economic evaluations of STI control programmes targeting young people;

I. No relevance to economic evaluations of STI control programmes targeting young people.

Figure 4.1. Stage 1 categories for the study selection.

Notes: DALY, Disability-adjusted life year; HALY, Health-adjusted life year; MSM, Men who have sex with men; QALY, Quality-adjusted life year; STI, Sexually transmitted infection.

1. Complete economic evaluation, e.g., cost-effectiveness analysis or cost-utility analysis of a STI control programme targeting young people including chlamydia only focus;

2. Incomplete or partial economic evaluation of control programmes for STIs including ongoing studies and studies focusing on measuring the economic burden and/or resource use;

3. A study describing different methods for an economic evaluation of control programmes for STIs;

4. Review of economic features of control programmes for STIs, i.e., a secondary study which includes some form of overview of costs or resource use of a STI control programme;

5. No relevance for economic evaluations of sexual health programmes.

Figure 4.2. Stage 2 categories for the study selection.

Notes: STI, Sexually transmitted infection.

The inclusion and exclusion process and categorisation of the records is presented in the form of a flow-chart (Moher et al., 2009) in the results section (Chapter 4.4.1).

4.3.5. Quality assessment

The quality of studies, which were categorised into the final stage A(1), were assessed by applying the BMJ checklist for reviewing economic evaluations (Drummond and Jefferson, 1996). For modelling studies from category A(1), the Philips criteria were utilised to critically appraise the methods and reporting (Philips et al., 2004). The purpose of the quality assessment was to critically appraise the current economic evidence for STI control programmes. No studies were excluded based on the critical appraisal. The appraisal supported the analysis of the different methods applied in the

studies and highlighted their strengths and weaknesses demonstrating the quality of available economic evidence. The quality assessment of economic studies can be useful in determining the robustness of study results. Lower levels of quality can potentially lead to misinformation and hence suboptimal assumptions by decision-makers (Drummond et al., 2015).

4.3.6. Data extraction and synthesis

In order to extract data from the study findings, the data were tabulated using a standard template and a narrative method of synthesis was used. This method of synthesis was chosen due to the diversity of the studies found and is based on the narrative synthesis framework from the Centre for Reviews and Dissemination, University of York (Drummond et al., 2015; Centre for Reviews and Dissemination and University of York, 2009, p.49). The data extracted were general study characteristics, such as the country, study population, results, and limitations reported. Additional information on the methods adopted concerning the type of economic evaluation, outcome measure, and costing approach was identified and collected. For a full list of data extraction categories see Appendix 4.3. In combination with the quality assessment, it was then possible to assess the robustness of evidence of studies conducting economic evaluations of STI control programmes.

4.4. Results

In this section, the results of the review are reported. It begins with the scoping of the review, depicting the categorisation process including the PRISMA diagram, and is followed by an overview of the study characteristics, methodological choices, overall outputs, and a synopsis of the critical appraisal.

4.4.1. Overview of the study selection process

The PRISMA diagram shows the different stages of the systematic review process (see Figure 4.3). It shows how many records from each of the databases were obtained: MEDLINE 2,113 records; EMBASE 4,312 records; Web of Science 2,544 records; PsycINFO 439 records; NHS EED 110 records; HTA 3 records; DARE 1 record. An additional eight records were found by hand searching the NICE database for both NICE and BASHH sources. This resulted in a total of 9,530 records of which 3,485 were identified as duplicates. Of the remaining records, 5,612 studies were excluded based on initial screening. This resulted in 433 records being screened as part of Stage I (see Figure 4.1). Based on title, abstract, and keywords records were coded into A to I categories. This process identified three additional duplicates and 366 records were excluded. The main reason for exclusion was that studies did not conduct an economic evaluation or had a different focus in their intervention, such as behavioural change or other STI focus. Studies in categories A and B were then selected for further categorisation in Stage II (see Figure 4.2). This resulted in 64 records with two additional records identified from hand searching reference lists. The records from categories A(4), A(5), B(2), B(4), and B(6) were excluded based on their relevance for answering the research questions. The six records from categories A(2)

and A(3) were not included in the final stage of data extraction since a large number of studies were already found for the most accurate category (A(1)) and additional information was not considered necessary at this stage. An additional study in category A(1) was a duplicate analysing the same data and applying the same outcome measure, which led to the exclusion of this study. The assessment of full-texts resulted in 31 category A(1) studies identified for inclusion in the quality assessment and narrative synthesis. The search was updated in May 2022, which found two additional studies fulfilling the inclusion criteria resulting in a total number of 33 studies to be reviewed.

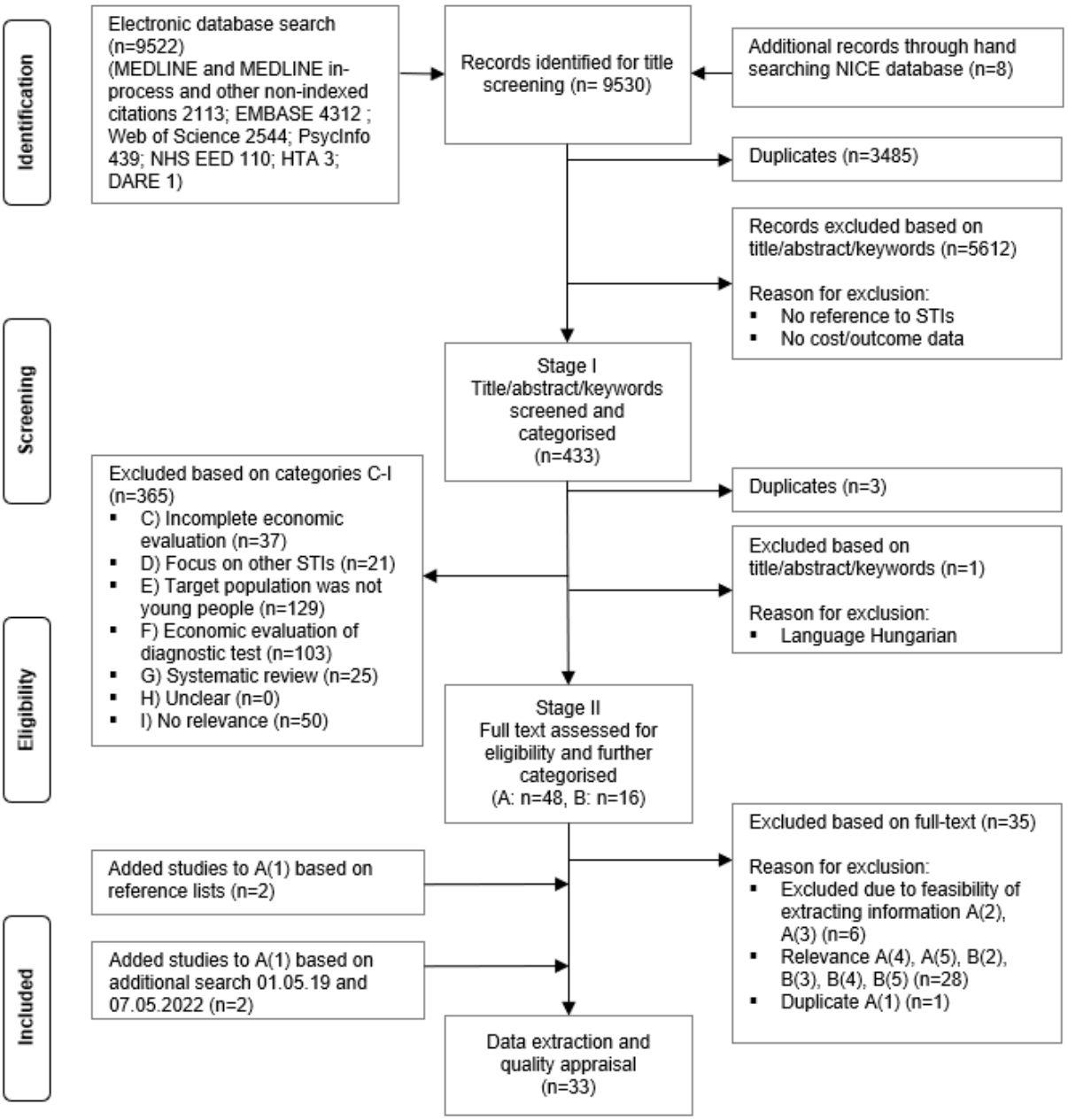

Figure 4.3. PRISMA flow-diagram of study categorisation stages 1 and 2.
Notes: NHS EED, NHS Economic Evaluation Database; HTA, Health Technology Assessment; DARE, Database of Abstracts of Reviews of Effects.

4.4.2. Study characteristics

The table below provides an overview of the main characteristics of the 33 studies included in this review (Table 4.1). The main countries where the studies took place

were the Netherlands (7), UK (8), and USA (14). The four remaining studies were conducted in four different countries: Ireland (Gillespie et al., 2012), Denmark (Andersen et al., 2006), Australia (Walleser, Salkeld and Donovan, 2006), and Sweden (Novak et al., 2004). The majority of studies compared the cost-effectiveness or cost-utility of two or more different screening options for chlamydia (27 studies). Six studies included gonorrhoea screening in their strategy (Eckman et al., 2021; Jackson et al., 2015; Aledort et al., 2005; Gift et al., 2005, 2002; Mehta et al., 2002) and one focused on the cost-effectiveness of age-specific HIV screening (Neilan et al., 2018). The reason why fewer studies are related to HIV, is that the focus of the search strategy was on young people and most HIV interventions target populations above the age of 30 or specific risk groups, such as MSM. The search did not identify any study assessing interventions for syphilis. Two studies considered newer screening modes, such as pharmacy based screening (van Bergen et al., 2004) and online screening (Huang et al., 2011).

Study populations

The majority of studies (20) focused on both men and women aged up to 30 years as the study population. Eleven interventions looked at women only. The studies by Jackson et al. (2015) and Stoecker et al. (2021) were the only studies which focused on the cost-effectiveness of screening men for STIs (Stoecker et al., 2021; Jackson et al., 2015).

Intervention and comparator

A range of screening interventions were considered, such as organised screening for chlamydia targeting a certain age group and/or setting, and they were generally compared to a no organised screening programme (17 studies). In three studies the comparator was not explicitly stated (de Vries et al., 2006; Evenden et al., 2006, 2005).

Study findings

The general conclusion by 18 of 33 studies was that screening for chlamydia below the age of 30 years is likely to be cost-effective. Nine economic evaluations concluded that screening for chlamydia was likely to be cost-effective if certain assumptions, such as uptake rate and chlamydia prevalence were correct (van Bergen et al., 2004; Postma et al., 2000; Welte et al., 2000; Turner et al., 2011; Adams, Turner and Edmunds, 2007; Evenden et al., 2005; Andersen et al., 2006; Novak et al., 2004; Tao et al., 2004). However, other studies have highlighted uncertainties around these assumptions. For example, one of the more recent studies used a much lower uptake rate for the screening programmes because the authors considered the rates used in previous studies to be too optimistic (de Wit et al., 2015). The authors stated that a large proportion of the costs were attributed to annual programme costs and that the uptake rate greatly influenced the cost-effectiveness of a large-scale screening programme (de Wit et al., 2015). Four additional studies did not find the STI intervention to be cost-effective (Gillespie et al., 2012; Low et al., 2007; Gift et al., 2002; van Valkengoed et al., 2001). The three studies assessing the cost-effectiveness of gonorrhoea screening concluded that the interventions were cost-effective (Bernstein et al., 2006; Aledort et al., 2005; Gift et al., 2005). The CCA by Jackson et al. (2015)

found that costs and outcomes were similar across the assessed interventions (Jackson et al., 2015). The study examing the cost-effectiveness of the optimal age for HIV screening also concluded the screening programme was cost-effective (Neilan et al., 2018).

One of the most influential parameters for cost-effectiveness stated by a number of studies was the probability of PID as a sequela (Gillespie et al., 2012; Adams, Turner and Edmunds, 2007; Gift et al., 2002). According to Gillespie et al. (2012), the studies where chlamydia screening was cost-effective included a minimum PID probability of 15%. A more cautious approach was to adopt a 10% probability that chlamydia progressed to PID as assumed by this study's team (Gillespie et al., 2012).

Table 4.1. Characteristics of economic evaluations of control programmes for STIs

Author (year)	Country	Study aims and context	STIs			Target population	Screening interval	Intervention and comparator[1]	Intervention was found to be cost-effective (✓=yes, X=no, ✓/X*, NA)	Main CE results
			CT	NG	HIV					
Eckman (2021)	USA	Assess the CE of screening strategies for CT and NG in adolescents and young adults who seek acute care at paediatric emergency departments	✓	✓		Individuals aged 15–21 years who sought acute care at paediatric emergency departments	No screening, targeted screening (based on STI risk), universally offered screening	Three screening strategies: no screening, targeted screening, universal screening	✓	ICER for targeted vs no screening=$6,444; ICER for universal vs targeted screening=$12,139
Stoecker (2021)	USA	Examine the CE of the Check It program, a novel community-based CT screening and expedited partner treatment program for young Black men	✓			Sexually active population 15-24 years in New Orleans, young Black men	One-off screening with monetary incentive	Routine care	✓	Programme cost $5468 per QALY gained
Neilan (2018)	USA	Identify the optimal age for one-time HIV screening for adolescents and young adults			✓	Adolescents and young adults 13-24 years without identified risk factors	One-off screening	Routine care	✓	ICER=$96,000/YLS (cost-effective by U.S. standards: less than $100,000/YLS)
Owusu-Edusei (2016)	USA	Explore the CE of a patient-directed, universal, opportunistic CT Opt-Out Testing strategy for all women aged 15-24 years	✓			High-risk women; 15-24 years†	Unclear	Risk-based screening (30% coverage)	✓	ICER estimated range from cost-saving to $19,974/QALY saved
de Wit (2015)	NL	Evaluate the CE of repeated CT screening and its influence on incidence and prevalence	✓			16-29-year-old men and women	Annual, every 2 years, every 5 years	No organised screening	X	More than 5,000€/MOA; Minimum 50,000€/QALY*
Jackson (2015)	UK	Compare costs and outcomes of two STI screening interventions (CT, NG) targeted at men in football club settings in England	✓	✓		Men (18 years and over) within six amateur football clubs in London	One-off screening	Two STI screening interventions	NA	Average cost: £82, £88, £89 per intervention
Teng (2015)	USA	Incorporate the age dependency of the infection risk into an economic study of CT screening; Optimise age-dependent screening strategies	✓			14–25-year-old women; intercity cohort	Various intervals	No organised screening	✓	Considering age-dependency is cost-saving
Gillespie (2012)	IRE	Estimate the cost and CE of opportunistic CT screening	✓			Men and women; 18-29 years	Annual	No organised screening	X	ICER/MOA=6,093€ and ICER/QALY=94,717€

Author (year)	Country	Study aims and context	STIs			Target population	Screening interval	Intervention and comparator[1]	Intervention was found to be cost-effective (✓=yes, X=no, ✓/X*, NA)	Main CE results
			CT	NG	HIV					
Huang (2011)	USA	Model a hypothetical cohort of 10,000 women/year who order an internet-based CT screening kit	✓			Women (no defined age; CDC recommendation: 15-24 years)	Annual	Routine care	✓	36 cases of PID prevented; $41,000 saved (direct medical costs)
Turner (2011)	UK	Compare the cost, CE, and sex equity of different intervention strategies within the English NCSP	✓			Women and men eligible for the NCSP (15-24 years)	Unclear	Base case data†: NCSP (2008/09)	✓/X	Increasing male screening to 24%=£528 costs per infection treated; PN efficacy to 0.8=£449 costs per infection diagnosed
de Vries (2008)	NL	Estimate the CE of repeated screening for CT at various time intervals	✓			Heterosexual men and women; 15-29 years	Annual, every 2, 5, 10 years	One-off screening	✓	ICER=below 20,000€ (Dutch threshold) for interval strategies for CT screening
Gift (2008)	USA	Examine the impact on men and their female partners of screening men for CT	✓			Women and men; 15-24 years; equal distribution of gender†	Annual	Screening programme for women	✓	ICER/QALY gained ranged from cost-saving to $97,789*
Adams (2007)	UK	Estimate the CE of the NCSP and its alternatives in England	✓			Men and women under 25 years	Annual	No organised screening	✓/X	Average CE ratio is about £27,000*
Low (2007)	UK	Examine the CE of active CT screening approaches in preventing major clinical outcomes	✓			Women and men; 12-62 years; 50% women	Annual, 6 monthly	No organised screening	X	ICER for women screening only=28,000 £/MOA; ICER for screening men and women=25,700 £/MOA
Andersen (2006)	DK	Estimate the incremental effects and costs of home sampling screening for CT over the current in-office screening practice	✓			Men and women; 15-24 years	Annual	In-office screening	✓/X	Total costs/MOA=$3,186; from year 4 the programme was cost-saving
Bernstein (2006)	USA	Identify an optimal screening algorithm for NG infection among women in private sector care		✓		Hypothetical population of women; 15-35 years; mixed race/ethnicity; 15% drug users	Unclear	No organised screening	✓	No screening was cost-saving over all screening strategies; Screening at risk women under 25 years is most cost-effective

Author (year)	Country	Study aims and context	STIs			Target population	Screening interval	Intervention and comparator[1]	Intervention was found to be cost-effective (✓=yes, X=no, ✓/X*, NA)	Main CE results
			CT	NG	HIV					
de Vries (2006)	NL	Estimate the impact of a screening programme on CT incidence and prevalence in the population	✓			Men and women; 15-29 years	One-off screening	X	✓	Net costs/MOA=373€*
Evenden (2006)	UK	Model the dynamics of infection recovery and sequelae to quantify CE of various CT screening strategies	✓			No details on target population; aim was to identify high-risk groups concerning age, gender, partnership frequency†	Unclear (opportunistic screening)	X	✓	£1,500/month saved when high-risk person screened; £200/month saved when low-risk person screened
Walleser (2006)	AU	Examine the CE of a hypothetical screening programme for CT based on annual opportunistic testing of women consulting a GP	✓			Women 25 years or younger consulting a GP	Annual	No organised screening	✓	Cost/QALY=$2,968
Aledort (2005)	USA	Assess the CE of screening women for NG seeking care in urban EDs using two different testing devices		✓		Women; 15-29 years; sexually active; presenting to the ED with non-genitourinary symptoms	Unclear	Routine care	✓	ICER=$6,490/QALY
Evenden (2005)	UK	Capture CT infection dynamics within a population, incorporating the behaviour of different risk groups, and provide a cost-benefit study for screening	✓			Men and women; 16-24 years†	Unclear	X	✓/X	5% high-risk group screening=£1,500 saved/person screened; 1% screening=£200 saved/person screened*
Gift (2005)	USA	Conduct a CEA of five interventions to encourage public STI clinic patients infected with CT/NG to return for re-screening	✓	✓		Men and women; 14-30 years; diagnosed with and treated for CT/NG in two STI clinics	Unclear (one-off screening)	Baseline intervention 1 and 4‡	✓	$622/infection treated (programme perspective); $813/infection treated (societal perspective)
Hu (2004)	USA	Assess the CE of new strategies for CT screening	✓			Sexually active women; 15-29 years	Annual, semi-annual	No organised screening	✓	$2,350 to $7,490 cost/QALY
Norman (2004)	UK	Determine CE of screening for CT in antenatal, gynaecology and family planning clinics	✓			Women; up to 20 years; 20-24 years; 25-29 years; 30 and above; Aberdeen and Glasgow	Unclear	No organised screening	✓	Net cost £771.36/MOA

Author (year)	Country	Study aims and context	STIs			Target population	Screening interval	Intervention and comparator[1]	Intervention was found to be cost-effective (✓=yes, X=no, ✓/X*, NA)	Main CE results
			CT	NG	HIV					
Novak (2004)	SE	Assess the CE of identifying and treating asymptomatic carriers of CT	✓			Women and men; 20-24 years; in Umea, Sweden	Unclear (one-off screening)	No organised screening	✓/X	Female screening cost-saving when >5.1% CT prevalence; male screening cost-saving when 12.3% CT prevalence
Tao (2004)	USA	Evaluate a mixed-integer programme to model CT in women visiting publicly funded family planning clinics aiming to maximise number of infected women cured of CT	✓			Women below 20 years, 20-24 years and above 24 years in family planning clinics	Unclear (annual, six monthly)	Different screening strategies	✓/X	Re-screening: number of cases cured 89-283; cost-savings $61,779-$166,779; Rescreening vs. no re-screening; Additional cases cured 7-20; Additional cost-savings $3,088-$16,820
van Bergen (2004)	NL	Assess the effectiveness and CE of a pharmacy-based screening programme for CT in a high-risk health centre population in Amsterdam using mailed home collected urine samples	✓			Women aged 14-29 years; multicultural, lower income area in Amsterdam; 50% of population had a Surinamese/ Antillean background	Unclear (one-off screening)	No organised screening	✓/X	Cost-saving to 3,872€/PID case averted
Gift (2002)	USA	Examine the CE of routine dual treatment of women with NG infection with or without separate testing for CT and restricting treatment for CT to women testing positive for CT	✓	✓		Asymptomatic women infected with NG; no defined age range	Unclear (one-off screening)	Different screening strategies	X	ICER= -$130 (cost-saving) to $557 cost/PID case averted
Mehta (2002)	USA	Evaluate the CE of enhanced screening for NG and CT in an ED setting	✓	✓		Men and women; 18-31 years; ED setting	Unclear (one-off screening)	Routine care	✓	ICER= -$437 (cost-saving) to $1694 per case treated*
van Valkengoed (2001)	NL	Evaluate the CE of a systematic screening programme for asymptomatic CT infections	✓			Women aged 15-40 years	Unclear (one-off screening)	No organised screening	X	Net cost $15,800/MOA
Postma (2000)	NL	Estimate the CE of screening women for asymptomatic infection with CT in general practice	✓			Men and women below the age of 30; different age sub-groups; general practice setting	Unclear (one-off screening)	No organised screening	✓/X	$386/MOA for women aged 20-24; $644/MOA for women aged 25-29; $2,583/MOA for women aged 30-34

Author (year)	Country	Study aims and context	STIs			Target population	Screening interval	Intervention and comparator[1]	Intervention was found to be cost-effective (✓=yes, X=no, ✓/X*, NA)	Main CE results
			CT	NG	HIV					
Townshend (2000)	UK	Evaluate impacts of a variety of screening interventions with a focus on the incidence of sequelae of CT	✓			Women and men; age groups:12±15, 16±20, 21±25, 26±40 years[†]	One-off, every year, every 2 years	No organised screening	✓	Intervention is cost-saving; after 5 years around 30,000 PIDs, 7,000 infertility and 700 cases of ectopic pregnancies would be prevented per year*
Welte (2000)	NL	Develop a novel dynamic approach for the economic evaluation of CT prevention measures; determine the CE of a general practice-based screening programme	✓			Men and women (15-64 years)	Annual	No organised screening	✓/X	-$492/MOA for direct costs; -$1,086/MOA including indirect costs*

✓, Done; ✓/X, To some extent completed (Under certain assumptions and conditions, the intervention was found to be cost-effective); X, Not cost-effective

[†] Risk factor was sexual activity groups.

[1]As stated by the authors;

[*]Further results on differences between men and women reported in the study.

ART, Anti-retroviral treatment; AU, Australia; AYA, Adolescents and young adults; CDC, Center for Disease Control; CE, cost-effectiveness; CEA, cost-effectiveness analysis; CEAC, cost-effectiveness acceptability curve; CT, *Chlamydia trachomatis*; DK, Denmark; ED, Emergency department; GP, general practitioner; HIV, Human immunodeficiency virus; ICER, Incremental cost-effectiveness ratio; IRE, Ireland; MO, Major outcome; MOA, Major outcome averted; NA, not applicable; NCSP, National Chlamydia Screening Programme; NG, *Neisseria gonorrhoeae*; NL, Netherlands; PID, Pelvic inflammatory disease; QALY, Quality-adjusted life years; RIS, rapid immunochromatographic strip test; SA, Sensitivity analysis; SE, Sweden; STIs, Sexually Transmitted Infections; UK, United Kingdom; USA, United States of America; YLS, Years of Life Saved

4.4.3. Methodological specifications

In order to obtain a better understanding of the methods applied within the economic evaluations, this section presents results on the types of economic evaluations, outcome measures, study perspectives and designs, costing approaches and costs included data sources for cost and outcome data, time periods and discount rates applied and sensitivity analyses considered (see Table 4.2).

Types of economic evaluations

The predominant method of economic evaluation applied was CEA (21 studies) followed by CUAs (10 studies) (Owusu-Edusei, Hoover and Gift, 2016; de Wit et al., 2015; Gillespie et al., 2012; de Vries et al., 2008; Gift et al., 2008; Adams, Turner and Edmunds, 2007; Walleser, Salkeld and Donovan, 2006; Aledort et al., 2005; Hu, Hook and Goldie, 2004). The latter measured outcomes in QALYs whereas a CEA assesses outcomes in natural units, e.g., life years gained, or MOAs (which in this context could refer to PID or infertility). One study self-identified as a CBA (Evenden et al., 2005) where costs and consequences are expressed in monetary units (Drummond et al., 2015). The studies by Jackson et al. (2015) and Tao et al. (2004) conducted CCAs (Jackson et al., 2015; Tao et al., 2004). CCAs list all costs and a catalogue of different outcomes of alternatives are listed separately, which results in no definite cost-outcome ratio (Drummond et al., 2005). Across the 20 years considered within this review, CUAs were more frequently applied from the year 2005 onwards.

Outcome measures

With respect to outcome measures, 22 out of the 33 studies applied MOAs, such as PID, ectopic pregnancy or infertility. Whilst most studies focused on PID averted as an

outcome measure, the study by Gift et al. (2005) looked at the number of chlamydia and gonorrhoea cases treated due to the inclusion of both men and women, and as PID is specific to women, MOAs would not be appropriate (Gift et al., 2005). Around one third of the studies (19) also applied other outcome measures, such as monetary outcomes or the number of patients cured (Tao et al., 2004).

Perspectives

Fourteen studies applied a healthcare and twelve a broader societal perspective. Whilst studies from the Netherlands and Sweden collected and analysed their data from a societal perspective as required by their national guidance, the economic evaluations from the UK were conducted from a narrower healthcare perspective. Two studies analysed their data from both a societal and provider perspective (Andersen et al., 2006; Gift et al., 2005). Five studies did not report their perspective (Low et al., 2007; Bernstein et al., 2006; Evenden et al., 2006, 2005; van Bergen et al., 2004). Over the search period of twenty years, there was no visible trend in which perpective was applied.

Study designs

The study design of the included studies were mostly model-based (32 studies). However, heterogeneity was found when looking at the range of model types applied. Out of the 32 modelling studies, fifteen applied dynamic models, which are recommended for economic evaluations of infectious diseases (Drummond et al., 2015, pp.337–338), one study utilised a mixed approach of static and dynamic modelling (Hu, Hook and Goldie, 2004), and the remainder exclusively applied static

models (16 studies). One study consisted of an economic evaluation only as it was based on a pilot cluster randomised controlled trial (Jackson et al., 2015).

Costing approaches and costs included

The cost data incorporated by the studies mostly used a bottom-up costing approach (24 studies). Nine studies chose a broad costing approach, which lists general programme costs but does not provide information on all costs per unit (Neilan et al., 2018; Owusu-Edusei, Hoover and Gift, 2016; Teng, Kong and Tu, 2015; Turner et al., 2011; Bernstein et al., 2006; Evenden et al., 2006, 2005; Tao et al., 2004; Townshend and Turner, 2000). Overall, the studies focused on direct medical costs, such as programme costs, which consisted of invites for screening and costs for testing and treatment. Eleven studies included indirect costs, which were mainly loss of productivity due to illness. One study considered lost health, medical, and programme costs (Stoecker et al., 2021).

Data sources for cost and outcome data

The majority of studies had a mixed data source for cost and outcome data (18 studies). This meant that some primary data was utilised, for example from trial data (Eckman et al., 2021), and other data was derived from secondary sources, such as from published studies. Twelve studies applied data from secondary sources only. For example, Teng, Kong and Tu (2015) referred to the study by (Hu, Hook and Goldie, 2004) for both their outcomes and costs data. Another two studies (Jackson et al., 2015; Turner et al., 2011) based their analysis solely on primary data.

The majority of economic evaluations used costs from previously published literature (26 studies) followed by primary data collection in form of clinical trials or the intervention itself (18 studies). Five studies also used clinical or patient databases as their costing sources (Eckman et al., 2021; Huang et al., 2011; Adams, Turner and Edmunds, 2007; Low et al., 2007; Novak et al., 2004). Some studies based their parameter estimates on expert opinion (de Vries et al., 2006; Evenden et al., 2006, 2005; Walleser, Salkeld and Donovan, 2006).

The ten CUAs utilised QALYs as an outcome measure and largely derived the estimates from existing literature (US Institute of Medicine, 2000; Smith et al., 2008; Gift and Owens, 2006) with seven out of ten studies not highlighting any associated issues, e.g. that estimates were based on expert opinion or assumptions (Stoecker et al., 2021; Owusu-Edusei, Hoover and Gift, 2016; de Vries et al., 2008; Gift et al., 2008; Walleser, Salkeld and Donovan, 2006; Aledort et al., 2005; Hu, Hook and Goldie, 2004). The US Institute of Medicine (some studies also cited this as Stratton et al. (2000/1999), e.g. Stoecker et al. (2021)) estimated disease scenarios for chlamydia infections (US Institute of Medicine, 2000). Some of the studies, which based their health utilities on the US Institute of Medicine's report, specified that quality weights for different health states were determined by using Health Utility Indices (de Vries et al., 2008; Walleser, Salkeld and Donovan, 2006). The study by Smith et al. (2008), which was referenced by (Owusu-Edusei, Hoover and Gift, 2016) used a visual analogue scale and time-trade-off valuations to obtain health utilities for different PID-related health states. Clinical trials were also used by one study (Hu, Hook and Goldie, 2004) to estimate health utilities (Stamm et al., 1984; Scholes et al., 1996).

Time period and discount rate

Out of the 33 studies, 30 did state a time period for their intervention and model calculations. Two studies did not provide clear information on the time period under consideration (Norman et al., 2004; Novak et al., 2004). There was a variety of time horizons applied ranging from two years to a patient's lifetime. Justification for the time periods varied and included the time onset of sequelae, such as PID, following an infection. In the study by Teng et al. (2015) the time length was dependent on the patient's age (Teng, Kong and Tu, 2015).

The majority of discounting rates applied in the studies followed national guidelines for each country respectively, if available. The studies by Townshend and Turner (2000) and Norman et al. (2004) were conducted prior to official guidelines in the UK being published, which resulted in a divergence of discounting. The study in Ireland adapted the discount rate (3.5%) from the UK (Gillespie et al., 2012) and studies from the USA consistently utilised a discount rate of 3% (Eckman et al., 2021; Stoecker et al., 2021; Neilan et al., 2018; Owusu-Edusei, Hoover and Gift, 2016; Huang et al., 2011; Gift et al., 2008; Bernstein et al., 2006; Aledort et al., 2005; Gift et al., 2005; Hu, Hook and Goldie, 2004; Tao et al., 2004; Gift et al., 2002; Mehta et al., 2002). In the Netherlands before 2016, the recommendation for discounting in economic evaluations was 4% (de Vries et al., 2008, 2006; van Bergen et al., 2004). However, from 2016 the Dutch National Health Care Institute recommended to differentiate the discounting rate for costs (4%) and outcomes (1.5%), which has been applied by de Wit et al. (2015). Before the year 2004, Dutch studies discounted by 3% (van Valkengoed et al., 2001; Postma et al., 2000; Welte et al., 2000).

Sensitivity analysis

All studies except for three (Teng, Kong and Tu, 2015; de Vries et al., 2008; van Bergen et al., 2004) conducted some form of assessment of uncertainty. The most common method applied was a univariate sensitivity analysis (30 studies) followed by multivariate sensitivity analysis (15 studies). This involved the variation of selected parameters at the same time, such as MOAs including PID probability, the discount rate or the probability of screening uptake. Shortcomings of the assessment of uncertainty in the studies are further discussed in the critical appraisal (Section 4.4.5.).

Table 4.2. Methods applied and data sources details

Author (year)	*Type of economic evaluation*	*Outcome measure*			Perspective (healthcare provider/ societal)	Study design (dynamic or static model/ trial)	Costing approach and included costs	Data source for costs and outcomes	Time period and discount rate	Sensitivity analysis
		QALY	MOA	Other						
Eckman (2021)	Cost-effectiveness analysis			✓	Healthcare provider	Static model (decision tree)	Bottom-up approach; direct costs of testing/treatment, sequelae, long-term complications	Primary[13] and secondary	No time period stated; 3%	✓
Stoecker (2021)	Cost-utility analysis	✓		✓	Societal	Dynamic model (Monte Carlo model)	Bottom-up approach; lost health, medical and programme cost	Primary and secondary	1 year and lifetime; 3%	✓
Neilan (2018)	Cost-effectiveness analysis			✓	Healthcare provider	Dynamic model (microsimulation model)	Broad approach[1]; direct medical costs[2]	Secondary	Lifetime; 3%	✓
Owusu-Edusei (2016)	Cost-utility analysis	✓	✓[4-7,10]		Societal	Dynamic model (compartmental transmission model)	Broad approach; direct medical costs and indirect costs[3]	Secondary	50 years; 3%	✓
de Wit (2015)	Cost-utility analysis	✓	✓[4-6]		Societal	Static model (outcome tree)	Bottom-up approach; programme costs, direct medical costs, indirect costs	Secondary	10 years; 4% costs and 1.5% effects	✓
Jackson (2015)	Cost-consequence analysis			✓	Healthcare provider	Trial	Bottom-up approach; direct medical costs and some private costs	Primary	NA; NA	✓
Teng (2015)	Cost-effectiveness analysis			✓	Societal cost-saving	Dynamic model (compartmental model)	Broad approach; direct medical costs	Secondary	Depending on the age; No discount rate stated	X
Gillespie (2012)	Cost-utility analysis	✓	✓[4-6,8-10]		Healthcare provider	Dynamic model (decision model)	Bottom-up approach; direct medical costs	Primary and secondary	10 years; 3.5%	✓
Huang (2011)	Cost-effectiveness analysis		✓[4-6]	✓	Healthcare provider	Static model (decision tree)	Bottom-up approach; direct medical costs	Primary and secondary	10 years, 5 years, 2 years; 3%	✓
Turner (2011)	Cost-effectiveness analysis			✓	Healthcare provider	Static model (simple economic model)	Broad approach; programme costs, direct medical costs	Primary	NA; NA	✓
de Vries (2008)	Cost-utility analysis	✓	✓[4-8]		Societal	Dynamic model (susceptible-infected-susceptible model)	Bottom-up approach; direct and indirect medical costs; programme costs	Primary and secondary	20 years; 4%	X (previously applied in the 2006 study)
Gift (2008)	Cost-utility analysis	✓	✓[4]		Societal	Dynamic model (compartmental model)	Bottom-up approach; direct medical costs, programme costs, indirect costs	Primary and secondary	Model: 5 years, analytic horizon 20 years; 3%	✓

Author (year)	*Type of economic evaluation*	***Outcome measure***			Perspective (healthcare provider/ societal)	Study design (dynamic or static model/ trial)	Costing approach and included costs	Data source for costs and outcomes	Time period and discount rate	Sensitivity analysis
		QALY	MOA	Other						
Adams (2007)	Cost-utility analysis	✓	✓[4-6,8-10]		Healthcare provider	Dynamic model (stochastic model)	Bottom-up approach; direct medical costs	Secondary	10 years; 3.5%	✓
Low (2007)	Cost-effectiveness analysis		✓[4-6,8-10]		X	Dynamic model (transmission model)	Bottom-up approach; direct medical costs, programme costs	Primary and secondary	Around 20.5 years; 3.5%	✓
Andersen (2006)	Cost-effectiveness analysis		✓[4-8]	✓	Societal and healthcare provider	Dynamic model (Monte Carlo model)	Bottom-up approach; direct medical costs, programme costs, indirect costs	Primary and secondary	10 years; 3%	✓
Bernstein (2006)	Cost-effectiveness analysis			✓	X	Static model (decision analytical model)	Broad approach; direct medical costs	Primary and secondary	10 years; 3%	✓
de Vries (2006)	Cost-effectiveness analysis		✓[4-8]		Healthcare provider	Dynamic model (susceptible-infected-susceptible model)	Bottom-up approach; direct and indirect medical costs; programme costs	Primary and secondary	10 years; 4%	✓
Evenden (2006)	Cost-effectiveness analysis			✓	X	Dynamic model (system dynamics model)	Broad approach; direct medical costs	Primary (expert opinion/trial) and secondary	2 years; No discount rate applied	✓
Walleser (2006)	Cost-utility analysis	✓	✓[4-7]		Healthcare provider	Static model (decision analytical model)	Bottom-up approach; direct medical costs	Secondary (expert opinion if no data)	25 years; 5%	✓
Aledort (2005)	Cost-utility analysis	✓	✓[4-7]	✓	Societal	Static model (state transition Markov model)	Bottom-up approach; direct medical costs	Secondary	A woman's lifetime; 3%	✓
Evenden (2005)	Cost-benefit analysis/ cost-effectiveness analysis			✓	X	Dynamic model (system dynamics model)	Broad approach; direct medical costs	Secondary (expert opinion)	2 years; No discount rate applied	✓
Gift (2005)	Cost-effectiveness analysis			✓	Healthcare provider & societal	Static model (mathematical model, decision tree)	Bottom-up approach; counselling costs, direct medical costs, and indirect costs	Primary and secondary	10 years; 3%	✓
Hu (2004)	Cost-utility analysis	✓	✓[4-6]	✓	Modified societal	Static and dynamic model (state transition simulation model)	Bottom-up approach; direct medical costs	Secondary	Lifetime; discounting applied, rate not stated	✓
Norman (2004)	Cost-effectiveness analysis		✓[4-11]	✓	Healthcare provider	Static model (decision model)	Bottom-up approach; direct medical costs	Primary and secondary	No time period stated; 5% and 3%	✓
Novak (2004)	Cost-effectiveness analysis		✓[4-9,11]		Societal	Static model (cost-effectiveness model)	Bottom-up approach; direct medical costs	Primary and secondary	No time period or discount rate stated	✓

Author (year)	*Type of economic evaluation*	***Outcome measure***			**Perspective (healthcare provider/ societal)**	**Study design (dynamic or static model/ trial)**	**Costing approach and included costs**	**Data source for costs and outcomes**	**Time period and discount rate**	**Sensitivity analysis**
		QALY	**MOA**	**Other**						
Tao (2004)	Cost-consequence analysis		✓[4-6]	✓	Healthcare provider	Static model (mathematical model)	Broad approach; direct medical costs	Secondary	NA; NA	✓
van Bergen (2004)	Cost-effectiveness analysis		✓[4-7]		X	Static model (pharmacoeconomic and funnel model)	Bottom-up approach; direct medical costs, indirect costs	Primary and secondary	Programme evaluation after 2 years; 4%	X
Gift (2002)	Cost-effectiveness analysis		✓[4-7]		Healthcare provider	Static model (decision analytical model)	Bottom-up approach; direct medical costs	Secondary	Patient's lifetime; 3%	✓
Mehta (2002)	Cost-effectiveness analysis			✓	Healthcare provider	Static model (outcome decision model)	Bottom-up approach; direct medical costs, programme costs	Primary and secondary	10 years; 3%	✓
van Valkengoed (2001)	Cost-effectiveness analysis		✓[4-9]		Societal	Static model (decision tree)	Bottom-up approach; direct medical costs, programme costs, indirect costs	Primary and secondary	5 years; 3%	✓
Postma (2000)	Cost-effectiveness analysis		✓[4-8]	✓	Societal	Static model (decision analytical model)	Bottom-up approach; direct medical costs, indirect costs	Primary and secondary	5 years, 10 years; 3%	✓
Townshend (2000)	Cost-effectiveness analysis		✓[4-6]	✓	Healthcare provider	Dynamic model (system dynamics model)	Broad approach; direct medical costs	Secondary	10 years for costs and 40 years for MOs; 6%	✓
Welte (2000)	Cost-effectiveness analysis		✓[4-8]		Societal	Dynamic model (stochastic simulation model)	Bottom-up approach; direct medical costs, indirect costs	Secondary	20 years; 3%	✓

✓, Done; X, not reported.

[1]Broad approach: Gross costs are listed.

[2]Direct medical costs: Costs for testing (including clinician time), treatment (including the cost of a return visit), and sequelae costs, such as PID.

[3]Indirect costs refer to cost of lost productivity due to illness.

[4]PID; [5]Ectopic pregnancy; [6](Tubal) infertility; [7]Chronic pelvic pain; [8]Neonatal pneumonia; [9]Neonatal conjunctivitis; [10]Epididymitis in men; [11]Urethritis in men; [12]Cervicitis;

[13]Primary data sources included clinic and patient databases or trial data; †Base-case data: A base case is the average scenario; ‡Baseline intervention 1 and 4: The interventions were closest to the standard care.

CT, *Chlamydia trachomatis*; MO, Major outcome; MOA, Major outcome averted; NA, Not applicable; NCSP, National Chlamydia Screening Programme; NG, *Neisseria gonorrhoeae;* PID, Pelvic inflammatory disease; PN, Partner notification; QALY, Quality-adjusted life year

4.4.4. Study limitations and authors' acknowledgements

The studies acknowledged several limitations for the economic evaluations conducted. For example, some studies recognised that modelling simplifies real world scenarios (Stoecker et al., 2021; Aledort et al., 2005) (see Table 4.3). Further, authors acknowledged that state transition Markov models do not take infection transmission into account (Aledort et al., 2005). For example, de Vries (2006) based their model on a previously published study (Kretzschmar et al., 2001). The authors recognised the useful approach of a network model. However, they emphasised the limitations in developing such a model because of the lack of available data on sexual behaviour, which is a main component of a stochastic network model (de Vries et al., 2006). Eckman et al. (2021) also reflected on the limitations of the use of estimates for parameters based on previous literature. Four studies did not discuss any limitations or only raised some limitations (Teng, Kong and Tu, 2015; de Vries et al., 2008; van Bergen et al., 2004; Postma et al., 2000)

Lack of data

The overall lack of information about the cost-effectiveness of non-clinical interventions for STI control was highlighted (Jackson et al., 2015). Some studies had to rely on dated literature and crude estimates for their economic evaluation (Teng, Kong and Tu, 2015). Several authors stated that they would have conducted a CUA but due to the lack of data on health utilities and transmission probabilities, this was not possible. For example, Bernstein et al. (2006) and Aledort et al. (2005) argued that due to lack of data about the progress of an acute gonorrhoea infection and impact on quality of life, they were unable to calculate QALYs. In addition, if utility data was available, it was still difficult to calculate QALYs due to the low quality of the data (de

Wit et al., 2015). Similarly, Adams, Edmunds and Turner (2007) argued the case for utilising the same input values as Hu, Hook and Goldie (2004) by saying that during the time of the study those were the only estimates available to measure QALYs. It was also recognised that data on sexual behaviour to model transmission patterns was lacking (Teng, Kong and Tu, 2015; Gift et al., 2008; Andersen et al., 2006; Welte et al., 2000).

Further, parameters around the probability of sequelae, such as PID, was documented as challenging since it estimates range from 10% to 40% in the literature (de Wit et al., 2015; Walleser, Salkeld and Donovan, 2006; Andersen et al., 2006; Gift et al., 2002; Mehta et al., 2002).

Table 4.3. Study limitations and funder of intervention

Table 4.3. Study limitations and funder of intervention

Lead author (year)	Limitations considered by the authors	Funder of intervention (✓=stated; X=not stated)
Eckman (2021)	- Use of literature-based estimates for base case parameter values and test characteristics for STI risk prediction survey	✓
Stoecker (2021)	- Impact of intervention is based on a mathematical model - Possible over- or under-estimation of programme impact - The context of the study may have impacted the results as New Orleans has a high density of young Black men	✓
Neilan (2018)	- Limited data availability for adolescents and young adults led authors to exclude quality-of-life adjustments in the primary analysis - Incidence inputs were estimated from rates of new diagnoses since the true number of HIV incidence is unknown - HIV screening inputs were derived from reported rates of HIV screening which likely do not capture barriers to HIV screening for all AYA - Did not explore multiple generations of HIV transmission	✓
Owusu-Edusei (2016)	- The model simplifies real world scenarios - Estimates solely obtained from literature which means differences in times and populations - Data was missing for homosexual behaviour and transmission dynamics, therefore the focus was on heterosexuals only - Possible overestimation of impact of CT screening as model does not consider reinfections - Equal insurance coverage and healthcare utilisation rates for both high and low sexually active individuals was assumed - Model was not age structured: one group only which may have neglected differences in dynamics among different ages	X
de Wit (2015)	- Utility values have limitations and uncertainty about the natural history of CT - The costs per QALY are estimates and should be viewed as indication of cost-effectiveness of screening only	✓
Jackson (2015)	- Difficult to estimate screening uptake precisely and acceptability of screening - The overall target sample size (N=200) was not achieved - No downstream screening included - No positive cases of CT/NG were found which is why no costs per positive diagnosis were calculated	X
Teng (2015)	- Not discussed; - Almost all the existing work largely relies on relatively crude estimates due to data scarcity and ethical concerns	✓
Gillespie (2012)	- The model for behaviour was based on UK data (intervention's context is IRE) - Uncertainty for CT prevalence and sexual behaviour in IRE not modelled - Costs for patients and wider society not considered due to healthcare provider perspective	✓
Huang (2011)	- Did not consider transmission or time-to-treatment effects in the analysis - Some estimates were derived from secondary data - The estimates had some uncertainty, which was explored through SAs - Data not transferable to other geographical areas due to possible differences in usage of clinical services and internet usage	X
Turner (2011)	- Due to concerns about the accuracy of the reported data, authors were unable to link PN costs directly to site specific estimates of PN efficacy - It was not possible to estimate long term cost-effectiveness	✓
de Vries (2008)	- Not discussed - The model was adapted from previous study where limitations were discussed (see de Vries et al., 2006)	✓
Gift (2008)	- Random events: infection and reinfection which were controlled for by only two factors: population prevalence and rate of partner change - No specific partnerships were modelled - No repeat screening was assessed	X
Adams (2007)	- High degree of uncertainty in findings	X
Low (2007)	- Confidence intervals were not presented - Need to conduct more SAs to test the robustness of the conclusions - Data stems only from hospital-diagnosed episodes of sequelae	✓

Table 4.3. Study limitations and funder of intervention

Lead author (year)	Limitations considered by the authors	Funder of intervention (✓=stated; X=not stated)
Andersen (2006)	- (Lack of) availability of data in general and data on sexual behaviour - Estimating the risk of developing PID - Assumption that GPs and physicians accept to provide testing kits for partners	X
Bernstein (2006)	- Limited data available on effect of NG infection and sequelae on individuals' QoL - Analysis was applied to a population of higher risk and this may have led to an overestimation of the CE of enhanced screening compared with no screening - Use of cost data from CT if no availability for NG data - Static instead dynamic model leads to only one outcome per person instead of varying health states and reinfection - No inclusion of indirect costs - Uncertainty was not fully addressed	✓
de Vries (2006)	- Difficult to include regular partner treatment in the model - Validity of results strongly dependent upon precise parameter estimates - The model assumes no population changes through migration or similar - The model predicts CT prevalence which may not be valid - This is a conservative approach where partners and impact of CT infection on susceptibility for other STIs were not considered	✓
Evenden (2006)	- Model assumes ideal situation that different risk groups can be specifically targeted	✓
Walleser (2006)	- Clinically indicated testing would be part of a broader CT control approach that has not been modelled - High uncertainty around CT sequelae and effectiveness of CT screening	X
Aledort (2005)	- Estimates of incidence in base case analysis may not be representative of all inner-city EDs - Uncertainty about the natural history of acute NG infection - Difficulty to distinguish 'persistent infection' vs. 'reinfection' - State transition model does not capture transmission to sexual partners or new-borns, impact of PN, averted male sequelae, and potential of enhanced transmission of HIV - Gram stain test was used as standard, which is not the usual case for ED	X
Evenden (2005)	- Model assumes ideal situation that different risk groups can be specifically targeted - In reality, it is difficult to identify high-risk groups	✓
Gift (2005)	- Cost per patient counselled may vary due to resources for supervision and quality assurance required for successful intervention delivery - Re-infections and patients seeking care elsewhere was not considered and would have contributed to higher return rates, which would impact cost per infection treated	✓
Hu (2004)	- There was uncertainty about the natural history of CT infection - Only indirect transmission effects of CT screening were considered	✓
Norman (2004)	- Use of estimates from several sources which were varied in SA and were proven as relatively robust - No consideration of relative CE of screening compared with other uses of scarce NHS resources	✓
Novak (2004)	- Methods to estimate sequelae of untreated CT based on local procedures, partly on local risk estimates and local costs - Study did not take into account subjective cost of suffering and increased susceptibility to further STIs and therefore may have underestimated cost of sequelae - The study group were students which does not reflect the general population	X
Tao (2004)	- Limitations of resource-allocation model included: Absence of potential cost-savings of preventing disease transmission to sex partners, cost of adverse side effects of treatment, clinical costs other than screening and treatment (e.g. risk assessment, counselling, personnel time needed for testing and treatment), and the assumption that the budget for CT screening and treatment is distinct and allocated separately from other clinic budget items - Several additional limitations discussed, such as assumption of return rates, estimates for reinfections	X

Table 4.3. Study limitations and funder of intervention

Lead author (year)	Limitations considered by the authors	Funder of intervention (✓=stated; X=not stated)
van Bergen (2004)	Not discussed	X
Gift (2002)	- Range of PID probability infection drawn from previous studies (10%-40%) - The model does not consider transmission to a partner - No neonatal complications were considered	X
Mehta (2002)	- No inclusion of costs of increased risk of miscarriage, low-birthweight infants and greater HIV transmission rates associated with NG and CT; if included it would make enhanced screening more cost-effective - No inclusion of indirect cost of indirect costs (lost productivity and loss of leisure time) - No modelling of spontaneous cure/decreased compliance - Possible overestimation of likelihood of sequelae in outpatients - PID development in women with NG/CT is debatable - Estimates for sequelae/costs are derived from multiple sources	X
van Valkengoed (2001)	- The CEA is a unidimensional view of screening - The emphasis is placed on proving that the intervention is cost-effective - Results can depend strongly on the assumptions included in a decision model - Other important aspects, such as invasion of privacy, psychological and social consequences of the test result, and the danger of medicalisation cannot be included in the model	✓
Postma (2000)	Not discussed	X
Townshend (2000)	- There was a large range of uncertainty around these base case figures due to uncertainty in numerous model parameters	X
Welte (2000)	- Uncertainty surrounding the parameter estimates, i.e., lack of data on sexual behaviour; - Model excluded the possibility of other public health measures having an impact on the CT prevalence over the 10-year time period, medical technology may shift relative costs, and productivity per capita may increase (effects no incl. in analysis); - No calculation of the gains in quality of life due to screening	X

✓, Yes; X, No

CE, Cost-effectiveness; CEA, Cost-effectiveness analysis; CT, *Chlamydia trachomatis*; ED, Emergency department; GP, General practitioner; HIV, Human immunodeficiency virus; IRE, Ireland; NG, *Neisseria gonorrhoea*; NHS, National Health Service (UK); PID, Pelvic Inflammatory Disease; PN, Partner notification; QALY, Quality-adjusted life year; QoL, Quality of life; SA, Sensitivity analysis

4.4.5. Critical appraisal of studies

All economic evaluations were subject to a critical assessment as a measure of study quality using one checklist for economic models and one for other economic evaluations (see Appendices 4.4 and 4.5) (Philips et al., 2004; Drummond and Jefferson, 1996). In general, the modelling studies frequently neglected to justify for the scope and perspective of the study. Studies were also unclear in reporting their modelling types, which made it challenging to classify some economic evaluations (Evenden et al., 2005; Tao et al., 2004). The uncertainties associated with model structures were often not completely analysed by the studies. Most studies did review parameter uncertainty in the form of a univariate analysis or PSA. However, they neglected methodological uncertainty, i.e., running alternative versions of the model with different methodological assumptions, as well as sub-group analysis, making the reliability of model results uncertain. Although some studies may have explained their model in detail including the underlying formula and assumptions, some essentials were not reported, such as choice of perspective, distribution of probabilities, nor was there a provision of a costing table and no limitations were discussed (Evenden et al., 2005, 2006). The study by Jackson et al. (2015) did fulfil most of the BMJ checklist criteria except for stating the research question and for explaining the choice of the study type in relation to the research question (Jackson et al., 2015).

4.5. Discussion

This systematic review identified 33 economic evaluations of control programmes for STIs and HIV targeting young people. In general, the studies applied a cost-effectiveness or cost-utility analysis for interventions that mainly focused on chlamydia screening. The results show that there was a great variety in the approaches adopted to evaluate the control programmes for STIs/HIV. This is reflected in the overall heterogeneity in the measurement of outcomes and differences in the perspectives applied, partly due to differences between national guidance documents for economic evaluations across OECD countries. The studies were also of variable quality.

One might expect that over a twenty-year period, there would be more convergence among the studies to allow better comparability and understanding of the overall result. However, due to the large variance in methods applied along with the low overall quality of studies, it is difficult to draw a final conclusion across the studies. Static models, among other aspects, do not take interdependences of individuals into account and therefore jeopardise the interpretation of the model results. The studies reviewed applied a range of static and dynamic models (15 out of 32 were dynamic models) and there was no evidence that since the review by Roberts et al. in 2006 (Roberts et al., 2006), which highlighted the importance of dynamic modelling for infectious diseases, that more dynamic models are being used. It was noted, however, that, more recently, when a dynamic model was not used, authors were more likely to acknowledge the limitations of this.

The evaluations did not consider equity of service provision for individuals nor the intervention's context, which are vital for local decision-makers in public health. Consideration of equity issues is required by guidance in some countries (Health Information and Quality Authority, 2020) and is important for public health interventions due to their focus on population health and the distribution of health (fairness). In order to enable outcomes beyond health to be considered, a broader perspective for economic evaluation would be required. This is particularly relevant to sexual health as it is associated with factors, such as housing problems and substance use (Royal College of Physicians, 2011; Slater and Robinson, 2014). Despite the recommendations by several national guidance bodies, such as NICE in 2012 around the need to consider a broader perspective, for economic evaluations of public health interventions (NICE, 2012), this was not the case for multiple studies (14 studies adopted a healthcare perspective for the evaluation).

Further, only two studies focused their economic evaluation on the newer modes of delivery for screening, such as online services and services provided in community settings (Huang et al., 2011; van Bergen et al., 2004). However, it was acknowledged by some authors that their economic models were limited in this respect (van Valkengoed et al., 2001).

To compare the different types of economic evaluations is challenging since the differences in methodologies applied result in different outcome measures, including intermediate (MOAs) and long-term (QALYs) outcomes. Several studies highlighted that due to the lack of data about the risk of clinical progression following acute

gonorrhoea infection and its impact on quality of life, they were unable to calculate QALYs (Bernstein et al., 2006; Aledort et al., 2005). In addition, where studies included QALYs they mainly relied on a limited set of values, an issue which has been highlighted in previous literature as a methodological limitation (Jackson et al., 2014; Roberts et al., 2006). The overall lack of data on sexual behaviour, transmission patterns, and transition probabilities (Andersen et al., 2006; Welte et al., 2000) (for example the probability of developing PID is estimated to range anywhere from 10% - 40% (de Wit et al., 2015; Andersen et al., 2006; Walleser, Salkeld and Donovan, 2006; Gift et al., 2002; Mehta et al., 2002)) intensifies uncertainty in interpreting study results. Further, one study is described as a CBA but does lack monetary values for its sequelae, which is why it could also be viewed as CEA (Evenden et al., 2005). Another study by Andersen et al. (2006) monetised its outcomes making it a CBA but opportunity costs were not considered.

The quality assessment of the studies showed that a significant number did not fulfil all the requirements for an economic evaluation (Philips et al., 2004; Drummond and Jefferson, 1996), and this was particularly the case for uncertainty assessment. Most of the authors did not justify why they omitted certain steps in assessing uncertainty and subgroup analysis was rarely conducted to understand the differential costs and effects for different population groups, which is an important aspect since resources may be wasted and opportunities for a specific sub-group may be lost (Drummond et al., 2015). The most appropriate model type would be an infectious disease model (dynamic model) and if a static model is chosen, authors need to argue for their choice and acknowledge in their limitations that the results may not truly be representative

(Roberts et al., 2006). This was not undertaken by all studies included in this review. Further, the time horizon was not justified by all studies. If the study compares screening vs. no screening, the time horizon should be carefully considered since the effects of screening interventions may only be realised in the longer term. A minimum length for a time horizon, e.g. 10 years to capture the onset of PID, may be important in order to capture an intervention's complete impact (de Vries et al., 2006). Although most of the studies included an economic model, they differed in their approaches as outlined above. This heterogeneity of economic methods utilised represents an important limitation to the existing body of literature, since it limits the comparability of the study results.

4.5.1. Comparison with other literature

The findings of this review update and confirm those from previous systematic reviews in this area. The predominant utilisation of CEAs with static models to evaluate costs and outcomes of screening and testing for STIs and HIV has been highlighted previously (Jackson et al., 2014; Low et al., 2007; Roberts et al., 2006). Despite this, methodological issues seem to persist, which may be explained partially by a lack of suitable data to include within analyses (Jackson et al., 2015), which was also confirmed by some studies in this review (de Wit et al., 2015). Nevertheless, this review found several studies that did apply a dynamic modelling approach, which is an important aspect to show transmission dynamics of infectious diseases. Another review by Low et al. (2007) identified that population-based screening and opportunistic screening are both likely to be cost-effective interventions, which confirms the results from this review. The review also highlighted that outcomes, such

as cost per positive chlamydia case detected, have limitations in terms of policy recommendations as the intermediate outcome does not allow the overall value of the intervention to be captured (Low et al., 2007). It is the responsibility of the economic evaluations to clearly state this limitation.

4.5.2. Strengths and weaknesses of this review

This review has several strengths. A robust methodology incorporating a thorough search strategy across multiple databases along with additional hand searching was applied. Further, it focused on young people, a group who are particularly vulnerable regarding STIs. One weakness of the review is that by focusing on young people, additional important economic evaluations specific to other groups, such as MSM, may have been missed. An additional strength is that all studies with a focus on chlamydia were included in the review, as chlamydia screening interventions predominantly focus on young people.

Hand searching was undertaken of the NICE database only and a wider search of relevant databases, such as the WHO database, might have generated additional results. In addition, although the studies were mainly concerned with young people, some included people who were aged over 30, however, this did not seem to affect the overall results. Applying different inclusion and categorisation criteria may yield further future insights into economic evaluations for older population groups. Further, in some studies the comparator arm was not clearly defined. One study was excluded due to language, which may have yielded additional findings. The review focused on only

OECD countries to allow for better comparison between across different health systems. Relevant studies from other contexts may therefore been excluded.

4.5.3. Policy implications

The results of this systematic review show that the current economic evidence relating to STI and HIV control programmes has limitations, which may impact on its interpretation and use in policy decision-making. The important focus of public health interventions on equity in addition to health improvement, as well as the context within which they are delivered, indicates that future economic evaluations also need to address these issues.

4.5.4. Further research

There is a tension between following guidelines for conducting an economic evaluation for a public health programme and ensuring real world applicability, for example utilising QALYs for comparability vs. the needs of local decision-making. Future research needs to address these tensions with the aim to improve knowledge translation between health economists and public health decision-makers and ensure the wider applicability of health economic findings.

4.6. Conclusion

This review has highlighted some limitations in existing economic evaluations which focus on STI and HIV control programmes, particularly in terms of context, equity, an appropriate time horizon, and wider costs and benefits beyond health. It has illustrated wide heterogeneity in the published economic evaluations of control programmes and

this, combined with limited study quality, demonstrates a need for further economic evaluations, which can directly inform improvements in SHS.

4.6.1. Implications of the systematic review for this thesis

This review provides an overview of current economic evaluations for STI/HIV control programmes. Since the main types of economic evaluations for chlamydia screening interventions were CEAs, it was of interest to see whether decision-makers in sexual health found this kind of evidence useful as well as whether and how it may be used to inform policy. This was explored in the form of interviews with sexual health decision-makers in England.

The findings of this review, in relation to the limitations with the existing sexual health literature, broadly align with other research highlighting that traditional economic evaluations are limited in assessing the scope and impact of public health programmes (Edwards, Charles and Lloyd-Williams, 2013; Marsh et al., 2012; Lorgelly et al., 2010). Therefore, the requirements for economic evaluations in this area were discussed with academic health economists and public health researchers during in-depth interviews. The findings of the interviews are described and discussed in the following chapters.

CHAPTER 5
Perspectives on decision-making processes in a sexual health context: How is economic evidence understood and applied by national and local decision-makers?

The following Chapters 5 and 6 present the qualitative empirical work of this thesis. This involved two sets of qualitative interviews with a) Decision-makers in sexual health in England and with b) Researchers in public health and health economics.

5.1. Introduction

Economic evaluations aim to inform decision-makers about the cost-effectiveness of interventions that improve health. Existing research has shown that current evidence from economic evaluations is underutilised by English local public health decision-makers for several reasons, such as not fully incorporating relevant time horizons and neglecting intervention effects beyond health outcomes and the complexity of the context in which the intervention is implemented (Edwards, Charles and Lloyd-Williams, 2013; Lorgelly et al., 2010; Eddama and Coast, 2009; Weatherly et al., 2009). In addition, the outcomes adopted in standard economic evaluations, for example QALYs may not fully capture the outcomes of relevant interest in a sexual health context, such as infertility, impact upon relationships, and stigma.

Further, due to the commissioning changes, economic evidence may be used and understood differently at a English local level compared to the national level (Robertson et al., 2017). Since the changes in commissioning of SHS, budgets for sexual health programmes are mainly managed by local authorities and providers rather than by clinical commissioning groups (Robertson et al., 2017). Although public health budgets are theoretically ring-fenced, this results in budgets potentially competing with funding for other services which are also managed by local authorities (BMJ, 2017). In addition, a number of local authorities have cut their budgets for sexual health programmes due to the real term reduction in public health grants since 2015/2016 (The Health Foundation, 2021; PHE, 2017a). Further information on how budgets are managed and allocated on a local authority level can be found in Chapter 2. Simultaneously, there is a growing demand for SHS and the number of diagnoses of STIs has risen (BMJ, 2017; Robertson et al., 2017). As pressures on local health budgets grow, there is a need to find the most cost-effective pathways to promote good sexual health, carry out STI screening and testing, and treat infections. The solutions for controlling STIs need to be both clinically effective and cost-effective as well as contributing to reducing inequalities.

Whilst research has been conducted with decision-makers in public health, the needs and priorities of those primarily concerned with SHS have not been previously considered (Eddama and Coast, 2009, 2008; Chen, Ashcroft and Elliott, 2007; Drummond et al., 2003). The existing studies highlight general decision-makers' preferences when using evidence from economic evaluations in decision-making processes. However, most of these studies were conducted prior to the introduction of

the Health and Social Care Act 2012. Thus, there is a need to find out whether local decision-makers for SHS consider current economic evidence useful and if not how to improve the existing information.

In this research phase, qualitative interviews were conducted to understand the ways in which sexual health decision-makers currently use economic evidence to inform decision-making for SHS as well as suggestions for how economic evaluations should be undertaken for STI control programmes.

The focus of this research is on sexual health and STI control rather than on public health in general. This is because commissioning responsibilities and priorities change depending on the public health area, which means that SHS face specific challenges. As described in Chapter 2, SHS are characterised by being an open-access service. Commissioning responsibilities are spread across the NHS, e.g., HIV treatment, and local authorities, e.g., STI screening, which highlights the complexity of the services. It is also crucial to remember that local authorities are operating in a political context. Sexual health is a stigmatised issue and hence it can be difficult to raise this as a political priority (Hill-Tout et al., 2018). The interviews provided insights into some of the local authorities' priorities by comparing SHS with other public health responsibilities.

The interviews were undertaken in the summer of 2020 during the COVID-19 pandemic (PHE, 2020e). The pandemic had a significant impact on the delivery of services for sexual health, over a prolonged period. Some sexual health clinics closed

and provided face-to-face consultations only for emergency cases (PHE, 2020e). At the time of the interviews, the full impact of the pandemic on SHS delivery and STI epidemiology was yet to be seen. Further impacts of the pandemic are discussed in Chapter 7.

This chapter reports on the interviews conducted with English national, regional, and local decision-makers for SHS. It presents the methods, ethical considerations, and results of the interviews, which give insights into the perspectives of sexual health decision-makers and their use and understanding of economic evidence.

5.2. Aims and research questions

The aim of the interviews was to understand decision-making processes in an English sexual health context; and to find out how current economic evidence is understood and applied both on a national and local level. The purpose was to develop a better understanding of specifically local sexual health decision-makers' needs when it comes to applying economic evidence to commissioning SHS.

The following research questions guided the interview process:

a) *How do English decision-makers involved in SHS understand economic evidence?*
b) *How do English decisions-makers currently apply economic evidence when making decisions for SHS?*
c) *What kind of economic evidence is useful for decision-making in the context of sexual health programmes?*

5.3. Methodology

As outlined in previous chapters, the decision-making processes concerning SHS are complex. Qualitative research methods can support the understanding of complex phenomena by investigating such processes (Coast, 2017, p.15). Therefore, in-depth semi-structured interviews were conducted with decision-makers in sexual health from a national, regional, and local level to increase the understanding of how decisions across these different levels take place and the role of economic evidence. This section describes the conceptual framework, research design, sampling and recruitment strategy, how the interviews were conducted, and method for analysis.

5.3.1. Conceptual framework

The approach to this research is based in qualitative methods, which contrasts to traditional economists' ontologies, epistemologies, and methodologies. Coast et al. (2017) differentiate between classical economists and qualitative research economists. The first are characterised by a normative, deductive research approach and understand the epistemology as a single knowledgeable reality. The epistemology of qualitative research economists considers multiple realities and the research conducted is inductive and iterative, resulting in the production of knowledge (Coast, 2017).

A constructivist paradigm was applied to this research (Creswell, 2014), which is viewed as unconventional but plausible for qualitative research in health economics (Coast, 2017). The ontology is constructivist and epistemology is viewed as subjective where different realities and knowledge are produced based on the researcher's

worldview in combination with the knowledge of the interview participant (Creswell, 2014). The findings are mainly based on the views of the interview participants and broad questions are used during the interview process to allow the participant to openly elaborate and develop answers based on the questions. As methodological approaches, narrative inquiry and grounded theory were chosen as this research focuses on individual's experiences of decision-making processes and the use of economic evidence in a sexual health context (Creswell, 2007).

5.3.2. Research design

A series of in-depth one-to-one interviews were undertaken to explore decision-makers' understanding of economic evidence and how they are applied in a sexual health context.

Semi-structured interviews were chosen as the most appropriate method to obtain insight into how decision-makers include economic evidence in their decisions about sexual health programmes as well as to find out which methods are most appropriate (Pope and Mays, 2006). The interviews provided a feasible method to gain knowledge on the perspectives of decision-makers efficiently (Coast, 2017, p.17). During each interview, notes were taken to provide a record on initial main themes discussed, any emerging questions as well as on the characteristics of the interview participants and the place, date, and time of the interview. Each interview took between 30 minutes to one hour to complete.

3.3. Sampling and recruitment

Participants were purposively and continuously sampled to ensure a spread of expertise across different levels of healthcare services and in relation to different roles (Creswell, 2007, p.125 ff). After an initial online search, a list was developed with sexual health decision-makers from an English national, regional, and local level across the country. The list was consolidated with the supervisors of this research project for additional contacts. Additional interview participants were recruited via snowballing, which involves recruited participants forwarding information about the study to other potential stakeholders (Creswell, 2007, p.127). Sampling ended once saturation was approached. This means that interviewing additional participants would no longer lead to new insights into the understanding of decision-making processes and use of economic evidence in a sexual health context (Creswell, 2007, pp.127–128).

Participants were recruited by sending out an email including a short introduction about the interview topic and the PhD researcher, with the participant information form attached (see Appendix 5.3). Suitable participants were contacted a maximum of two times. If there was no response after the second email, there was no further contact. Once the contacted person gave consent, they were contacted with further information including the consent form as well as a request for a time that was suitable for both the participant and for the researcher (see Appendix 5.2. for the consent form). Due to the COVID-19 pandemic, the interviews took place online via video call software, such as Zoom or Microsoft Teams, or via telephone, which was based on the preference of the participant. The interviewer aimed to make sure that the participant would be as

undisturbed as possible throughout the interview. Difficulties associated with using video and audio software are further reflected upon in Section 5.6.1.

Eligibility of study participants

This study aimed to recruit decision-makers for SHS in England. In general, decision-makers have been defined differently by various studies (Frew and Breheny, 2019; Williams, Mannion and Hall, 2017). For the purpose of this study, decision-makers in sexual health were defined as any person involved in commissioning, organising, managing, and financing SHS or in the provision of guidance for these services, which have been described in more detail Chapter 2. The participants were divided into three categories:

1) National level organisations (including charity organisations, which provide guidance on the commissioning of SHS),
2) commissioners for SHS at the local level, and
3) local SHS providers (see Figure 5.1).

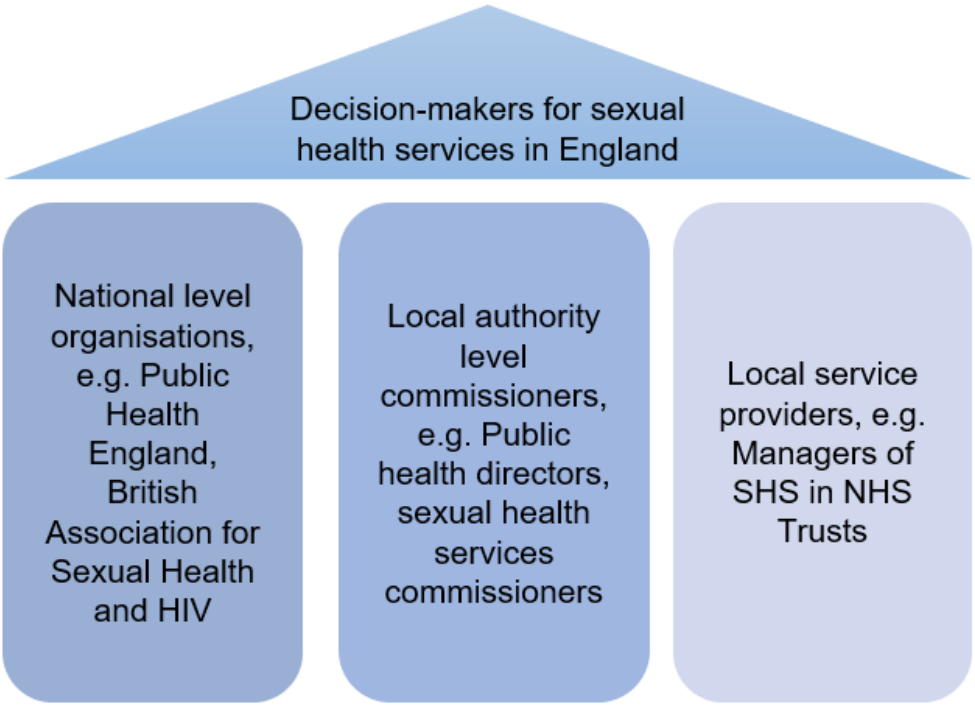

Figure 5.1. Overview of interview participant categories.
Notes: NHS, National Health Service; SHS, Sexual health services

From each category, a number of participants were interviewed to retrieve different perspectives on the use of economic evidence, as well underlying reasons for this. Given the recent changes in responsibilities and the holistic nature of public health services, interview participants included individuals from both national level organisations, such as the NHS, and commissioners based in local authorities. The providers of SHS are relevant as they have control over budgets and therefore can make decisions at the service provision level on the allocation of funds. Participants were also targeted by region across England, i.e., to include both rural and urban SHS as well as ensure geographical diversity.

5.3.4. Scoping review on tools for public health decision-making

The systematic review analysed the available economic evidence on control programmes for STIs in OECD countries in peer-reviewed scientific journals. However, there was a need to identify a broader range of economic evidence and guidance materials which might potentially be used by decision-makers in public health and sexual health in an English context. Therefore, a scoping review of the different tools and guidance available for decision-makers was conducted. Main government websites, such as PHE and gov.uk were reviewed to identify guidance materials and tools which might inform sexual health decision-making. The review identified resources such as a prioritisation framework for local public health spending and the SPOT tool (Office for Health Improvement and Disparities, 2020; PHE, 2019f). The latter is the spend and outcome tool developed by PHE. The tool can examine relationships between budget and outcome indicator data and thereby show how one local authority's expenditure and outcomes compare to others (Office for Health Improvement and Disparities, 2020). The findings on the range of available tools and guidance materials for sexual health decision-makers supported the preparation of the topic guide for the interviews and helped inform subsequent discussions.

5.3.5. Interview process

The views of stakeholders were explored using a semi-structured interview guide (see Appendix 5.4). A semi-structured format was adopted for the interviews in order to facilitate a systematic coverage of key topics and to allow the participant to elaborate on the answers due to the nature of open-ended questions (Pope and Mays, 2006).

Using a semi-structured interview guide with open ended questions, permits the participants to elaborate on their responses, which further supports gaining a deeper insight on the interviewee's perspectives (McCracken, 1988). The interview guide was piloted with a supervisor of this thesis. This was to ensure that questions suited to the time of around 40 minutes planned for the interview and had a good flow. Feedback was received afterwards, and the interview guide was adapted accordingly. Throughout the interview process, the guide was then further adapted with the aim to explore emerging findings and to adapt to the differences between the decision-makers, i.e., national commissioner, local commissioner, service provider. The interview began with exploratory questions asking about the participant's work and decision-making processes. This was followed by questions about economic evidence and the participant's understanding and potential application of it.

Some interview participants were presented with a simplified example of an economic evaluation of a control programme for STIs (see Figures 5.2 and 5.3). The decision on presenting the example depended on the knowledge of the participant relating to economic evaluations. If there was no general understanding of the basic principles of an economic evaluation, such as the need to consider both costs and outcomes, the decision was made by the interviewer to not present the examples. This was because the example required some basic understanding of the elements of economic evaluations.

The writing of observational notes also called field notes is a form of qualitative observation (Creswell, 2014). Such notes were taken during the interview process. To

provide additional information for the analysis, it is important to note how the participant and the researcher may have felt during the interview process, e.g., feeling of comfort, stress, etc. This can have an impact on the flow of the conversation and therefore on how in-depth the answers to the questions may be.

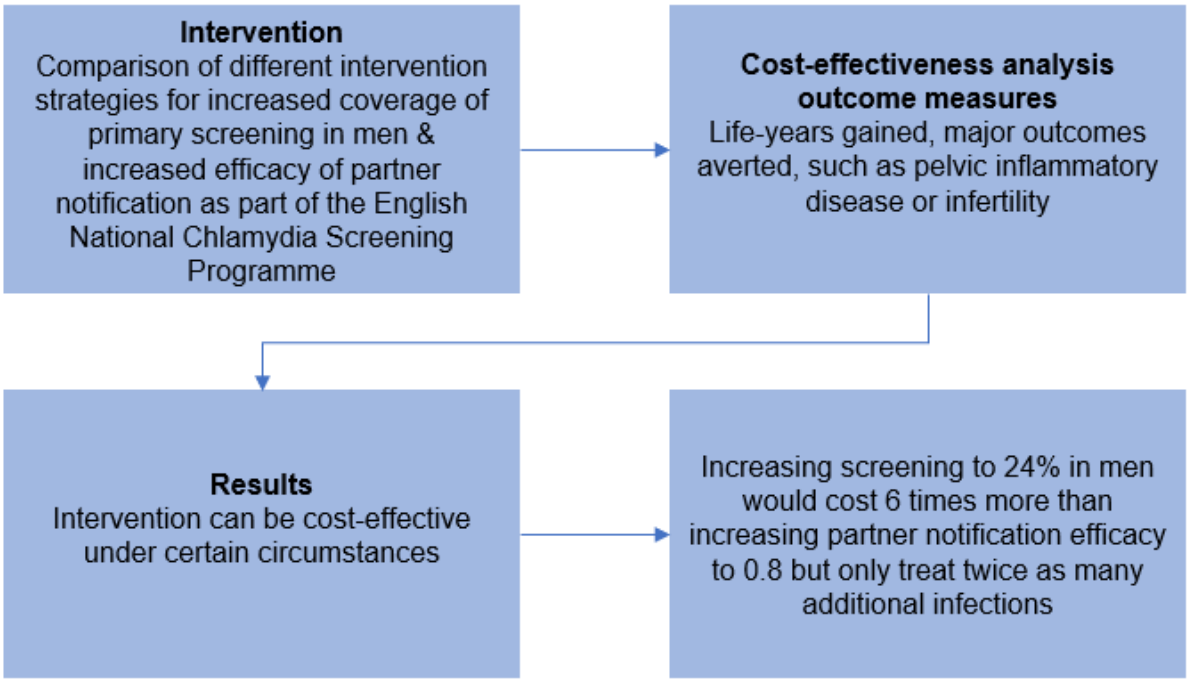

Figure 5.2. Simplified example of a cost-effectiveness analysis.

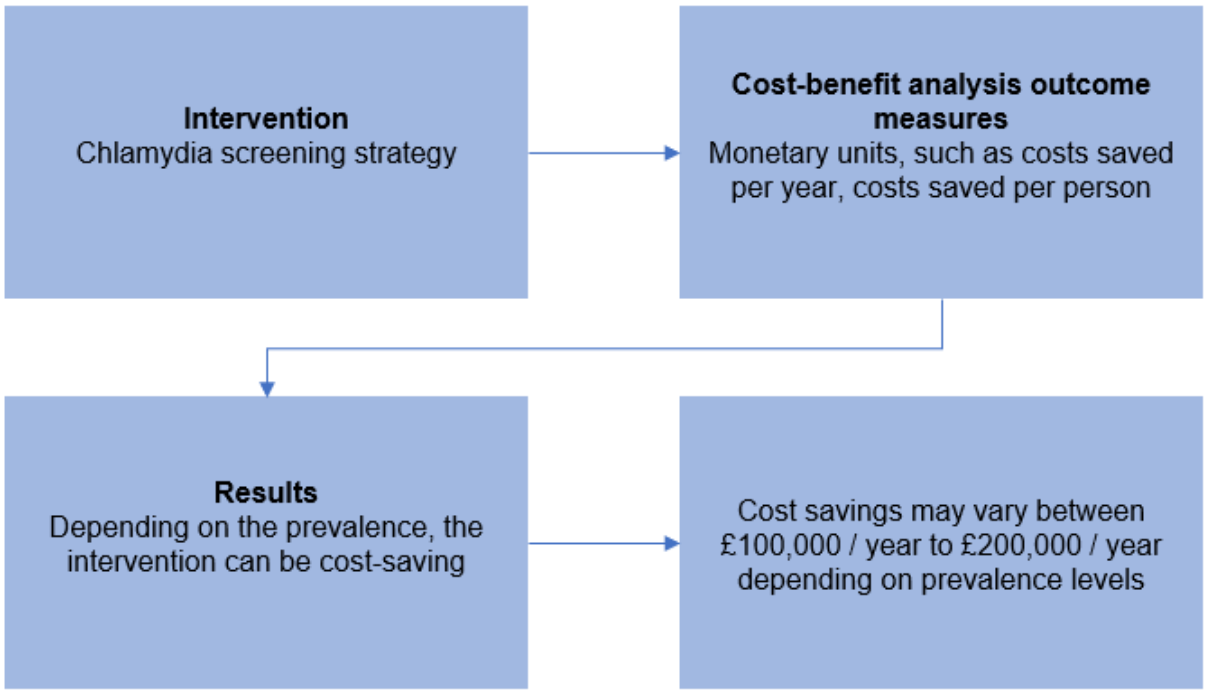

Figure 5.3. Simplified example of a cost-benefit analysis.
Notes: Fictive example.

5.3.6. Data analysis

The interviews were audio recorded, transcribed, and then analysed using the framework method as outlined by Gale et al. (2013). To ensure validity and reliability of results two validation strategies were applied: inter-coder reliability and comparison with other research in the area, which are further outlined below (Castleberry and Nolen, 2018; Creswell, 2014).

The framework method established by Ritchie and Spencer in the 1980s, and used in social sciences research is adaptable to the chosen epistemology (Ritchie and Spencer, 1994). It can support with organising and managing data from multiple sources (Ritchie and Lewis, 2003). This study followed the guidance by Gale et al.

(2013) in terms of the essential seven steps to follow when conducting a framework analysis (Gale et al., 2013).

Each interview was anonymised by assigning an ID, and transcribed ad verbatim, and uploaded to the data management software system NVivo 12 during which the PhD researcher began with the familiarisation of the data (Stages I and II) (Braun et al., 2019; Thomas and Harden, 2008; Gale et al., 2013). This involved intense reading of the transcripts and of the observational notes taken during the interviews. The observational notes included the main themes discussed, the ambience of the interview, i.e., whether it was interrupted, the participant was distracted or other observations, and final thoughts of the interviewer noted straight after the end of the interview. The first interviews were coded soon after the completion of the interview. The focus was mainly on language and certain key words and substantive content. Interviews were then coded in a bundle of three and charted to develop a working analytical framework (Stages III and IV). These codes were then revisited after a short period of time for reflection. The working framework was co-checked with one other independent researcher who reviewed the same bundle of interviews. The independent analyses were then discussed within the supervisor team and the framework was applied to the remaining interviews to index these, which was followed by the development of the framework matrix (Stages V, VI, and VII) (Gale et al., 2013). The final matrix was discussed with the whole supervisor team to assure its accuracy and to condense the themes guided by the research questions. This was also done to avoid any possible research bias (Galdas, 2017). The data in the matrix was used to

analyse decision-making processes and use of economic evidence in a sexual health context.

5.4. Ethical considerations

Ethical approval was granted by the Science, Technology, Engineering and Mathematics Ethical Review Committee at the University of Birmingham (reference: ERN_19-0714) (see Appendix 5.1).

Consent was provided both in written (prior the interview start) and in oral form (at the beginning of the interview) (see Appendix 5.2). The written consent was sent to the interview participant prior to the interview date and the participant was asked to return the form via email. At the beginning of the interview, the researcher reminded the participant that participation was completely voluntary. Participants were able to withdraw their participation at any time during the interview and up to two weeks after the completion of the interview. At the end of the interview, the participant was asked whether they would be interested in being informed about the findings. A summary of the research was sent to all participants who agreed to this.

5.4.1. Confidentiality

The data was only accessed by the research team. The PhD researcher transcribed the information provided during the interview in an anonymised form. The anonymised data was analysed by the PhD researcher and the supervisory team. This was to ensure an adequate analysis of the data. Any direct quotes from the interviews did not include any personal information to ensure that neither the participant nor other

mentioned persons were identifiable. Organisations were described in general terms only and were not named. During all stages of the recruitment process, personal information, which included name, email address and organisation, was not accessible for other people outside the research team.

5.4.2. Data management, monitoring, and oversight

There were three main forms of information collected: audio recordings, electronic communication (emails, consent forms), and paper records (observational notes). For the interview, audio recording devices were used. All formats were stored according to university policy and data protection policies, which was approved as part of the ethical approval process.

The recordings and transcripts were stored in a password protected file, on a password protected section of the University of Birmingham server. Transcripts and recordings were indexed solely with the study ID number so that participants were not identifiable. Once the one-to-one interviews had taken place, electronic communication with participants was securely destroyed unless the interview participant consented to be contacted again regarding the interview findings. Paper records consisted of observational notes from which the participant was not identifiable, as name and organisation information were not recorded. After completion of the study, data will be stored for 10 years (in line with University of Birmingham recommendations), after which electronic files will be deleted and hard copies will be shredded.

5.5. Results

Fifteen interviews were conducted between June and December 2020, with 17 participants (six women and eleven men) who were SHS providers, commissioners or consultants from across England. There were more participants than total interviews because two interviews were of two participants (interview number 3 and number 9). This was due to these participants requesting to be interviewed together. Table 5.1 outlines the characteristics of each participant, the place of the interview, interview length and comments on the setting and the interview itself. Out of the 15 interviews, three participants were providers for SHS, eight were local commissioners, and four were national decision-makers for SHS.

As anticipated, the interviews lasted between 30 minutes to one hour. The shortest interview was 29 minutes and the longest lasted for 1 hour and 7 minutes. Shorter interviews included participants who indicated less time at the outset, which resulted in more condensed questions and answers. The atmosphere was noted in the observational notes, including comments on noise, any disruptions, and technical issues. The main issues were due to Wi-Fi connectivity or interruptions due to emails or phone calls when speaking to the participants (e.g., DM_08.1/DM_08.2). Overall, the interviews had a good flow. This means that the interviewer and interviewee felt comfortable, which led to an in-depth conversation. An indicator for the in-depth conversation is the length of the participant's answers to each question. There were notable differences between participants who felt comfortable and participants who may have required some time to understand the purpose of the interview and to fully engage in the process (e.g., DM_03 vs. DM_14).

Table 5.1. Characteristics of interview participants

No.	ID	Gender	Decision-making level	Place of interview	Interview length	Comments on setting	Comments on interview
1	DM_00	M	Service provider	Zoom	53 mins	Minor distractions (light and computer)	Good flow; participant seemed to feel comfortable
2	DM_01	M	Local commissioner	Phone	32 mins	Calm atmosphere	Good flow; short but informative
3	DM_02.1 DM_02.2	M, F	Local commissioner	Microsoft Teams	29 mins	No major interruptions; initially a bit unstructured due to two participants	Very informative; additional information via email
4	DM_03	M	National commissioner	Zoom	57 mins	Short interruptions	Good flow with good follow-up questions
5	DM_04	F	Local commissioner	Zoom	38 mins	Wi-Fi connection was lagging which caused minor interruptions in sound	Slow start initially, participant was very open and helpful
6	DM_05	F	Service provider	Microsoft Teams	40 mins	Low quality of sound, some background noise, short break	Good flow
7	DM_06	M	National commissioner	Zoom	1.07 hours	Calm environment, used phone for video conference, which was less stable (lagging)	Good flow, topics beyond guide were discussed, participant was very talkative
8	DM_07	M	Local commissioner	Zoom	57 mins	No interruptions, calm environment	Good flow and very detailed; I felt very comfortable
9	DM_08.1 DM_08.2	M, M	DM_08.1: National commissioner DM_08.2: National commissioner	Zoom	52 mins	Severe interruptions due to my Wi-Fi; no video = no observations; sound quality was low	Slow start initially, conversation started to flow after around 20 mins; interruptions made me feel uncomfortable, but participants were very understanding
10	DM_09	F	Service provider	Zoom	31 mins	Insufficient sound quality: interview took place whilst participant was in the car; preliminary findings were summarised and confirmed by the participant	Good flow, participant was very open and upfront about addressing issues
11	DM_10	M	Local commissioner	MS Teams	57 mins	Some audio issues; mic was muted mic to avoid this	Good flow, good questions raised, participant spoke very openly about issues
12	DM_11	M	Local commissioner	MS Teams	1 hour	Some audio issues in the beginning; no interruptions	Good flow, participant took a lot of time and showed great interest in questions
13	DM_12	F	National commissioner	MS Teams	55 mins	No interruptions, no video, audio only	Good flow, participant was very friendly and spoke openly about issues
14	DM_13	M	Local commissioner	MS Teams	1 hour, 3 mins	No interruptions	Good flow of conversation and high quality of information provided
15	DM_14	F	Local commissioner	MS Teams	58 mins	Audio issues at the start	Slow start initially, better flow in the later stages of the interview; participant was open and provided details (also via e-mail)

F, Female; M, Male; MS Teams, Microsoft Teams

The subsequent sections present the three main themes – commissioning environment, context, economic evidence – with subsequent sub-themes and exemplary quotes. Behind each quote the participant ID and the decision-making level (national commissioners [NC], local commissioners [LC], service providers [SP]) were indicated. Pauses and unfinished quotes were indicated by […] and anything added to clarify quotes is indicated by ["XYZ"]. The three overarching themes were agreed between the PhD researcher and the supervisory team. These consisted of several sub-themes. All quotes presented in the text and tables were corrected for grammar to allow for better understanding of each quote. An overview of the completed matrices can be found in Appendix 5.5, Tables 5.5.1 – 5.5.3.

Initially, the examples of economic evaluations, which were presented during the interviews, consisted of a CEA and a CUA. After the first four interviews, the CUA was changed to a CBA example (see Figures 5.2 and 5.3). This was because the interview participants were less familiar with the outcome measure of QALYs used in CUAs and the example was not helpful for the discussion. Therefore, the choice was made to present a CBA rather than a CUA.

5.5.1. Commissioning environment

The commissioning environment was raised and highlighted in detail by the participants. Sub-themes of this section included commissioning changes and fragmented commissioning, contracting, types of decisions made, and technological changes in service delivery. These are detailed with examples in the paragraphs below (see Appendix 5.5., Table 5.5.1).

Commissioning changes and fragmented commissioning

Decision-making processes around SHS were reported as complex as they involve multiple stakeholders, particularly since the change in decision-making responsibilities in 2013. As one participant described:

"*Back in 2012, public health teams transferred to local authorities from Primary Care Trusts as they were before. So they are now CCGs. We* [local authorities] *took responsibility for commissioning a large range of sexual and reproductive health services"*, DM_LC_07.

Due to reduced funding, some services had made the decision to reduce the number of partner organisations. A critical issue highlighted was that different services are commissioned by a wide range of decision-makers, i.e., the NHS is responsible for HIV treatment whereas HIV testing is commissioned by local authorities, contributing to the fragmented landscape of SHS commissioning:

"[…] *and then there's a fragmented system in the sense that different organisations are responsible for different parts of the pathways"*, DM_NC_03.

Some participants stated that the differences in responsibility for sexual and reproductive health services have an effect on the 'joined-up' nature of working. Nevertheless, the general move of commissioning responsibilities from NHS England to local authorities was generally perceived as an advantage leading to better service

delivery, even though some local authorities seemed to take longer to implement the changes following the shift in commissioning.

Contracting

Contracts were described to last for three to five years and up to nine years with an extension in some regions. The types of contracting arrangements were seen as influential. For example, according to one participant, a block contract would be likely to result in the Directors of Public Health being less interested in the detail of the numbers of people accessing the service as this would not affect their expenditure:

"So it doesn't matter to me in effect how many people come in the door if I've got a block contract because I'm not carrying the risk but the providers are carrying the risk. The provider wants less people coming in the door because then they can make more money. I want more people coming in the door because in effect the cost per case comes down", DM_LC_01.

The example described above contrasts tariff-based contracts, which act on a cost per case basis. According to one service provider, tariff-based contracts do not leave enough opportunity for adaptations and changes to the service:

"Tariff basis is damaging [for the quality of the service] as the main focus is on return on investment (ROI) […]", DM_SP_09.

Types of decisions made

To better understand the decision-making process, the participants were asked if they could provide examples of decisions they had to make in the context of SHS. One local commissioner described the complex politics of the decision-making process and the number of people involved:

"So for myself and it goes to my manager, then it goes to the management of them, then it goes into a senior leadership team for joint decision making", DM_LC_04.

As for a specific decision, the participants provided several examples especially in relation to decisions taken as consequences of budget pressures. One participant described a situation where they decided to no longer work with a certain partner organisation to provide SHS in order to make savings. The service provider in this example based their decision on performance of the service, as well as the need to ensure that other partnerships could be continued:

"[…] *So I mean, the way that it was viewed, it was weighed up very much in terms of those* [organisations] *that are delivering well, but we're not going to make a huge indent into the savings, but it will be, it will help us to actually deliver and keep them going, rather than those that we probably would have let go anyway*", DM_SP_05.

Technological changes in service delivery

Most participants reported that online screening services to detect STIs are important for SHS. One interview participant felt that decision-makers liked the idea of online

services anticipating that this would reduce pressures on SHS. It was argued that based on current data that the services are in fact meeting some unforeseen unmet demand, resulting in more people accessing the services. Another participant highlighted the open-access aspect of SHS and suggested that this requirement would not be fulfilled with online SHS, since service access is based on the person's home address:

"And then we were talking about digital or telephone services if it is a digital service and you go online, normally asking people for their postcode, and it will redirect you to your local service if it is not a service that is commissioned for your area. So the idea of open-access doesn't really apply to online services", DM_LC_14.

A number of interviewees talked about the idea of online SHS being cost saving: "[…] *because you could test remotely and self-sample. People thought, well, this must be cost saving",* DM_NC_03.

This is further discussed in the section below. One national commissioner highlighted the importance of maintaining some face-to-face services because health professionals may observe and recognise other factors influencing poor sexual health outcomes, such as housing problems or alcohol misuse:

"*I think clinicians would say we sometimes need to see people for a whole host of wider issues: violence, psychology, pleasure,... all of these other things which, I think,*

research shows that are hugely important to being empowered and preventing STIs", DM_NC_12.

5.5.2. Context

Participants in the interviews raised a number of contextual factors, which influenced the commissioning and decision-making around SHS (see Appendix 5.5., Table 5.5.2). This included the COVID-19 pandemic, the political context, the general integration of SHS, equity aspects, the financial context, and local differences.

Impact of COVID-19 on sexual health services

The interviews were conducted during the COVID-19 pandemic. Therefore, participants reflected on how the pandemic may influence SHS and STIs. A local commissioner described the pandemic's impact on services to date:

"[…] *it shifts to predominantly telephone and postal provision and the most significant impact will be on those individuals that don't have access to digital* [services]*", DM_LC_01.*

One service provider expressed their concern that the COVID-19 pandemic may negatively impact the political priorities concerning SHS:

"[…] *the pressures that local authorities have for their own funding, because I mean, obviously they're allocated funding. And they have to be very mindful as to where that funding is distributed. So I was concerned when COVID came into play* […] *whether*

that will impact on any future funding allocations, and that's yet to be seen", DM_SP_05.

Political context

SHS are a mandated service in England, and this was described by the participants as making them of high political priority. They felt that the budget allocated meant that SHS were viewed as important and subject to political and public scrutiny:

"*I still see it* [SHS] *as being a high priority, certainly within the public health arena* […]*. It is a statutory requirement of a local authority to provide that service. So it isn't going away. They have to do it"*, DM_LC_04.

Integration of sexual health services

Regarding the sub-theme of the integrated nature of SHS, one local commissioner highlighted that their service is aiming to reduce the burden on the patient of having to visit different clinics for contraceptive and gynaecological purposes by combining these into one hub:

"We are starting to really move it and kind of make sure that a woman who is accessing wherever, can get whatever [SHS]*. Rather than it be: You can only have contraception here, sorry we can't fit you for that which is absolutely ridiculous"*, DM_LC_07.

Another commissioner described the nature of integrated services as being part of the community, which is achieved through creating outreach services into schools and other relevant community hubs:

"[…] *the strength of the integrated approach to sexual and reproductive health is it needs to be integrated within the community, it needs to be integrated with things like children's centres"*, DM_LC_01.

Equity

Equity aspects were often described in terms of accessibility to services for all patients, e.g., in terms of service providers who are responsible for rural areas facing greater difficulties to ensure accessibility for all.

"[Commissioners] *may be dealing with populations that are spread over much more extensive areas, or the transport and other networks that would allow people to get access to care are much more challenging*", DM_NC_06.

Equity was also discussed in terms of reaching vulnerable groups and how to best approach this. This was especially raised in relation to online SHS, and the assumption that all communities have a certain level of digital and health literacy[78]:

[7] Digital literacy can be described as the "ability to understand and to use information from a variety of digital sources" (Bawden, 2008, p.18).
[8] Health literacy is "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (Ratzan and Parker, 2000, p.vi).

"[…] *to access online health systems, you need digital literacy and a level of health literacy, or you assume that level but actually that level of health literacy is not evenly spread across the population*", DM_NC_03.

Financial context

The characteristic of SHS being an open-access service was described by the participants as important and resulting in budget flow issues. In England, a patient may access a service in another area, but with a different service charge compared to the local authority of their home address. Currently, local authorities pay the charges coming from other areas when one patient accesses a SHS outside the commissioning area of the patient's residency. This was an aspect highlighted by several participants, which from their point of view should be addressed in the future. Due to changes in service delivery as a result of the COVID-19 pandemic, such as increased telephone consultations, patients could call any SHS irrespective of their location, which was contributing to the budget flow concerns:

"*When does telephone triage become a consultation that another area could bill you for?"*, DM_LC_14.

Decision-makers described pressures on budgets due to increasing demand for SHS whilst resources were decreasing. These pressures were described as influential on the quality of service delivery:

"*It comes to a point where you can no longer deliver gold standard services*", DM_NC_12.

There were two contrasting statements concerning cuts to the public health grant. One local commissioner (DM_LC_01) stated that SHS particularly only saw a 3% cut whereas a national commissioner (DM_NC_03) highlighted that service providers would need to work with a decreased budget from year to year (see Table 5.5.2, subtheme Financial).

In this context, some interviewees also mentioned the advantage of moving to online services as these were assumed to be cost saving:

"*They* [local authorities] *wanted people who didn't need to be in clinics, not to be there* [to generate cost-savings]", DM_NC_12.

This assumption was contested by one national commissioner and a service provider stating that the evidence for online screening services of STIs being cost saving is insufficient (DM_NC_03, DM_SP_00). Although the service provider highlighted that overall online screening is likely to be cheaper compared to face-to-face screening, the degree was not clear:

"[…] *online testing is cheaper than face-to-face testing. I think, it's probably true. Although not by what extent. So it is rather assumed that the new ways of working are way cheaper but this is often not particularly well tested"*, DM_SP_00.

A final sub-theme within the financial context was the combined complexity of budgets and commissioning arrangements. Nearly all participants stated that the fragmentation of commissioning had led to issues around budget flows. Health providers outside of sexual health benefit from interventions which have been paid for by local authorities. For example, a local authority paying for screening of chlamydia, does not realise the cost-savings created due to the avoidance of cases of PID, since the treatment for this sequela would be paid for by the NHS (DM_NC_03). Another example was described by a participant for a woman accessing GP services for contraceptive vs. gynaecological purposes:

"So we [local authorities] *pay for GPs to fit coils and implants for contraceptive purposes. Not* [for] *non-contraceptive purposes. A woman accessing them, potentially for heavy menstrual bleeding* […] *is gynaecological related; it technically shouldn't be paid for by the local authority",* DM_LC_07.

An additional issue with different responsibilities for SRH services was highlighted by a local commissioner, who stated that it reduces the incentive to further develop services:

"*If you are paying for abortions, you pay a lot more attention to the provision of contraception but because the NHS pays for abortions and local government pays for contraception that disconnect in economic benefit unwinds or unruffles* [disarranges] *the potential for cost-effectiveness to drive change*", DM_LC_01.

Local differences

Substantial local differences were discussed by nearly all participants, who emphasised that some local authorities are diverse and serve distinctive population profiles. These included statements about the uniqueness of the population, e.g., high numbers of ethnic minorities and people with lower socio-economic status, or geographical differences, and local authorities may be responsible for a city and others would be commissioning services for both towns and rural areas. These differences would also result in different budgets for local authorities to commission SHS:

"*And it* [the city council] *does stick out like a sore thumb* […] *in terms of its uniqueness because of the vast size and nature of* [this city council]*",* DM_LC_02.

5.5.3. Economic evidence

The third theme was *economic evidence*, which consisted of five sub-themes: understanding and use of economic evidence, data/evidence available for SHS, evaluating SHS' impact, outcome measures, and presentation of evidence (see Appendix 5.5, Table 5.5.3).

Understanding and use of economic evidence

Most participants mainly focused on economic evidence in terms of assessing return on investment. In the example below, a national commissioner talked about local authority commissioners' needs and understanding of economic evidence:

"[…] *My experience is that they're* [local commissioners] *more interested in return on investments, which is challenging within sexual and reproductive health, for a number of reasons, not the least of which the return on the investment is not seen by the person who invests in it*", DM_NC_03.

During some of the interviews, the decision-makers were directly asked what they understood by the term "economic evidence".

One participant replied:

"*I love nothing more than seeing a return on investment tool*", DM_LC_13.

When talking about economic evidence, some participants used economic evaluation terminology, such as cost-effectiveness and cost-benefit, but did not differentiate between these:

"*So, the question I think we have is, it is an economic question in terms of return on investment.*[…] *What is the cost-effectiveness of sending out voluntary sector staff to a crowded bar and talking to a self-selecting group of people who are maybe not demographically targeted*", DM_LC_10.

Some participants who had working experience on a national level demonstrated a greater understanding of economic evidence and the advantages and disadvantages of it.

According to the interviewees, some local authorities rely on guidance from national bodies, such as PHE to inform decisions. Local commissioners felt that they would expect to see some form of economic evidence applied in a bid for tendering by service providers:

"So the bidders [potential service providers] *were referencing it* [tool/model] *and attaching the tool, and demonstrating how their service has been applied to that tool. So given the value of this contract, that is a minimum, I would expect, on any bid that comes through*", DM_LC_02B.

Data/evidence for sexual health services

An overall lack of data was repeatedly reported by multiple participants. For example, one stated that:

"*We always find around health economics* […] *that actually, there's not much evidence really"*, DM_LC_11.

Other participants stated that the available evidence does not address the needs of decision-makers showing discrepancies between the economic evaluations available and local decision-makers' interests:

"[…] *fundamental question mark about what is the cost benefit of treating sexually transmitted diseases versus what we more often see which is cost-effectiveness*

analysis of different modalities of the same service but with a different method", DM_LC_01.

There was also a concern about how old the data may be, which informs economic models:

"*And often people are referencing other modelling studies and* […] *actually these estimates are* […] *40 years old*", DM_NC_03.

Evaluating the impact of sexual health services

When evaluating SHS, a form of benchmarking is often applied to understand how the service is performing compared to other services; this is done often by using tools developed by PHE, such as the Fingertips tool. The tool allows local authorities to input their own data and compare this to the national average as well as other local authorities, e.g., for chlamydia screening rates. This was described in terms of a range of comparisons:

"And how do we compare nationally. So obviously we'd use public health fingertips. *So obviously we can compare ourselves against other local authorities within our region, but also then within the country. So that helps us give a bit of a benchmark as to where we are and what we need to work on",* DM_LC_04.

Some local authorities have specific indicators for the service providers to report on:

"*So it is of course different between local authorities, for ours, we have 125 key indicators on delivery, which we* [providers] *deliver each month to them* [local authorities]", DM_SP_00.

When asked about what kind of evidence is considered, some interviewees stated that prior to introducing a new service, a needs assessment was conducted. A few local authorities would also conduct focus group discussions to incorporate perspectives from the public on service needs and audit, and surveillance data would be considered. Additional evidence considered were costs, governmental guidance, e.g., from PHE, the PHOF indicators, which are based on national level evidence:

"There are national documents to support us [local commissioners] *around which outcomes we should ask for from a new service.* […] *I know that it'll be better for us now because we don't get some of those national integrative framework indicators. And then the PHOF indicators give us an overall look, which is [fine]. But we don't get some of those ones we should get: Partner notification and things like that are quite complex"*, DM_LC_07.

Some participants also stated that the PHE ROI tools would be helpful, but it was unclear whether they had actually used them.

Outcome measures

Although the participants' showed interest in broader outcomes, i.e., inequalities or wider determinants of health, this was often overshadowed by concerns over costs and the need for cost-savings, such as:

"*If you prevent X amount of gonorrhoea cases, you can save X amount of pounds*", DM_NC_12.

One national commissioner stated that QALYs are not considered when looking at available evidence for SHS:

"I've not had conversations about QALYs with local authority commissioners", DM_NC_03.

Due to the patterns of how decisions are made concerning SHS, i.e., by committee, QALYs were not considered as helpful. The PHOF indicators were also referred to as measures for outcomes, which were considered as they were monitored externally in terms of:

"[…] *reduction of new STIs, STI prevalence in the area, increased LARC* [long-acting reversible contraception] *uptake* […] [reduction of] *late diagnosis of HIV"*, DM_LC_07.

In general, costs and cost-savings seemed to be most important to all those involved in local decision-making, and this was argued as necessary due to the existing budgetary pressures. One participant described this in the following way:

"[…] *councils will have no money.* […] *So first and foremost, it becomes an economic question. Not about what is optimal spending to achieve your outcomes, but it becomes an economic question of what is available* [to fund the service]*",* DM_LC_10.

As a result of the budget pressures, the focus seemed to be on achieving shorter-term outcomes instead of having a long-term vision. One participant described this in the following way:

"[…] *if somebody turns up with syphilis for example and needs treatment. You're going to spend the money on that rather than on the long-term outcome stuff that is very difficult to measure. You can't. You will only see benefits, 2 years, 5 years later",* DM_SP_09.

Once the options of a CEA or CBA were presented, there was no specific preference for an evaluation method. Interview participants stated that both examples seemed helpful for different reasons, saying that they would use the evidence depending on the context and time:

"*I don't know if there is a preference. I think they are all useful. Costs received back against an intervention are massively useful. I think that's always useful to*

commissioners to see that, to know that actually, longer-term, they are spending this now, but they will see this return, DM_LC_07.

Presentation of evidence

Helpful evidence was described as tools that are adaptable to the local population that include unit costs specific to local areas. These tools should include the unique population characteristics as each local area seems to view themselves as unique. Further, unit costs specific to local areas were viewed as important. One local commissioner suggested that it would be helpful to look at the costs incurred across the whole pathway, e.g., for online services to test and screen for STIs, it should not only be about the direct costs but also consider other costs associated with sending kits:

"*So if you then think about not just the cost of the kit and processing, but the cost of time and resource and energy. […] we need to almost try and cost more of the pathway*", DM_LC_11.

The timing of when to deliver the evidence was also discussed. Local commissioners and service providers indicated that evidence is needed at the start of the tendering process for contracts:

"[…] *it would be very much a question of time, we probably wouldn't have a great deal of time to read this unless we're actually making these decisions*. *So that would be very useful coming up to the whole re-tendering of sexual health*, DM_SP_05.

Overall, it was recognised that an evaluation is difficult in a complex system and that there may be a lack of data. This in combination with the considerable differences between local authorities as described in Section 5.5.2 may lead to a low generalisability of economic evaluations utilising local data. The participants were asked how they would prefer the evidence to be presented. The answers were heterogeneous and ranged from granular cost data, figures, to graphs, and short statements with reference for further information.

"[…] *that would be still quite interesting in a sexual health capacity to say: this is how much of the test costs, this is how much a consultant would cost; or this is how much a nurse would cost",* DM_LC_04.

5.6. Discussion

The qualitative interviews with sexual health decision-makers in England aimed to gain an insight into the decision-making processes and utilisation of economic evidence. The interviews highlighted heterogeneous commissioning processes for SHS across England but an overwhelming consensus on the importance of reduced budgets and concerns about costs. The data show the differences in familiarity with and use of economic evidence in a SHS decision-making context, particularly between national and local levels. This heterogeneity of service provision, including different forms of contracting SHS, affects the comparability of decision-making processes.

5.6.1. Decision-makers' perspectives on economic evidence

The following paragraphs highlight the different aspects discussed with decision-makers for SHS concerning their perspectives on economic evidence with the aim to answer the research questions.

Overall, the interview participants did not seem to utilise a wide range of economic evidence and placed a greater emphasis on the cost aspects of SHS due to the existing public health budget pressures. There were distinctions between the three decision-making levels (national commissioner, local commissioner, and service provider) on the understanding of economic evidence. Interviewees who had experience working on a national level showed a greater familiarity with outcome measures, such as QALYS, compared to participants at a local commissioning or service provider level.

Due to budget pressures, most participants agreed that costs were a significant factor when commissioning and delivering SHS. Although there seemed to be a disconnect between national and local decision-makers concerning cuts to the public health grants. Moreover, there were serious shortcomings in the data available on costs that was relevant to local areas.

QALYs were not explicitly considered as helpful, especially not for a local context, as they were perceived as too generalised and not taking into account the characteristics of STIs. This shows an overall discrepancy between existing economic evaluations on control programmes for STIs and the needs of local commissioners for SHS (see Chapter 3, Section 3.2).

Although the decision-makers may have not mentioned that they are concerned with equity explicitly, it is part of their role description as stated in the Health and Social Care Act (2012.6), which states that employees in the English NHS have to work towards reducing inequalities (Health and Social Care Act 2012 c. 7, 2021). The participants did refer to equity aspects in the form of accessibility of services. Although previous research has highlighted that the aim of public health decision-makers is to address equity aspects (Eddama and Coast, 2009; Chen, Ashcroft and Elliott, 2007), it did not seem to be a high priority in these interviews due to budget pressures and resulting need to reduce costs of SHS.

According to the interview participants, useful economic evidence for commissioners and providers of SHS should be adaptable to the local context with an emphasis on disaggregated cost data. Both CBAs and CEAs were seen as helpful for SHS commissioners and providers when making decisions. The participants did mention that depending on the situation, each type of economic evaluation may be helpful. However, the identified overall lack of familiarity with economic evaluations and associated methods might limit their actual use of the evidence. The importance of timing was mentioned in terms of when the evidence is needed. There may be a tension between academic rigour in developing the evidence compared to the shorter time frames associated with commissioning and providing SHS (Eddama and Coast, 2009; Chen, Ashcroft and Elliott, 2007).

5.6.2. Comparison with other literature

Previous studies have interviewed public health decision-makers about their use of economic evidence (Brousselle and Lessard, 2011; Williams et al., 2008). This research confirms the findings of these studies, which found that economic evidence is rarely applied at a local level and that decision-makers experience specific barriers to accessing the evidence (Eddama and Coast, 2008). Brousselle and Lessard (2011) stated that time constraints and poor understanding of economic evaluation terminology are barriers for decision-makers when it comes to the use of economic evaluations to aid their decision-making process. These two factors, time constraints and the low level of familiarity with principles of economic evaluations were also mentioned by the participants in the interviews presented here.

One study, which reviewed methodological challenges for economic evaluations of public health programmes, highlighted that there is a need to incorporate equity considerations when conducting economic evaluations due the tackling inequalities in health being a public health priority (Weatherly et al., 2009). The interviews presented here demonstrated that participants' primary concern was not about reducing inequalities but about allocating their budget as efficiently and effectively as possible.

Frew and Breheny (2020) conducted qualitative interviews with public health decision-makers from one local authority. The study found that despite a general interest in using health economics, several barriers were identified with accessing and utilising economic evidence at a local authority level (Frew and Breheny, 2020). The participants also suggested methodological improvements, which included

consideration of wider non-health outcomes. The research reported here also considered perspectives from a national and local commissioner and service provider level. However, in this study the participants' focus was on outcomes was on health impacts associated with SHS in terms of to improving diagnoses and reducing STIs, as measured by the PHOF indicators, and not necessarily on wider outcomes. One reason for this difference in findings may be that the interviews included different decision-making perspectives and did not probe specifically on wider outcomes, which was done by Frew and Breheny (2020). Further, the study by Frew and Breheny (2020) also focused on public health programmes more generally rather than on SHS specifically.

5.6.3. Strengths, limitations, and reflections

This study conducted in-depth semi-structured interviews with decision-makers within SHS. The method facilitated a deeper understanding of the topic in question – how economic evidence is utilised in this context and what kind of evidence would be particularly helpful for local decision-makers. The participants reflected a range of decision-making levels across England allowing for a better understanding of services and information needs across the country. The findings are not necessarily generalisable to other areas of public health but do provide a contextualised understanding of the use of economic evidence for SHS. Nonetheless, some of the findings might be relevant to other contexts (Polit and Beck, 2010).

The participants were recruited during a public health crisis and the interviews were initially delayed as many participants were relocated to support the emergency

pandemic response. Originally, the interviews were planned to be face-to-face allowing for additional data to be generated, such as additional observations but due to the circumstances, all interviews needed to be conducted online. The online nature of the interviews did result in some obstacles, e.g., one interviewee was in a car whilst doing the interview, which created some issues with the sound quality. For this interview, in order to check for understanding, a summary was sent to the participant who then confirmed the accuracy. Some qualitative researchers co-check all findings and analysis with the interview participants to ensure that the interpretation of the quotes is accurate. This step was omitted during these interviews due to resource constraints. By conducting online interviews, more flexibility was possible around the recruitment of participants, and this may have contributed to more participants agreeing to take part, compared to face-to-face interviews. Another obstacle encountered was managing two participants in an interview. To ensure that the participants did not speak at the same time, which would have made the transcription process more difficult, they were informed about the interview structure at the start and asked to answer the questions in a particular order. However, this may have influenced the participants' answers. Finally, prior to conducting the interviews, it was assumed that there would be a greater focus on equity by decision-makers. This was not the case and it seemed that this was overshadowed by the budget pressures.

5.6.4. Reflexivity and power relations

The role of the PhD researcher as a health economist conducting qualitative research may have impacted on the answers of study participants and therefore also the findings. Although the participants were experts and held senior positions in their field,

they may have been influenced by the researcher's role as a health economics PhD student. To reduce this power imbalance, the researcher aimed to make it clear at the beginning of each interview that they were a student in this field of research, and that the participants would not be expected to know health economics concepts and related information.

5.7. Conclusion

The interviews with commissioners and providers for SHS revealed that existing economic evidence is not widely used by local decision-makers. Most of the interview participants showed a lack of familiarity with current economic evaluation methods and although these were of interest to some, the current evidence did not seem to be supporting their actual decision-making needs. These needs were driven by budget pressures, the fragmentation of budgets, and specific contextual factors. Future economic evaluations of SHS need to be tailored to ensure that they provide economic evidence that meets the needs of decision-makers. This could include the incorporation of local data and a focus on cost aspects as this was mentioned across different decision-making levels as important. Further analysis of how this could be achieved will be presented after the next chapter, which focuses on interviews with researchers in health economics and public health.

CHAPTER 6
Challenges and opportunities in developing economic evidence for public health programmes: A qualitative study with UK researchers

6.1. Introduction

The previous chapters highlighted current challenges associated with the use of economic evidence as well as with adapting standard economic evaluation methods to fit the needs of local decision-makers. The perspectives from public health decision-makers on economic evidence have been explored by several studies (Frew and Breheny, 2019; Williams, Mannion and Hall, 2017; Edwards, Charles and Lloyd-Williams, 2013). However, to the knowledge of the author of this thesis, there is no research, which focuses on the perspectives of academic health economists and other researchers relating to the use of economic evidence to inform decision-making in sexual health. In addition, the question remains on how to adapt national methodological guidance to local settings. In this chapter, the views of academic health economists and researchers who work closely with public health decision-makers when generating economic evidence were investigated. Qualitative interviews were conducted to gain an insight into the researchers' perspectives when developing evidence for decision-makers.

Public health interventions often strive to achieve gains beyond health such as educational, productivity and wider wellbeing gains and are regularly implemented in settings where there are multi-sectoral costs and outcomes. Methodological guidance for economic evaluation in public health therefore places careful emphasis on the choice of appropriate time horizon; methods for measuring costs and trading off with outcomes; and adopting different criteria for making recommendations such as maximisation versus a sufficiency/equity principle. Although economic evaluations are often used to inform decision-making at the English national level, evidence suggests that they are rarely considered by local decision-makers (Brousselle and Lessard, 2011; Williams et al., 2008).

Therefore, interviews with academic health economists and researchers in public health were conducted to gain insights into the challenges and opportunities associated with developing economic evidence within a sexual health context. The researchers were recruited based on criteria further outlined below. Public health decision-makers need to make decisions across all public health functions, and they require economic evidence, which can be adapted to the context and encompass equity aspects in the decision-making process. This research adds an academic perspective on economic evaluation methods for public health programmes, with a specific focus on SHS.

This chapter builds on the methods described in Chapter 5. It presents the results of the interviews with academic health economists and other researchers who have experience of developing evidence for public health decision-makers. At the end of the

chapter, the findings are discussed in relation to the findings from the decision-maker interviews presented in Chapter 5.

6.2. Aims and research questions

The aim of this research phase was to explore researchers' experiences of collaborating with public health decision-makers and to learn from their experiences. The interviews provided the opportunity to discuss how economic evaluation methods might be improved to better fit within a local public health context. Differences and similarities concerning methodological approaches for the sexual health context could thereby be identified. The applicability of current recommendations for economic evaluations in a public health context was investigated with the interview participants. Finally, these interviews allowed comparisons between the experiences of researchers and the views of decision-makers on methods.

The research questions were:

a) *What are the experiences of academic health economists and other public health researchers when working with decision-makers to develop economic evidence?*
b) *What kinds of challenges have researchers faced when developing information for decision-makers and how did they overcome these challenges?*
c) *How may economic evidence be improved to inform local decision-makers in England, with a focus on sexual health?*

6.3. Methodology

All methods followed those described in Chapter 5 apart from the sampling strategy, which is further outlined in the sections below.

6.3.1. Sampling strategy

Participants were purposefully sampled through a snowballing approach and all interviews were conducted using audio-video software until saturation was reached (Creswell, 2014; Tracy, 2010). The participants were selected based on their previously published work in the area and to include those who could provide an in-depth understanding of the development of economic evidence for public health decision-makers (Creswell, 2014). Participants were approached who had conducted work on either conceptualising tools and giving guidance for decision-makers in public health, or who had conducted interviews themselves, to get an insight into decision-makers' understanding and preferences for economic evidence. The experience from these researchers may not be directly linked to a sexual health context but could potentially be transferred.

Scoping review

A scoping review was conducted prior to identifying the research participants to illuminate contemporary literature on decision-making research in public health relating to health economics. The review was guided by the following question:

What are the main findings on research conducted to date in the UK context concerning local public health decision-making and the utilisation of economic evidence?

The aims of this review were two-fold. First, information on the decision-making context and how researchers worked with decision-makers to elicit information was collected. Second, the findings on opportunities, challenges, and recommendations concerning appropriate methods for economic evaluations, such as recommendations for the types of economic evaluations, perspective, time horizon, and equity considerations, were reviewed. The findings from this review are not presented in this thesis but were utilised for background information and to help with developing the topic guide for the interviews. The authors from the identified literature were considered for the interviews. Additional participants were identified through recommendations from interview participants as well as by the supervisors of this thesis (snowballing).

Sampling framework

A framework for the sampling process was developed to categorise the research participants (see Figure 6.1). The three categories were: a) Health economists who conducted research with public health decision-makers; b) Health economists who developed methods for improving public health economic evaluations; and c) Public health researchers who worked with public health decision-makers on aspects related to economic evidence.

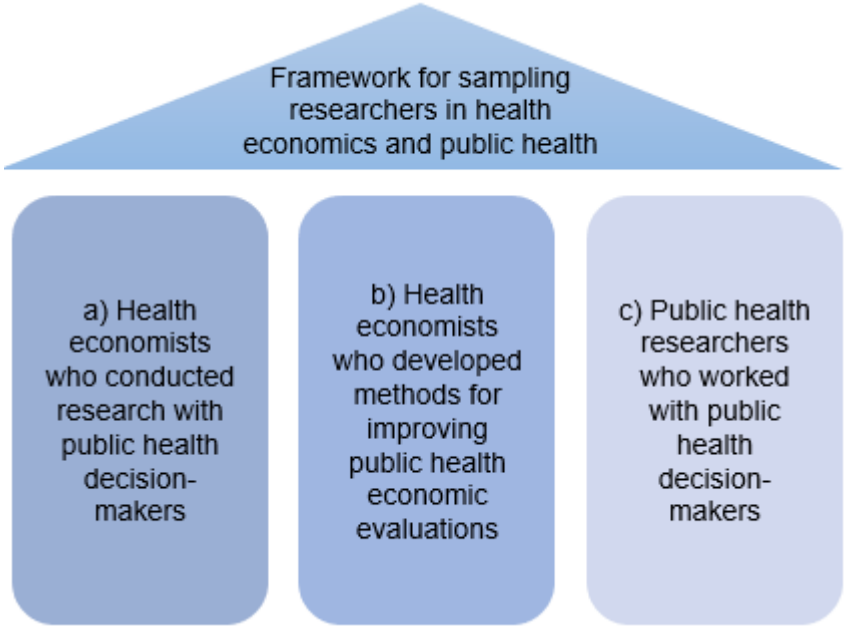

Figure 6.1. Framework for sampling the participants.
Notes: The framework shows the three different categories for sampling interview participants (a-c).

6.4. Ethical considerations

The ethical considerations were followed as outlined in Chapter 5 and were approved by the University of Birmingham Research Ethics Committee (ERN_19-0714). The aspects, which differed for the interviews presented here, were reflexivity and power relations, which are reflected on later in this chapter.

6.5. Results

Twelve qualitative interviews with researchers from health economics and public health across the UK were conducted using video/audio software. Interview participants consisted of six men and six women who all held academic positions at a UK university.

Four main themes with several sub-themes were identified (see Table 6.1. and Appendix 6.3). Table 6.1 below shows the characteristics of the interview participants. It lays out some personal aspects as well as refers to the sampling framework when describing which area of research the participant was mostly working within.

The interview participants consisted of a heterogeneous group. The majority were health economists, who specialised in various disciplines within health economics (n=9). Four of these participants were health economists who conducted research with public health decision-makers to improve current economic evidence (category a, Figure 6.1). Another five interviewees were health economists who have worked on developing economic evaluation methods for public health programmes (category b, Figure 6.1). Three participants were public health researchers who worked with public health decision-makers and on the wider sphere of economic evaluation methods (category c, Figure 6.1). The interviews lasted between 30 minutes to 1 hour. Most of the interviews did not encounter any interruptions and had a good flow, meaning that it was an in-depth conversation with follow-up questions rather than a question-answer interview. Small interruptions were recorded for five interviews, but this did not affect the overall quality of the conversation (RS_00, RS_02, RS_03, RS_04, RS_06). As mentioned in the previous section, some interviews started slowly due to the increased length of the warm-up phase, e.g., interview with RS_04. Nonetheless, this was resolved after some time into the interview session.

Table 6.1. Interview participant characteristics

No	Participant ID	Gender	Occupation	Framework ID	Place of interview	Interview length	Comments on setting	Comments on interview
1	RS_00	F	Professor of Health Economics	A	Zoom	1 hour	Wi-Fi stopped working; call had to be restarted	Good flow; I felt comfortable
2	RS_01	M	Professor of Health Economics	B	Zoom	40 min	No major interruptions; quiet office	Slow flow at the start; I felt a bit uncomfortable; took time to talk about decision-making
3	RS_02	M	Reader in Health Policy and Management	C	Zoom	54 min	Short interruptions in audio and interview	Good flow; participant was very attentive and took notes
4	RS_03	F	Professor of Public Health & Sexual Health Clinician	C	MS Teams	41 min	Short interruptions	Good flow; very precise recommendations
5	RS_04	F	Professor of Health Economics	B	MS Teams	58 min	Started late; short interruptions	Slow beginning; more informative after some time
6	RS_05	M	Senior Research Fellow Health Economics	A	Zoom	47 min	No interruptions; recording quality was low	Good flow; very fast and a bit hectic, which made it difficult for me to follow and therefore could not ask as many follow-up questions as would have been appropriate
7	RS_06	M	Professor of Health Economics	A	Zoom	38 min	Interruption due to phone call	Slow flow; quality suffered as I was not feeling well and participant gave short answers
8	RS_07	F	Professor of Health Economics	A	Zoom	53 min	No interruptions	Good flow; relaxed atmosphere; in-depth conversation
9	RS_08	F	Professor of Health Economics	B	Zoom	29 min	No interruptions	Good flow and high quality; had to rush with questions due to time limit of 30 minutes
10	RS_09	F	Professor of Health Economics	B	Zoom	42 min	No interruptions	Good flow
11	RS_10	M	Professor of Health Economics	B	Zoom	53 min	No interruptions	Very good flow and quality; participant asked questions before start of interview, which may have influenced their answers slightly; offered support in the future
12	RS_11	M	Professor of Vaccine Epidemiology	C	Zoom	48 min	Some background noise	Slow flow in the start; more elaborate answers later

F, Female; M, Male; MS Teams, Microsoft Teams

A, B, C: Please consult sampling framework Figure 6.1.

The interviewees provided specialised knowledge on various areas within health economics relating to economic evaluations and working with public health decision-makers. This also led to a range of recommendations for developing economic evidence for SHS.

Four main themes with several sub-themes were identified and are reported in the sections below: context, decision-making process, economic evidence, and recommendations for conducting future economic evaluations. All quotes presented in the text and tables were corrected for grammar.

6.5.1. Context

The theme of context related to public health, the financial context for local authorities, national vs. local decision-making costs and time horizons, thresholds for budgets, and the impact of the COVID-19 pandemic on service delivery and decision-making processes.

Financial context: Budgets; Cost (savings); budget flow

In the context of public health and supporting decision-makers with economic evidence, academics highlighted the importance of budget pressures, public health services having to make cost-savings, and the fragmented nature of budget flows. For example, one researcher described the pressure to make cost-savings and the constrained time frames for spending the allocated resources as being the main considerations for decision-makers:

"*My understanding is that they're* [decision-makers] *incentivised by making cost-savings in the short term. And until that incentive is removed* […] *I think the whole structure of those budgets and the time horizon associated with the budgets and the incentives for decision-makers to be successful in their roles personally, needs to be disentangled*", RS_09.

Another important aspect explained by multiple interviewees (RS_04, RS_09, RS_11) was the need for public health to save money, which is not the case for other services in health:

"[…] *public health is also always pushed to say that it has to be cost saving. And obviously it's much more accepted to spend budgets on, I don't know, cancer treatment. So, yeah, different clinical trials showing cost-effectiveness, it's okay but it doesn't need to be cost saving. So, yeah, there's lots of pressure on the public health budget for sure*", RS_11.

With regard to the budget flows, academics who had experience of working with local public health decision-makers highlighted the concerns of decision-makers that for investments in public health, benefits are largely realised by the NHS instead of the local authority who invest in the prevention programme:

"*The costs don't reflect what they're* [local authorities] *paying and also don't reflect what difference it makes to their budget. Because they're quite concerned with what difference it makes to their budget versus being driven, very largely by NHS costs* […]. […] *a couple of people* [… were] *saying that they didn't like the fact that when you bring all the costs or the healthcare costs together, that kind of obscures for them what it means for the council*", RS_08.

The fragmentation in budget flows may also lead to local authorities questioning the need to invest in certain prevention programmes, such as tobacco control:

"*So the local authority decision-makers* […] *wanted to know whether it was worth actually funding the smoking cessation interventions, given that most of the benefits actually are generated in the NHS context, not the local authority context*", RS_10.

National vs. local decision-making costs and time horizons

During the interviews, it became evident that there are differences in the decision-making aims, which, according to the participants, depend on the decision-maker or decision-making level, i.e., local vs. national level. On the one hand, NICE provides guidelines for health technologies and uses economic evidence to make recommendations accompanied with national cost averages. A local health authority on the other hand would prefer the utilisation of local costs and would need different evidence to make decisions for investment:

"*So in economic evaluation and sort of NICE decision-making* […], *it's always about 'Shall we do this intervention or shall we do that intervention?'. But* […] [local level decisions] *were: 'Are we going to buy this piece of* [self-sampling] *kit, or are we going to invest in another nurse or doctor*?' […]. *NICE always wants sort of national costs to be used. Whereas actually if you're really wanting a local group to use the results of your economic evaluation, then it makes more sense to use local costs* […]", RS_07.

Another participant added that the long-term time-horizon used in economic evaluations for national decision-makers may not reflect local decision-makers concerns:

"*It's about practicalities on the ground. Will this cost you money, save you money, and over what timeframe? Saying it's cost-effective, but it'll cost you a lot of money in the short term and you'll get money back in the future is rubbish because you may not get the money back*", RS_01.

Thresholds

Several interview participants discussed that decision thresholds for the national level may be different to the local level. This would mean that one intervention may be cost-effective from an NHS perspective but not from the perspective of a local health authority. This may be important for both decision-makers from local and national decision-making contexts:

"[…] *this intervention might be cost-effective for* [the] *NHS to fund but probably not for* [local authorities] *since* [their] *threshold is lower* […]. […] *our current national budget allocation is saying that we fund the hospital care at this threshold. But we fund public health at a local level at this threshold. Which means we value a life three times higher if* [a person goes] *to a hospital compared to if they don't receive this intervention*", RS_11.

COVID-19 pandemic

As the interviews were undertaken in the midst of the COVID-19 pandemic, the potential impacts on service delivery were discussed by several academics. The urgency of the pandemic had led to changes in decision-making and on thresholds, which may in turn put pressure on the methods used by health economists:

"*[…] but now if you think COVID. The chancellor just said we'll spend everything that is required. So the boundary went out the window. And that's an uncomfortable place for health economists*", RS_04.

This theme was also related to the prioritisation processes, which is further elaborated within Section 6.5.2 below.

6.5.2. Decision-making process

During the interviews, one of the main topics was the decision-making process and associated sub-themes, such as who are the decision-makers and what are their objectives and priorities. There was also a discussion about what commissioning and decommissioning processes involve, thresholds for budget spending, and the overall complexity of decision-making in public health and sexual health specifically. In addition, differences between national vs. local decision-making aims were alluded to. Finally, the nature of SHS was discussed.

Who are the decision-makers?

The interviewees described who public health decision-makers are and with whom they are collaborating most frequently:

"*[…] at the national level so it's working with people in Department of Health for NHS England around things they're interested in conducting research associated with that. As part of that we've also linked in with the government, sort of the directors of public health*" RS_05.

They also highlighted the complexity related to the different layers of decision-makers, which was graphically described by one participant (RS_07). Figure 6.2 depicts four main decision-making levels with examples. The first is the service user level, followed by SHS' providers and Directors of Public Health including local commissioners. The final level as described by RS_07 was the wider political context listing the NHS and the DHSC as examples. This shows the different stakeholders needing to be considered when making decisions.

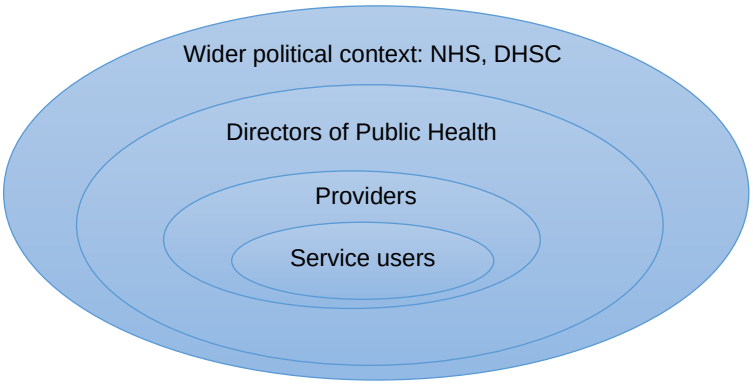

Figure 6.2. Public health decision-makers in England.
Notes: NHS, National Health System; DHSC, Department of Health and Social Care

There may be several parties involved within one layer of decision-makers. One interviewee highlighted the complexity resulting from having multiple commissioners commenting on SHSs and STIs:

"*Everybody's got an opinion about education, and everyone's got an opinion about STIs and why they* [are transmitted]. […] *And what's worse now is that every local council has got an opinion on it and that matters*", RS_03.

Objectives of decision-makers

Participants reported that it was crucial to understand that public health decision-makers may have objectives beyond health maximisation and that these objectives should be addressed within an economic evaluation. The objectives of local decision-makers may differ from the objectives of national decision-makers:

"*There's a disconnect* [regarding objectives] *from the Treasury - to NICE - to local decision making* […]", RS_04.

Besides this disconnect, the researcher highlighted that the underlying goal for national decision-makers (including the NHS and NICE) was to maximise QALYs with some considerations of equity aspects. The thresholds mentioned by the participants to allow for equity consideration related to treatment and care, but not prevention aspects, which are addressed by public health programmes:

"[…] *we talk about health gain maximisation that is what underlies NICE, whatever they say, it is about QALY maximisation with some adjustments for equity, which are operationalised through a higher threshold for cancer drugs, and a higher pay threshold for end of life drugs,"* RS_04.

In addition, based on the researcher's experience, decision-makers in general may have multiple objectives:

"*They can range from adhering to central government goals or target public acceptability by improving the health of the worst off* – [… which means] *equity goals*", RS_04.

This was discussed in tandem with the political and wider context in which public health programmes take place. Another participant highlighted that the existing budget pressures influence the decision-makers' objectives to invest in cost-saving interventions:

"*But is it really a sort of long-term budget minimisation problem like they're* [decision-makers] *trying to* […] *invest in the interventions that will save money in the long-term*", RS_11.

The interviews with researchers also enquired about how to incorporate equity aspects in economic evaluations and what the current best practices are. When asked whether they were requested by decision-makers to consider equity aspects in an economic evaluation, one interviewee stated:

"*Not that much actually, which is surprising because you would think that this* [inequalities] *is an important aspect. I do see the question being asked more in the last few years. Also analysts including myself starting to be actually more conscious about, well, even if this is not part of the ask, maybe we should do an analysis by* [subgroup]*.* […] *It's usually been about the average cost-effectiveness of the intervention. I think partly because I've been in vaccinations. The UK does have very high vaccine*

coverage. So most people do get vaccinated, regardless of whether they're rich or poor or ethnic group or so forth", RS_11.

Another challenge highlighted by one participant was to define the equity objective, i.e., what inequalities they may want to address, and that decision-makers would be reluctant to do so:

"[…] [decision-makers] *talk about equity, fairness* […] *what exactly do you mean by that?* […] *Which social groups do you want to reduce inequality between?* […] *Is it lifetime health that you care about or current severity of illness*?", RS_06.

Priorities

Priority setting in the context of decision-making processes for resource allocation was discussed. These were, according to most participants, critical aspects to comprehend when working with decision-makers. One participant highlighted the intersections between budget pressures, cost-saving strategies and still following the overall goal of public health to reduce inequalities:

"[…] *if you've got to kind of cut things, how do you prioritise in a way that doesn't exacerbate health inequalities?* […] *it's quite negative but trying to prioritise. And that links to some work in terms of the impact of COVID and lockdowns and stuff. How should you prioritise what you do in that emergency situation in a way that doesn't disadvantage those groups that are already disadvantaged?*" RS_08.

Another interviewee stated that the priorities may vary depending on the stakeholder and that it would be important to consider the service user perspective as well. For example, when it comes to waiting times to get treated for a STI:

"[…] *it might be that speed of treatments beyond a certain threshold doesn't really matter very much. But if the patients really care about that, then you might want to commission* [i.e., consider this as a public health director in a tender] *that in, because it's part of their experience*", RS_03.

(De)commissioning process

Decision-making processes concerning the commissioning and decommissioning of public health services were described by multiple participants. This included the general commissioning changes resulting from the Health and Social Care Act 2012. The 2012 Health and Social Care act led to greater responsibilities for but also pressures on local authorities (Robertson et al., 2017; PHE, 2013). The interviewees also explained that when working with decision-makers the focus was often on budget impact and cost-savings. The participants discussed what decommissioning means and what the process entails:

"[…] *decommissioning, the term as I use it, refers to deliberate processes of trying to, to remove replace or, or reduce services*", RS_01.

The decommissioning process' aim should be to generate cost-savings. However, as stated by one interviewee, there is no support in this process for decision-makers, especially when it comes to introducing new services. Further the participant described

the introduction of new services, i.e., online SHS, whilst continuing previous services, which may not be the appropriate use of resources:

"[…] [there is a researcher who is] *interested in digitally providing sexual health services, and the potential for decommissioning old style face to face services and replacing them with digital.* […] *there's no support for service planners and decision-makers in how to implement the processes. And what you tend to find is the new way is introduced, the old one is never removed. So all you've done is double the resources that you're providing in the service area*", RS_02.

Nature of sexual health services

Characteristics of GUM clinics were described, which are of relevance for STIs and HIV. One researcher highlighted the importance of GUM clinics being separate from GPs and thereby ensuring the patient's confidentiality. They also concluded that the culture around sharing information between GUM clinics and GP has changed:

"*So GU* [genitourinary] *clinics have historically been quite separate from general practice. That is changing quite a lot. But they've been quite separate partly because they were there's this huge priority on them being confidential and nobody knows you've gone there and all that sort of stuff*", RS_03.

6.5.3. Economic evidence

This theme consists of six sub-themes: developing economic evidence, problems with current economic evaluations, accessing evidence, outcomes, opportunity cost, and equity aspects in economic evidence.

The development process

Many of the participants commented on the potential for health economists to be too distant from the realities facing decision-makers:

"[…] *You are sitting in an ivory tower of academia and then create all these kind of models and think okay this is how it should be*", RS_10.

This is one of the examples how economic evidence may be developed. To avoid this, collaborating with decision-makers for whom the evidence is being developed for was described as being essential:

"[…] *You kind of need to speak to the people that you're hoping will use the results so that you can check whether what you're doing is useful* […]", RS_08.

One of the main challenges experienced by the researchers when developing economic evidence for public health decision-makers was timing. Participants reported that it was difficult to deliver a high-quality economic evaluation in a short timeframe, which is needed by local decision-makers. One participant described this as the following:

"*Nobody's going to wait for the researcher, unless it's a vaccine for COVID*," RS_01.

Further, transparency was one of the frequent characteristics mentioned when developing economic evidence:

"*We should be trying to be transparent what our methods are doing and highlight how value judgements feed into any of our evaluations* […]", RS_05.

The transparency mentioned here refers to how value judgements are incorporated into an economic evaluation, which should be clearly communicated with decision-makers.

Problems with current economic evaluations

Several participants felt that local decision-makers are not necessarily using the available economic evidence. This is because:

"[…] *most of the economic evidence generated at the time, or in the literature, was basically informing the national context*", RS_10.

The participants explained that how decisions are made on the local level is different compared to the national level. Decision-makers might want to see evidence on how to deliver a portfolio of interventions rather than whether one intervention should be funded or not. Another participant highlighted that value judgements made in a conventional economic evaluation may not represent local decision-makers' views:

"*The problem with economic evaluation generally is, there are a lot of value judgements which feed into it anyway, which aren't necessarily value judgements the decision-maker would agree with or hold*", RS_05.

Most researchers stated that current methods for economic evaluations need to be further adapted in collaboration with local decision-makers to be more relevant for a local public health context. However, one researcher disagreed that reconsidering current communication would be helpful:

"[…] *as though they're* [the decision-makers] *hungry beasts that just need to be taught how to eat properly and that that's so patronising and stupid and wrong*", RS_01.

The interviewee felt that commissioners could understand the evidence and that current problems with economic evidence were primarily related to timing and the relationship between the researcher and decision-maker, rather than the methods themselves.

Accessing evidence and data

There were also discussions on how the evidence is accessed on a local level and that the resources to do so may be lacking. This does entail both accessing the information but also interpreting it:

"One of the biggest barriers that we had to them using anything like that was that the information wasn't instantly accessible", RS_07.

"*So in terms of accessibility. They struggle to understand it and they didn't know where to go to find it*", RS_02.

Problems with accessing good quality data became apparent during the interviews:

"*One issue that we've found is that there's not really much information on what they're* [local authorities*] actually currently doing, what they're actually currently spending on, that's easily accessible*", RS_08.

Further, it was mentioned that when it comes to routine data, the focus is often on hospital admissions. This data would not always be informative when evaluating public health programmes. Access to routine data can be difficult for SHS, as some SHS are provided outside hospitals, and there are strict controls around access due to confidentiality.

Outcomes

Most interview participants stated that outcomes for traditional economic evaluations do not encompass the breadth of outcomes, which need to be considered when evaluating SHS:

"[…] *if better sexual health gives women, young women a particular more confidence, more ability to study or to lowering anxiety or depression. We may not pick any of that up in our rather narrow evaluations which are more alongside an RCT design*", RS_04.

Specific outcome measures, such as QALYs, were discussed in most of the interviews. QALYs were regarded as an important measure to allow for comparison between different health programmes. However, researchers highlighted that public health relates to a different scenario to clinical medicine:

"*Something like a QALY might not always be that helpful in public health*", RS_05.

The researchers assumed that public health decision-makers including decision-makers for SHS may be interested in other outcomes besides QALYs. A minority of researchers did not see the need to change or to adapt current methods (see also *Problems with economic evaluations*), but the overwhelming majority felt that current methods and outcome measures were not appropriate:

"*And* [I] *actually argue back to my academic colleagues that this pursuit to just* […] *focus on a QALY as being the outcome that local decision-makers are interested in is just so... it's just not reflective of the real world at all. Although I think to some extent that is changing a little bit and I think more academic health economists are agreeing with that*", RS_00.

Opportunity cost

Some academics stated the need to better understand the opportunity costs associated with choosing one intervention over another. For example, one researcher (RS_05) discussed the idea that the assumption for SROI and CBA is that every pound spent is the same pound spent elsewhere. However, this is wrong as one must consider health outcomes among others and not the programme cost alone. When translating this to public health programmes, e.g., smoking cessation vs. testing for STIs, the true opportunity costs should be considered:

"[…] *what we really need to know is what would have been generated if that pound was spent elsewhere* […]", RS_05.

The aim would be to allow for a fair comparison between different programmes considering both benefits of the intervention and the true opportunity cost:

"*We're trying to persuade people to pay attention to the opportunity cost side of the economic evaluation as well as the benefits side*", RS_06.

6.5.4. Recommendations for conducting economic evaluations

The final theme, which emerged from the interviews with researchers, was recommendations for conducting future economic evaluations. These can be divided into subsections relating to recommendations before commencing an economic evaluation, methodological recommendations including how to best collaborate with decision-makers, and how to present the evidence to increase impact from the economic evaluations conducted.

Before starting an economic evaluation

The participants were asked directly what they would recommend on how to best conduct an economic evaluation of a SHS. One theme, which emerged and which was reiterated by most participants, was that before starting an economic evaluation decision-makers should be asked to define the target groups and objectives of the evaluation:

"*So first thing I would do is think about who is going to use this, the results of this economic evaluation and what are they going to use them for*", RS_07.

This would also fulfil a crucial role of health economists:

"*It is sometimes the best thing that a health economist does is get people to start asking certain questions*", RS_02.

The participants highlighted the need to be very clear with the objectives of the economic evaluations and that these should be agreed between the decision-makers and researchers.

Methodological recommendations

Participants suggested a range of methods to conduct an economic evaluation, which may be helpful for local SHS decision-makers. These included disaggregating data by socio-economic group and by ethnicity as an initial step (RS_10). Some argued that combining a CEA with a budget impact analysis would be appropriate to accommodate the needs of local decision-makers with specifically considering costs (RS_00, RS_01, RS_04). Others proposed to apply a distributional cost-effectiveness analysis, which allows for consideration of different population subgroups and therefore targets the overall aim of public health to address health inequalities (RS_05, RS_06, RS_08):

“[…] *we should care not just about improving population health, but we need to care about our distribution of health. And therefore, we should start including distributional cost-effectiveness analyses where possible*”, RS_05.

One participant also highlighted the need to understand existing barriers and facilitators associated with accessing SHS and recommended to collaborate with behavioural psychology experts:

“*So I would definitely be conducting an economic evaluation and working with my behavioural psychology colleagues to understand the barriers and facilitators to use of the intervention* […]”, RS_09.

Collaborating with decision-makers

Besides methodological recommendations, the researchers also advised on the need to collaborate with decision-makers from the start, i.e., to understand their needs and receive data, as well as on how to approach the collaboration. The participants described how research projects were allocated and how this has changed over the past years. There used to be more frequent long-term collaborations between a council and a certain research unit, which did develop trust between the decision-makers and researchers. This trust was highlighted by multiple participants as a prerequisite for a successful economic evaluation (RS_00, RS_10):

“[…] *so it's important that you know you're starting with those new stakeholders on board and start kind of building trust relationships and mutual respect*,” RS_10.

In addition, timing was emphasised as important when conducting an economic evaluation to ensure that it is fulfilling the needs of decision-makers:

"*It's about the right information at the right time*", RS_01.

It was felt that by collaborating with decision-makers, the right timing and information will become clearer to the researcher, which again would make the evidence produced more useful.

Presenting evidence

Academic health economists and public health researchers were asked whether they could recommend methods and formats for presenting economic evidence to decision-makers. Since local decision-makers' needs were described as requiring more short-term evidence, the researchers suggested how this can be considered in an economic evaluation, for example by showing the results for different time horizons:

"*So one of the things we actually did was to present the data in terms of very short-term returns, medium-term returns and the long-term ones.* […] *we were able to show that some of the investment they're* [local authority] *trying to make actually doesn't make any money in the next two years, but from five years, actually they start making money. And if you take a lifetime perspective, it is highly cost-effective*", RS_10.

Another aspect, previously described as a challenge, was the accessibility of the results of economic evaluations. One participant therefore recommended to not only publish the evidence in relevant journals but also to develop reports with images to

increase accessibility for decision-makers. The academic health economist highlighted the need to translate findings from economic evaluations into a more accessible format:

"*So we produced three accessible reports with photographs.* […] *The point is a lot of decision-makers don't read academic papers. And so those reports... I mean you might argue they are not peer reviewed, they don't have an impact factor, but they are very accessible to local decision-makers*", RS_04.

6.6. Discussion

This research provided an overview of the various challenges encountered when undertaking an economic evaluation of public health programmes. It showed the developments necessary to produce meaningful evidence to ensure that economic evidence can be used appropriately by decision-makers to improve healthcare and SHS in particular. The findings from interviews with health economics and public health researchers in the UK highlighted a range of recommendations on the methodologies for economic evaluations to support public health decision-making. The participants were a heterogeneous group with various experiences concerning the development of economic evidence and collaboration with decision-makers.

Through these interviews it became apparent that there are several opportunities in relation to the development of economic evidence. Of particular importance was the need for early collaboration with decision-makers to understand the context and their objectives, which may enhance the usefulness of the evidence. The participants frequently reported the importance of a certain level of trust between the researcher and decision-maker, which should be established along with identifying appropriate timing, e.g., delivery of economic evidence when decision-makers are planning a new bid and tailoring the economic evaluation to the needs of local decision-makers.

Nevertheless, challenges associated with traditional economic evaluations seem to persist and were reiterated by the interviewees. These included differences between national and local decision-making aims, data, timing, and creating evidence which is adaptable to the local context with an added focus on local costs. The main challenges

faced by the researchers when developing information for decision-makers were that the decision-makers seemed to work in different time cycles and that it seemed difficult for researchers to develop short-term high quality economic evidence. Further, the interviews confirmed other challenges associated with economic evaluations for public health programmes. For example, interview participants stated that cost-utility studies with QALYs as an outcome measure often do not fulfil the needs of public health decision-makers, as they focus on health only as an outcome.

The researchers provided several recommendations on how to address these challenges. Whilst most recommended methods were specific to each participant's research focus, they agreed on the need to make the economic evidence more adaptable to the local context and allow for subgroup analyses to contribute to the overall aim of reducing inequalities, which is important in public health. However, there was some divergence concerning adherence to NICE guidelines when conducting an economic evaluation. A minority of participants described this as essential, whilst others emphasised the need for a more practical approach. There was heterogeneity in the recommendations proposed by the interviewees. On the one hand, a number of academics stated that economic evaluation methods needed to be further adapted. On the other hand, a minority of the interviewed researchers felt that timing was the only issue when developing and presenting economic evidence to decision-makers.

6.6.1. Comparison with other literature

To the knowledge of the author of this thesis, similar research has not been conducted previously. However, there is research on the challenges associated with economic

evaluations of public health programmes as well as on decision-making processes in a public health context.

One study systematically reviewed guidance for economic evaluations of public health interventions both in the UK and internationally (Edwards, Charles and Lloyd-Williams, 2013). The study found that most guidelines recommended the use of QALYs, and the authors argued that there is a need to widen outcome measures. This finding was confirmed by Frew and Breheny, who conducted in-depth interviews with one English local authority to understand whether and how economic evidence was utilised (Frew and Breheny, 2020). The study also found that the public health decision-making context is complex and recommended to consider the local infrastructure in which decisions take place as well as to apply shorter timescales. These challenges and recommendations were confirmed by the participants in the interviews presented here. Another study from the USA did suggest that in order to provide more resources for public health programmes, economic evaluations for public health programmes need to be similar to clinical interventions but include broader outcomes (Woolf et al., 2009). The scarcity of data highlighted by several interview participants was also emphasised by previous studies (Jackson and Roberts, 2016). As for decision-making processes, one study, using NHS England as an exemplar, concluded that it is difficult to define a successful decommissioning decision. Local decision-makers would require information about “engagement, local context and outcomes” in order to make such decisions (Williams, Mannion and Hall, 2017, p.2). The need for disaggregated data was also highlighted in this study.

6.6.2. Strengths and limitations

This study has several strengths and limitations. By using online or phone communication to conduct the interviews, the recruitment of a range of leading health economics and public health researchers was possible, which delivered important findings for developing economic evidence for sexual health programmes. However, the interviewer might have missed some observations due to the remote structure of the online interviews. Because of the nature of qualitative research, the study findings are not generalisable. Nonetheless, they do provide insights into current challenges, potential solutions, and recommendations from the perspective of researchers in health economics and public health.

6.6.3. Reflexivity and power relations

Interview participants were recruited based on their expertise in economic evaluation methods and their experiences of working with public health decision-makers. In contrast to the interviews with decision-makers in sexual health, the participants had years of experience within health economics and public health, which outweighed the experience of the main researcher. This had an impact on the interview process overall as well as on the power dynamics during the interview itself. Before each interview, preparation was undertaken by researching the most relevant literature from the participant's work. Literature was determined to be relevant when it met the inclusion criteria for the interview participants as described above. This allowed the researcher to become familiar with the work of the interview participant which helped to tailor the questions for the interview guide. All interview participants showed great interest in the research, which made the experience very fulfilling. By talking about recommendations

for conducting economic evaluations in a sexual health context specifically, it highlighted the plethora of potential methods, which require further exploration.

The power dynamic during the interviews was deemed as the power lying more with the participant than with the interviewer. One main reason was that the interviewer was new to the discipline of health economics and was talking to senior researchers who were very experienced in their field of expertise. Initially, the length of the so-called "warm-up phase" for the interviewer was longer than during the sexual health decision-maker interviews, but this reduced over time. This may have slightly impacted the interview findings as it was more difficult for the interviewer to ask follow-up questions to get in-depth answers in some interviews.

6.7. Discussion of results from decision-maker and researcher interviews

The interviews with decision-makers and researchers delivered valuable insights into the current understanding and use of economic evidence by decision-makers and the challenges and opportunities associated with developing economic evidence from the perspective of the researchers.

Table 6.2 shows the similarities and differences in themes that emerged between the decision-maker and researcher interviews. Overall, there were multiple themes, which were discussed in both sets of interviews. These included the impact of the COVID-19 pandemic, the decision-making context, financial pressures, challenges of current economic evidence and the presentation of evidence. With regard to differences

between the findings from the two sets of interviews, it was mainly the importance of equity and methodological diversity, which emerged.

In general, equity aspects and how to address these were mostly discussed during the interviews with researchers. Although some decision-makers acknowledged that reducing inequalities was a general public health aim, this was overshadowed by financial pressures as well as concerns about costs. For the decision-makers, current budget pressures along with the fragmented system of commissioning and budgets were key concerns.

Both groups highlighted the impact of COVID-19. The researchers and decision-makers were interested in how this may impact service delivery in the short and long term. Most participants described the current context for decision-making, the complexity of SHS, as well as the changes in commissioning processes. These aspects need to be considered when conducting an economic evaluation. In addition, persistent challenges associated with developing economic evidence were mentioned during both sets of interviews and included data availability and especially access to local data as well as appropriate outcome measures.

The aspect most discussed by all interviewees was the financial context and budget flow (costs being realised by the NHS although investments are made by the local authorities), and since costs appeared to be an integral part of the decision-making process, all participants from both sets of interviews seemed to agree that this needs to be addressed. Most researchers suggested considering local costs for an economic

evaluation, which may be more helpful for current public health decision-making, and this was congruent with statements made during the interviews with decision-makers, although this may lead to the results being less generalisable.

The decision-maker interviews showed that decision-makers do not always have specific expertise available in health economics, which can limit how effectively they can use formal economic evaluations. Therefore, the translation of findings from economic evaluations into a more accessible format, i.e., reports and simple messages with further information to be available via a link, along with training of decision-makers to increase their familiarity with health economics concepts in general might be important.

Table 6.2. Similarities and differences between decision-maker and researcher interview themes

Theme	Decision-makers' perspective	Researchers' perspective
COVID-19	- Did have an impact on SHS delivery	- Did have an impact on SHS delivery
Equity aspects	- *Were not always important to decision-makers and if mentioned they were overshadowed by budget pressures*	- *Methods to consider equity aspects, e.g., by conducting subgroup analysis, were described and seemed of high relevance*
Decision-making context	- Processes were described as complex - *There was also the need to decommission services to make cost-savings*	- Processes were described as complex - *It was important to define decommissioning and support decision-makers in this process if needed*
Challenges of current economic evidence	- Lack of data, outcome measures may not always be appropriate as they focus on health maximisation	- Lack of data, outcome measures may not always be appropriate as they focus on health maximisation
Financial context	- Fragmentation of budgets - Current budget pressures forcing services to generate cost-savings	- Fragmentation of budgets - Most researchers seemed to understand current financial pressures
Presentation of evidence	- Need to increase accessibility of evidence for decision-makers	- Need to increase accessibility of evidence for decision-makers

Differences are written in italic. Only main themes are depicted.

SHS, Sexual health services

Finding a balance between ensuring academic rigour and high standards when conducting economic evaluations and fulfilling the needs of local decision-makers potentially creates a tension, which has been previously discussed and was also mentioned by some researchers. This research did not aim to find a consensus between the two stakeholder groups. The aim was to gain as much insight as possible into SHS decision-maker preferences for economic evidence, and how to meet these needs. An appropriate next step would be to take this forward by producing an

economic evaluation using disaggregated data, for example to analyse the costs associated with online screening of STIs.

6.8. Conclusion

This research provided an overview of various aspects to consider when planning an economic evaluation of a public health programme. There is a range of methodologies for economic evaluations to explore with the main recommendation to have a clear understanding of decision-makers' needs, for example by using disaggregated data, whilst considering the appropriate timing for delivering economic evidence. The findings from both sets of interviews with decision-makers and researchers in public health and health economics were compared. Both groups agreed on several aspects when it comes to developing economic evidence, which is meaningful to local sexual health decision-makers. The main differences in findings were the importance of considering equity aspects. The results were utilised to inform a cost analysis of different sexual health programmes aiming to meet the needs of local decision-makers. This is further described in the next chapter.

CHAPTER 7
Patient care pathways for STI screening services:
An early costing model

7.1. Introduction

This chapter presents a cost analysis of alternative patient care pathways for STI screening. The focus is on costing service delivery after the emergence of the COVID-19 pandemic, developing different scenarios for heterosexual women and comparing different models of care. To demonstrate this methodology, a SHS was used as an exemplar to present an analysis in the form of a disaggregated costing model to support decision-making processes for service delivery for STI screening and testing in a post-pandemic scenario. This work was informed by the findings from the interviews with decision-makers and does reflect on the recommendations from the academic health economists and public health researchers. It is intended as an example of an economic evaluation approach that attempts to fit the needs of local decision-makers.

7.2. Objectives and research questions

The focus of this chapter is on using a SHS as a case study to compare different scenarios of hybrid screening pathways for STIs including online, telephone, and face-to-face services and to present a disaggregated costing analysis for these services.

The aim of this costing analysis was threefold:

1) To identify all costs associated with alternative existing treatment pathways.
2) To model different pathway scenarios to estimate clearly the impact on overall costs.
3) To conduct a series of sensitivity analyses to assess the impact of different factors on overall costs.

The pathways were modelled using a specific SHS as an exemplar, using TreeAge software to analyse three main service configurations relevant to the post-COVID-19 context:

a) **Women accessing services online**: Women who access SHS via the website and order a self-sampling kit for STIs to take samples at home. The sample is then sent to the laboratory and the patient is informed about the result, negative/positive/inconclusive, via text message – OR: women who call the SHS and are then referred to order a STI self-sampling kit;
b) **Women accessing services face-to-face**: Women accessing the SHS by making an appointment or walking in the clinic without an appointment to get tested for an STI – OR: women who call the SHS and are then referred to a face-to-face appointment;
c) **Women accessing services via phone-consultation**: Women who call the SHS and receive a consultation by a health advisor.

The objective was to enable a better understanding of resource utilisation associated with different SHS pathways. This was achieved by modelling various scenarios for

costs associated with different face-to-face, phone, and online STI screening pathways.

The following research questions guided this analysis:

a) *How do different service pathways impact on overall costs of chlamydia screening?*
b) *What are the main influencing factors when considering overall costs associated with different service pathways for chlamydia screening?*

7.3. Background

This background section presents the rationale for choosing to do a cost analysis of STI screening services and how this has been informed by the work presented in the previous chapters. It introduces information on the impact of the COVID-19 pandemic on SHS and provides a brief overview of the theories and concepts applied for this particular costing model.

7.3.1. Rationale for the costing analysis of STI screening services

The following paragraphs discuss the rationale for the case study undertaken to analyse the costs of screening pathways. These were based on results from the systematic literature review on economic evaluations for STI control programmes and from the interviews with decision-makers in sexual health as well as researchers in health economics and public health. The main findings from the previous research in relation to this costing model are presented below.

The qualitative interviews with decision-makers for SHS revealed that there is a general need for analysis and presentation of disaggregated cost data associated with the delivery of online screening for STIs, compared with other pathways. This especially concerns the newer pathways for STI screening and testing. In terms of decision-making, this interest was heightened because of the pandemic and the resulting impact on service configuration and the need to understand better how different service models impact on overall costs and whether any learning can be gained from the pandemic on the design of future service delivery models. This will also be important in the future, as it is expected that hybrid service delivery, i.e., face-to-face services along with phone and OPSS services, will continue. This has been recently confirmed as SHS have needed to address the emergence of the monkeypox virus (Local Government Association, 2022).

Further, the decision-makers who were interviewed assumed that through the provision of online screening, resources would be freed up, which can be used elsewhere. The interviews revealed that equity issues were much less of focus for decision-makers at the current time, due to the budget and commissioning pressures experienced.

In addition, the interviews with researchers in health economics and public health reiterated current challenges associated with conducting economic evaluations of public health programmes. They recommended to consider the timing of when to deliver the evidence and to be very clear about the needs of decision-makers to be able to deliver evidence, which is useful to them.

Further, the systematic review showed the heterogeneity in types of economic evaluation applied for STI control programmes. Most studies were CEAs or CUAs modelling different chlamydia screening interventions. The data used in these models was general data, e.g., derived from national datasets, or data from a range of data sources. One study was a CCA, which captured costs and outcomes from a clinical trial (Jackson et al., 2015). Another modelling study addressed internet-based screening for young women and concluded that this would save $41,000 in direct medical costs and prevent 36 cases of PID (Huang et al., 2011). These economic evaluations generally fell short in addressing contextual and time horizon factors.

7.3.2. COVID-19 phases and the impact on sexual health services

In the beginning of 2020, the COVID-19 pandemic began to spread in the UK with impacts on people's health, everyday lives, and the delivery of services (Bambra, Lynch and Smith, 2021). To control the spread of the virus, the UK Government introduced a national lockdown in March 2020. This had an effect on the open-access nature of SHS.

At first, most SHS closed all walk-in and face-to-face services and moved to a telephone triaging service where a patient would call the SHS in their region to be either categorised for self-sampling to test for STIs (via an online portal), for a remote appointment with a specialised nurse or doctor (usually via telephone), or for an emergency face-to-face appointment in a clinic (BASHH, 2021).

It was initially assumed that the impact of the pandemic and the subsequent national lockdown would provide a potential opportunity to better control the spread of STIs, as overall sexual activity within the population would be impacted. However, according to recent evidence about people's sexual behaviour (e.g. Natsal 2021 survey data), the behaviours associated with a risk of contracting an STI, such as high sexual activity with high change in partners, did not significantly change during the pandemic (Mercer et al., 2021). This meant that there was a continued demand for STI testing and treatment, and it is likely that many infections remained undiagnosed. In March 2020, SHS needed to reorganise service delivery to meet national guidance, and services were also pressured by staff shortages. It is still unclear what kind of impact the pandemic had on STI rates. The 2020 national figures showed a 32% decrease in STI diagnoses compared to 2019 (see Figure 7.1) (Ratna et al., 2021; Mitchell et al., 2020). However, this could be due to underdiagnoses of infections as in 2020 there was a 25% decrease of STI/HIV tests as a result of clinic closures and/or reduced capacity. Simultaneously, there was an increase in people accessing STI testing via OPSS services (Ratna et al., 2021). However, the pandemic resulted in lower accessibility of SHS overall, especially for those who are less likely to access online services, such as people who do not have English as their first language, those without regular access to the internet, and people with a disability or low digital literacy (Takemoto et al., 2021).

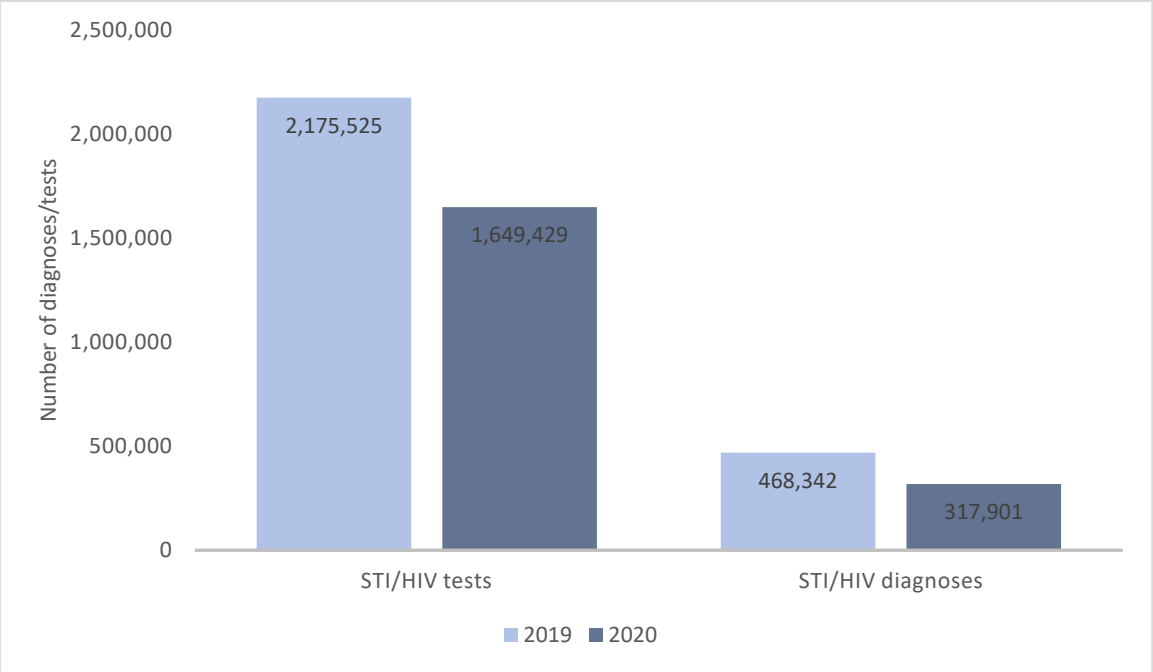

Figure 7.1. Number of STI and HIV tests and diagnoses in England in 2019 and 2020.

Notes: HIV, Human immunodeficiency virus; STI, Sexually transmitted infection (Ratna et al., 2021; Mitchell et al., 2020)

For the purposes of this analyses, the COVID-19 pandemic was divided into three main phases (see Figure 7.2) based on the development of the pandemic and the adaptation of SHS: 'Emergency phase', 'adaptation phase', and 'recovery period'. This categorisation takes an English perspective and is based on both literature and information on the changes to provision made by the local SHS example used throughout this chapter. The "pre-pandemic" period is defined as the time before the first lockdown in March 2020. The changes in service delivery are described in the next sections.

Emergency phase

The first phase of the pandemic, which was characterised by the first national lockdown, began in March 2020 and ended in May 2020 (Bambra, Lynch and Smith, 2021). These first months were also described as the “Emergency phase” since SHS had to respond to significant changes in service delivery during that time and had to reorganise care pathways following local and national guidance.

In Birmingham, and many other local authorities, a number of SHS were no longer provided. Walk-in appointments or routine appointments, such as services for asymptomatic patients, were suspended. Service users who walked-in to the service for a face-to-face consultation, were rejected. Condom distribution and other contraceptive services were stopped. Finally, services for HIV prevention, such as PrEP services and future procedure appointments were no longer provided. A telephone triage service was introduced to offer services to patients with the following characteristics: symptomatic, requiring emergency contraception, having been in contact with a confirmed STI, aged under 16 years old, post-exposure prophylaxis (PEPSE) for HIV, repeat PEPSE bloods, and those having experienced sexual assault. STI self-sampling kits were no longer offered via the SHS directly. This was because laboratories were working on full capacity for COVID-19 diagnostics and some staff including consultants and junior doctors were deployed to work for other healthcare services. It was still possible to order self-sampling kits online and there may have been some self-sampling kits available in collaborating pharmacies. Some appointments for high-risk, symptomatic patients were still offered in person at the main SHS in Birmingham (Whittall Street Clinic) and two other clinics (Boots City Centre or

Boots Erdington). Patients were not allowed to enter clinics if they had a new continuous cough and/ or a high temperature (Dema et al., 2021).

Adaptation phase

The second phase can be described as the “Adaptation phase” (see Figure 7.2). It began in June 2020 after the end of the first COVID-19 surge in England. In this phase, COVID-19 measures included local lockdowns if necessary and schools and non-essential shops were re-opened (Institute for Government, 2022). At the end of 2020, the COVID-19 vaccination programme was rolled out in England contributing to immunisation and thereby reducing morbidity and mortality rates from the infection (National Audit Office, 2022). This phase ended in March 2021 when the 4-step roadmap for lifting the lockdown and other restrictions was introduced by the government. During the adaptation phase between June 2020 and March 2021, the SHS in Birmingham was characterised by having a higher threshold for patients to come into the clinic[9]. The service was organised as follows: prior to accessing the clinic, all patients were still triaged via phone and if required via video. OPSS kits were available in the beginning of this phase, however, between September 2020 and early January 2021 there were shortages of STI self-sampling kits, which resulted in patients being unable to order self-sampling kits online. Patients were triaged through a preliminary phone consultation to test at home based on risk and were eligible for a self-sampling kit if they were in contact with a positive person or had symptoms. Throughout this phase, staff continued to see and treat high-risk patients, survivors of sexual assault, patients reporting domestic abuse, and people who had been in contact

[9] The information for this paragraph specific to the SHS example was received from conversations with staff from the respective service between 2021 and 2022.

with a person diagnosed with a STI/HIV. A postal condom service was introduced for patients including sex workers. Further, all medication posted to patients included condoms in the pack, with prior agreement with the patient. In January/ February 2021 procedure clinics and satellite clinics were closed again due to reduced capacity for face-to-face appointments. Satellite clinics are services which may have a specific target group, e.g. students, and are open less frequently compared with the main SHS hub (UKHSA and BASHH, 2021). The main clinic for SHS in Birmingham at Whittall Street continued to provide face-to-face services.

Recovery period

The recovery period began in April 2021 (see Figure 7.2). It was mainly characterised by a “new normal” with learning to live with the pandemic. Step four of the roadmap ended in July 2021, which meant that limitations on social contact were removed in England (Institute for Government, 2022). In April 2021, all nine priority groups received a COVID-19 vaccination offer and by mid-July 2021 the offer was extended to all adults in England (National Audit Office, 2022). In June 2021, the SHS in Birmingham began to develop new triage criteria for face-to-face appointments. These included pain in lower abdomen or genital area, men with discharge, patients with genital sore/ ulcer, survivors of sexual assault, and patients requiring treatment for a positive STI diagnosis (see Figure 7.3). The service offered phone consultations to assess the need for a face-to-face appointment or postal treatment, e.g., for chlamydia. The plan was to provide treatment for chlamydia at home if the patient was asymptomatic. If the patient had one of the characteristics as listed above (see also Figure 7.3), they were invited for a face-to-face appointment.

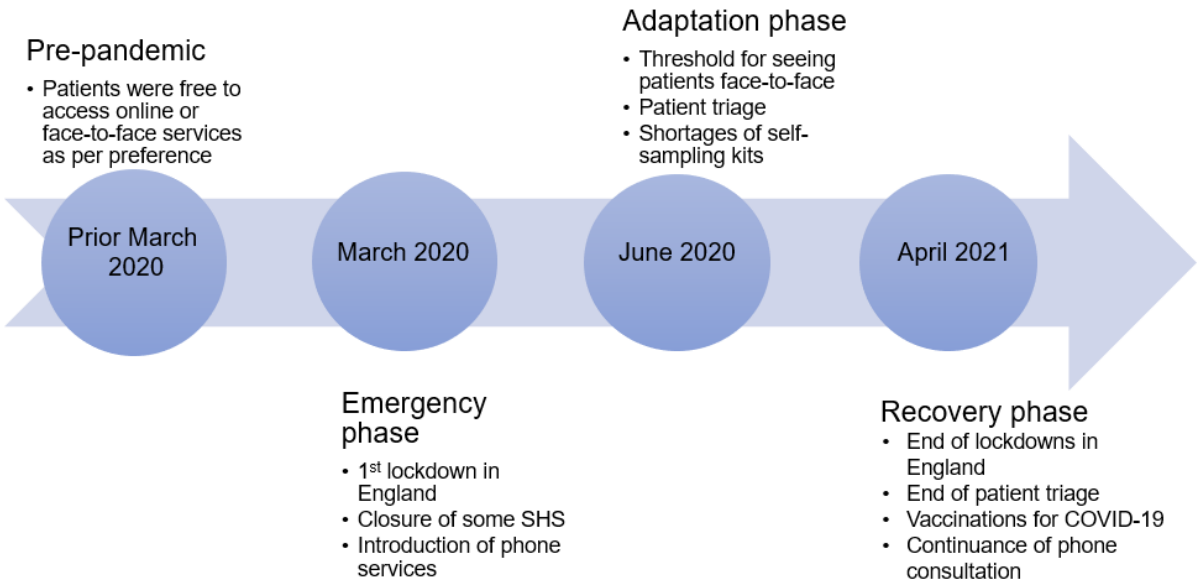

Figure 7.2. Overview of COVID-19 phases and the impact on sexual health services.

Notes: COVID-19, corona virus pandemic; SHS, Sexual health services

7.3.3. Theoretical background

The following sections provide an overview of the underlying theories and concepts on care pathways, health economic modelling, and cost analysis applied in this chapter. Some of the concepts concerning health economic evaluations have been defined in a previous chapter, e.g., on costing theories, different perspectives and approaches, and will not be repeated in this section (see Chapter 3).

Care pathways

A care pathway can be defined as the following:

"*A care pathway is a complex intervention for the mutual decision-making and organisation of care processes for a well-defined group of patients during a well-defined period*", (Panella and Vanhaecht, 2010, p.1).

In this thesis, care pathways are used to understand the care continuum and to optimise the use of resources.

Early health economic models

Early economic modelling is typically used as an internal process for product development by the pharmacological industry (Love-Koh, 2020; Ijzerman et al., 2017; Annemans, Genesté and Jolain, 2000). It allows an early exploration of a programme or product with limited data concerning outcomes and potentially costs due to the early timing of the evaluation. According to a review, early economic models can aid decision-making processes around further development of an innovation as well as support insights into what kind of additional research is required, and distinguish between advantageous and disadvantageous programmes or inventions (Grutters et al., 2019).

This method is of relevance to the costing analysis undertaken in this thesis. The interviews with decision-makers revealed the urgent need for analysis of the costs associated with newer hybrid pathways, i.e., SHS provided via phone, online as well as face-to-face services, and the early economic modelling approach provides a

framework to guide analysis where data is limited and emerging. Mathematical modelling can support the combination of information from a range of resources and provides the opportunity to explore implications on policies (Barton, Bryan and Robinson, 2004). For the purposes of this research, a decision tree was chosen, which can depict an individual going through the pathway without interacting with any other individuals (Barton, Bryan and Robinson, 2004) (for further information on decision trees see Chapter 3).

Cost analysis

The choice of economic analysis was to conduct a cost analysis. It provides the opportunity to measure disaggregated costs in monetary units (Drummond et al., 2015). It is crucial to specify the perspective for the analysis as this will determine the different categories of costs to be considered. The costs assigned to each category represent market or prices incurred by the healthcare provider. Cost analyses are important to be conducted as they can identify all costs throughout the care pathway in detail (Drummond et al., 2015). The methods section of this chapter provides additional information on the costs considered.

7.4. Methods

This analysis was an early costing model to illustrate the costs associated with alternative patient care pathways of STI screening services post COVID-19 from April 2021 onwards from a healthcare provider perspective. The focus was on this period as service delivery models for SHS were affected by the pandemic, and there was a lack

of evidence on the costs associated with the newly introduced phone consultation pathway.

The care pathways were designed assuming an asymptomatic low-risk woman who required access to screening services for chlamydia. This service user would not belong to a high-risk group or have additional complexities, such as being under the age of 16. Any service user presenting as more complex throughout the pathway would be invited for a face-to-face appointment or referred to other services.

Chlamydia is one of the most common STIs and young women including cisgender women, transgender men, and non-binary people are the target group for chlamydia screening in the UK (PHE, 2021a). Therefore, this bacterial infection was chosen as an example for accessing screening services.

The interviews with sexual health decision-makers showed costs and cost-savings were key factors for making decisions for SHS. Some decision-makers assumed that OPSS would offer opportunities to save costs and other resources, such as staff time. However, if a patient uses OPSS and then returns to clinic for further assessment, it may not be as efficient as assumed.

The model presented here only considered costs. Data on outcomes was only just emerging and therefore the inclusion of outcomes would have required too many assumptions, which, even after testing for uncertainty, was not considered to be helpful for local decision-makers of SHS. Outcomes can be added to the model as this data

becomes available in the future. The model was exploratory in nature using the best available data from a range of sources to measure the costs associated with the pathway changes after the onset of the COVID-19 pandemic. The reason for developing this model was to better understand patient care pathways for screening of STIs and associated costs. The pathways and costs analysis were modelled in TreeAge Pro Healthcare 2021 (Copyright 2021 TreeAge Software, LLC (TreeAge LLC, 2020)) as a decision tree.

The following steps were taken to develop the model:

1. Structuring of the tree;
2. Estimation of probabilities;
3. Estimation of costs;
4. Analysing the tree (rollback calculation);
5. Sensitivity analyses including one-way, probabilistic, and scenario analyses.

This research followed recommended research practices for modelling and economic evaluations for public health programmes as recommended by the ISPOR Society for Medical Decision Making and by the UK NICE (NICE, 2014; Caro et al., 2012).

7.4.1. Model structure

The model pathways were developed in collaboration with the supervisors of this thesis as well as staff from the respective SHS. Hereafter, this group will be referred to as the experts. Initially, the main changes (following the pandemic) in service delivery were mapped out and information on how patients were triaged within the SHS were

extracted using phone, video, and email conversations with the experts. Figure 7.3 shows a simplified service model based on Umbrella SHS Birmingham and the different options available for service users when they first call the SHS (BASHH, 2021).

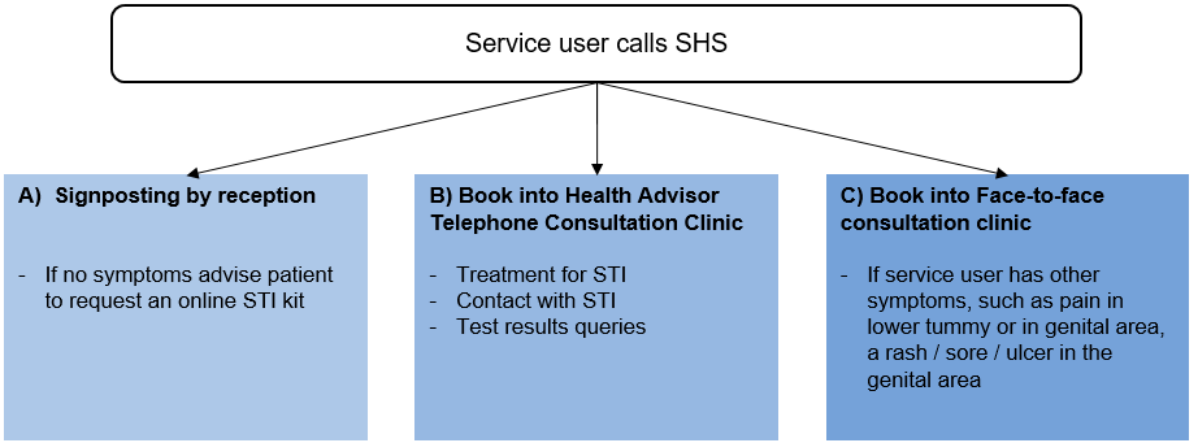

Figure 7.3. Instructions for reception when service user calls sexual health service.

Notes: This is a simplified version relating to the pathways, which are modelled in this thesis.

EHC, Emergency healthcare; STI, Sexually transmitted infection

Based on: Umbrella SHS Birmingham Pathway, June 2021 (BASHH, 2021)

The model structure focused on capturing the options to signpost a service user to request a self-sampling kit (column A); on the health advisor phone consultation clinic (column B); and on the option to book the service user for a face-to-face appointment (column C).

Based on Figure 7.3, the model pathways were developed. This was an inductive process where different iterations of the model were presented to staff from Umbrella

SHS to ensure the model's accuracy and clarify any queries concerning the pathways if necessary.

The following paragraphs describe the patient care pathways. First, the different elements involved in the tree including the tree structure as well as probabilities and how these were named are explained. This is then followed by describing each of the pathways (phone, OPSS, face-to-face) in more detail. The different pathways are illustrated in Figures 7.4.-7.7.

Figure 7.4 shows the first branches of the three pathways, which were incorporated in the model. The blue square is the decision node and the green circle is a chance node. The tree continues until a terminal node (red triangle). For each next step in the pathway, transition probabilities are calculated, e.g., in this tree, one transition probability (distribution) is called d_CSSK_OrderKit, and the '#' represents the remaining probability so that the whole sums to 1. The abbreviations used in the model for the distributions indicate each pathway: WAC relates to distributions for the walk-in clinic pathway. A "C" means that the pathway started with a service user calling the SHS plus face-to-face (F2F) or plus self-sampling kit (SSK). SSK only reflects the service user directly ordering the self-sampling kit and "PC" includes the phone consultation and the referral to either of the two pathways (F2F/SSK), or referral to other services (see Table 7.1).

Table 7.1. Overview of abbreviations used to describe distributions in the pathway

Pathway	Abbreviation	Meaning
Phone	C	Call
Online postal self-sampling	SSK	Self-sampling kit
Face-to-face	F2F	Face-to-face
	WAC	Walk-in clinic

Pathway abbreviations were combined. For example, “CF2F” would mean that the service user called the sexual health service and was then referred to a face-to-face appointment.

Phone pathway

Figure 7.5 depicts the pathway for when the patient calls the clinic. After the service user has called the SHS, they may be triaged to order a self-sampling kit, which refers to the signposting option by reception as explained above. This is done if no safeguarding issues were identified, and the patient is asymptomatic. The second option is to be booked for a phone consultation clinic where the service user may either be referred again to order a self-sampling kit, booked for a face-to-face appointment due to necessary further assessment or referred to other services. The pathways following from the phone consultation have the same structure as the pathways for directly ordering a self-sampling kit via a website or accessing the SHS directly as a face-to-face/ walk-in service user. The final option is that the service user is requested to come in person (‘invited for F2F appointment’).

Online postal self-sampling pathway

When a service user decides to order a self-sampling kit via a website, the options are either that they return the self-sampling kit to the laboratory via post or that they do not

return the self-sampling kit, which is where the pathway would terminate. The test may be either positive or negative (Figure 7.6). If the test is negative but the patient shows other risk factors, such as starting to develop some symptoms, they will be invited for a face-to-face appointment. In the case of a positive chlamydia test, the patient will be notified via text message and receive the medication via post. There are two follow-up phone calls from a health advisor asking about whether the patient received and took the medication and to ensure that no other symptoms or questions remain with the service user.

Face-to-face pathway

SHS are characterised by their open door policy. A service user can walk-in to the service and request to be tested for an STI ('sample taken'). It is highly unlikely that this would be refused or that the service user may leave the SHS before a sample is taken. Figure 7.7 illustrates this pathway with a service user walking into a SHS to get tested for chlamydia. Once a sample has been taken, the service user is sent home and is notified via text message about the result. The notification option is included because at the clinic there is a quick-test option where (genital) discharge and inflammation levels can be assessed for chlamydia risk. However, the laboratory needs to confirm the initial diagnosis, which is why there is a notification option in the face-to-face pathway. A service user may also be scheduled for another face-to-face appointment after a positive or negative chlamydia diagnosis. This may be due to lack of postal address or medical problems. In the case of a positive chlamydia diagnosis, the medication is sent out to the service user's home address. There are other options to receive medication, e.g., pick up in pharmacy, but these are less common and were

not considered in this model. In case of a negative diagnosis, the service user may be treated irrespective of the result as they may show other symptoms (‘medication for other syndromes received’). Similar to the other pathways, there are follow-up phone calls after the medication is sent to the service user as well as in the case for medication not received to, for example to identify the service user’s address.

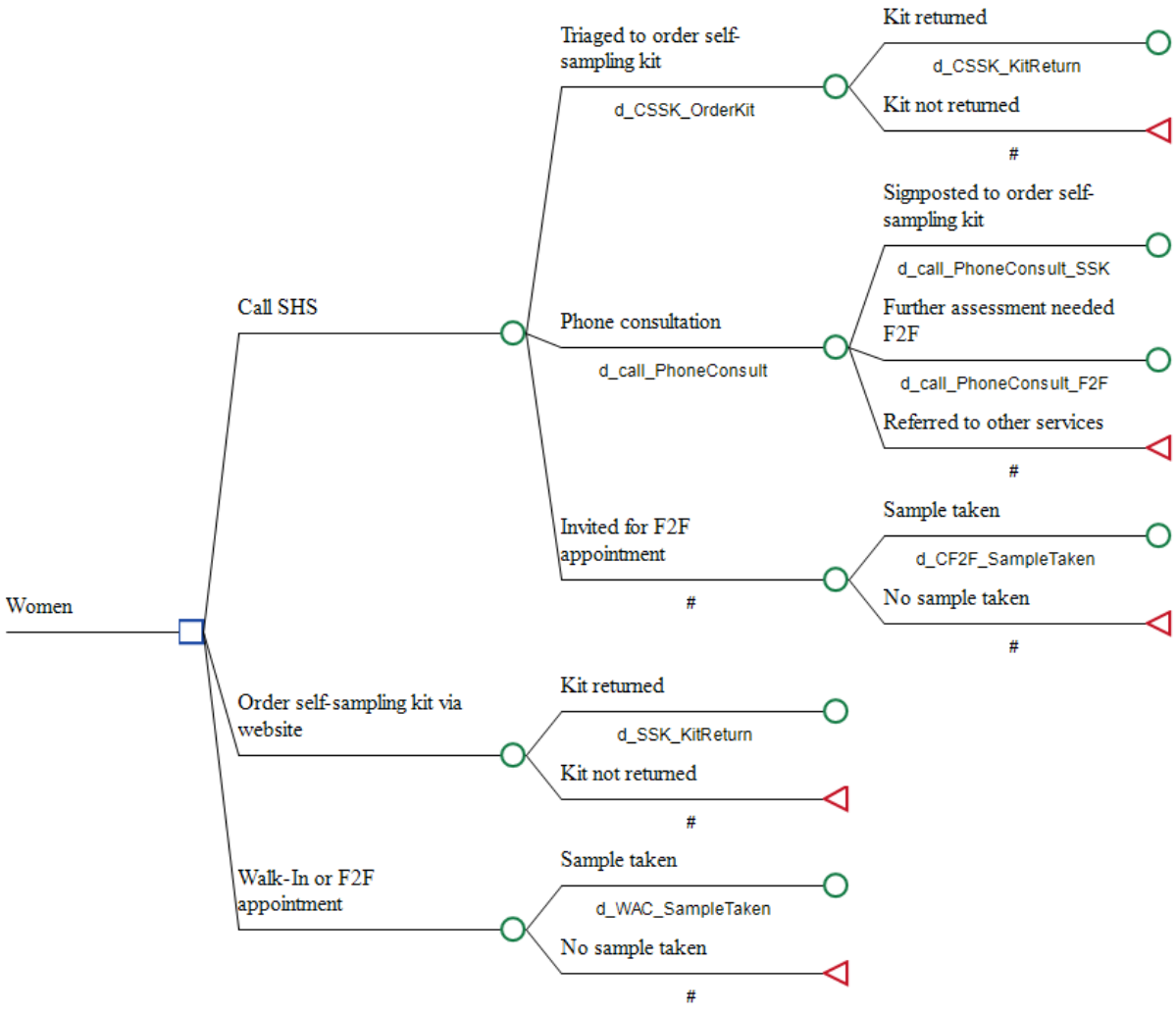

Figure 7.4. Overview of patient pathways incorporated in the model.

Notes: Blue square, decision node; Green circle, chance node / tree continues until terminal node; Red triangle, Outcome/terminal node

#, Remainder; CSSK, Call SSK; CF2F, Call F2F; F2F, Face-to-face; SHS, Sexual health service; SSK, Self-sampling kit; WAC, Walk-in clinic

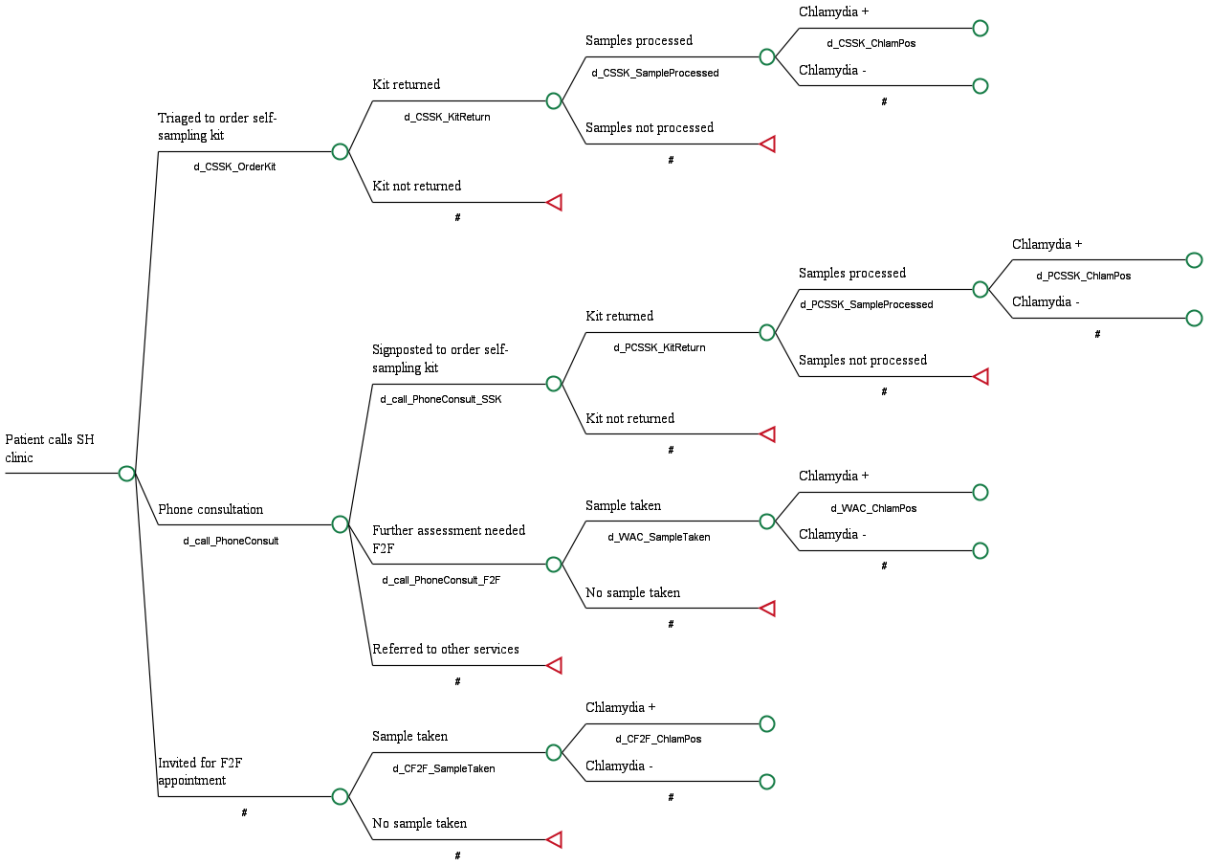

Figure 7.5. Overview of patient calling the sexual health clinic with three pathway options.

Notes: CSSK, Call SSK; CF2F, Call F2F; F2F, Face-to-face; PCSSK, Call and phone consultation followed by triage to SSK; SH, Sexual Health; SSK, Self-sampling kit; WAC, Walk-in clinic

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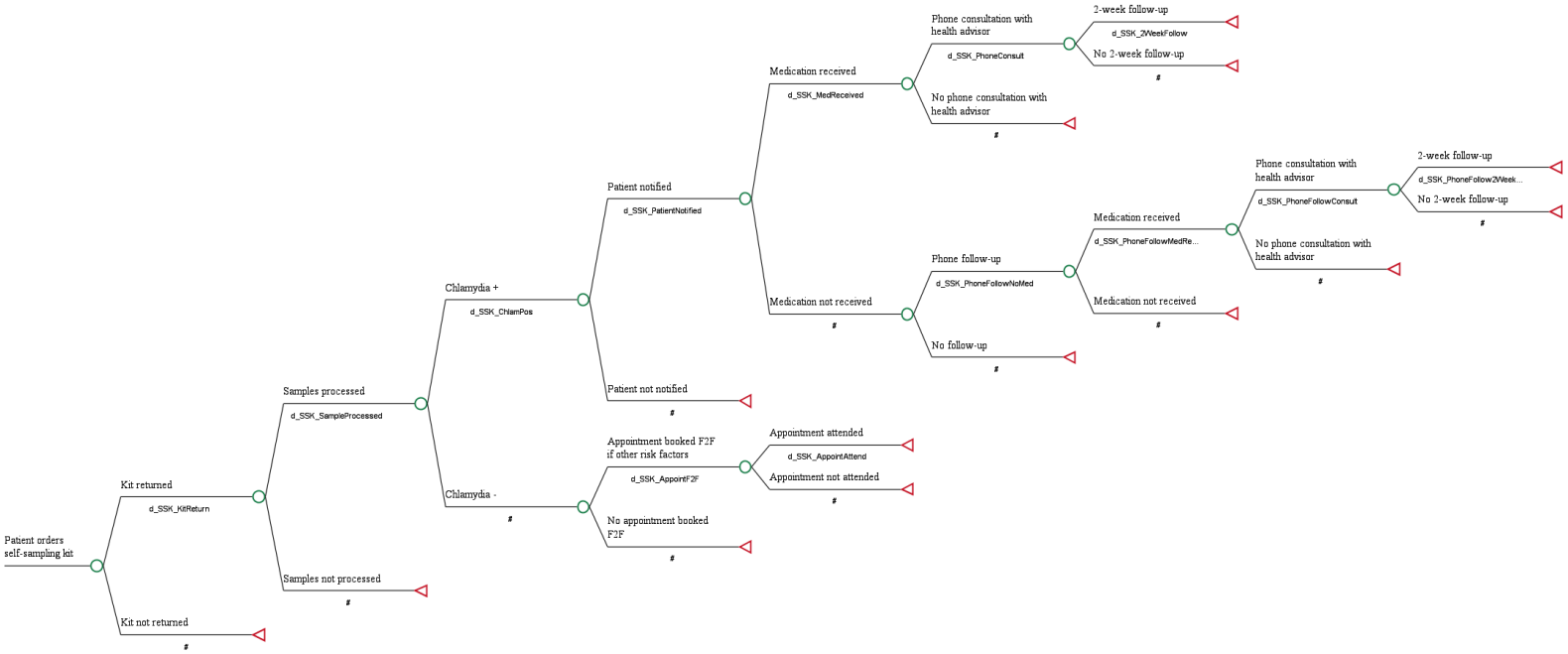

Figure 7.6. Pathway for asymptomatic service user ordering a self-sampling kit via the Umbrella Birmingham SHS website.

Notes: F2F, Face-to-face; SH, Sexual Health; SSK, Self-sampling kit

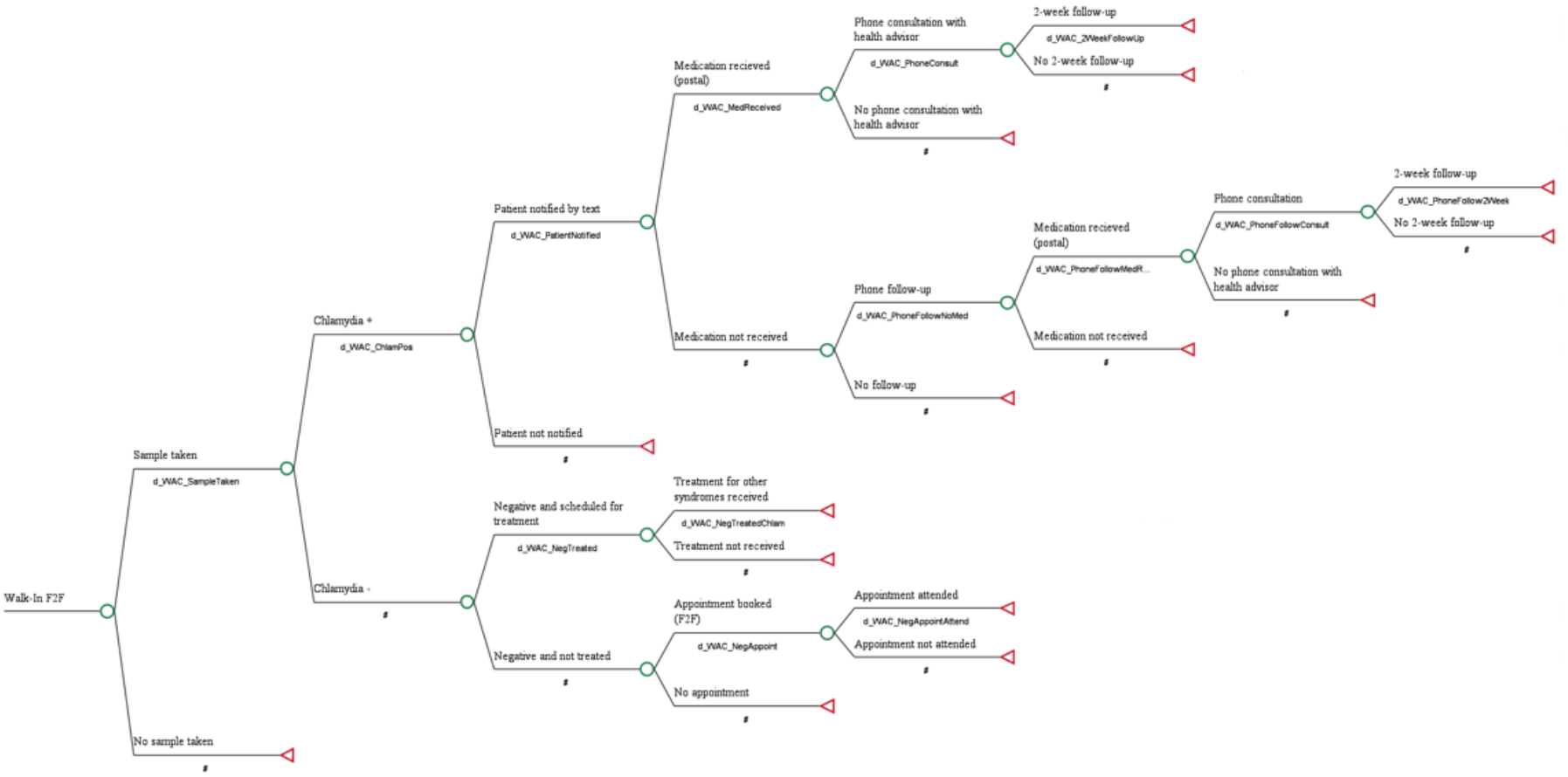

Figure 7.7. Walk-In / Face-to-face pathway for asymptomatic women to get tested for chlamydia.

Notes: F2F, Face-to-face; WAC, Walk-in clinic

7.4.2. Model assumptions

A number of assumptions were made for the development of the pathways, which concerned the distributions and transition probabilities. The model distributions and transition probabilities were primarily informed through a combination of expert advice, current literature, and clinic data. It was assumed that women accessing the service would not have any symptoms or risk factors. In general, in order to be eligible for remote testing and treatment for chlamydia, the service user usually had to be asymptomatic and would not fall into any other risk categories, such as being under the age of 16. The main assumptions are described in the following paragraphs and a complete list can be found in Table 7.2. Since the data was a combination of clinic data and data from literature, it resulted in some ranges on costs being provided. For the baseline analysis, the highest cost data was used.

Assumptions associated with the testing procedure, chlamydia positivity, and treatment

When a service user returns a sample or a sample is taken by a clinician, it may not be valid due to, for example, test handling issues or issues during storage. In reality there is a difference between presumed positive chlamydia cases given treatment and validated positive chlamydia cases following laboratory testing. For the purposes of this analysis, it was assumed that all samples received at the laboratory were processed. Another assumption was that a service user remained asymptomatic with a positive chlamydia diagnosis. A service user would be notified with the chlamydia result via text-message irrespective of which pathway they had entered for chlamydia testing. Further, it was assumed that the medication for a positive chlamydia diagnosis would always be shipped to the patient. In reality, a minority of patients pick up the

medication in a pharmacy or directly at the SHS. The probability of not receiving the medication was assumed to be around 1% for all pathways, based on local data.

Assumptions specific to the phone pathway

In general, those service users undertaking phone consultation appointments are usually different in risk characteristics from those in the OPSS pathway. The phone consultation group may be PEPSE users, sexual assault survivors or younger people, which may have similar characteristics to service users who access face-to-face services. The risk for being diagnosed with chlamydia was not accounted for per individual but based on expert advice, the chlamydia positivity rate was assumed to be similar to those service users accessing the service face-to-face. The chlamydia positivity rate in face-to-face service users was assumed to be higher than in service users accessing OPSS services directly.

Assumptions associated with cost data

It was assumed that most services which required healthcare personnel were provided by a health advisor (nurse band 6, PSSRU 2020/2021). This was also assumed for the phone consultation. A phone follow-up and any similar consultation was assumed to take around 5-10 minutes. For the base case analysis, the highest values were considered. For the self-sampling kit, the costs of the kit consisting of tubes, swabs and postage, and processing costs for the swabs were included.

Assumptions for willingness to pay threshold

In order to perform further analyses of the model, a willingness to pay threshold had to be decided on. Currently, there is no threshold for spending on SHS or screening

of STIs in particular. The cost-effectiveness threshold range by NICE is between £20,000 and £30,000 per QALY gained (McCabe, Claxton and Culyer, 2008). In the case of this analysis, QALYs were not generated. However, new thresholds could be determined by decision-makers in the future. Therefore, a variety of willingness to pay thresholds were assumed for the purpose of this analysis.

Table 7.2. Model assumptions

Assumptions	Details
Population risk was low	- Focus population: Asymptomatic low-risk women - Service user was asymptomatic when entering the pathway - If chlamydia test was positive, patient was asymptomatic - Low proportion of patients who were symptomatic to be picked up through the pathway
Cost assumptions	- Highest costs for baseline analysis to avoid recounting - Nurse band 6 for baseline analysis as the main personnel cost
Sample validity	- Assumption that all samples sent to the laboratory can be processed
Notification on chlamydia result	- Service users irrespective of the pathway were notified via text message about their chlamydia test result
Postal medication	- Medication gets shipped to the service user
Willingness to pay threshold	- A range of thresholds were explored

7.4.3. Model parameters

The primary focus of the early costing model was to analyse the costs associated with the different pathways and to understand how changing key parameters for costs and distributions would affect overall pathway costs. The data for the analysis was obtained from a variety of sources.

The estimates for the baseline parameters on general risk to be diagnosed with chlamydia and transition probabilities for the face-to-face and OPSS pathways were derived from local routinely collected data. The data was updated with more recent patient volume data obtained from Umbrella SHS Birmingham for the years 2020-2021.

Patient volume data/ distributions

To inform the transition probabilities, data from the Umbrella SHS Birmingham was received for the years 2020 to 2021. The clinic data used to create some of the distributions was received by month. The averages from this period were then calculated for example, for the return rate of STI self-sampling kits, with rounding of decimals. Since COVID-19 did impact on service delivery and also the access to self-sampling kits, the months in which the SHS had markedly lower uptake rates (September 2020 to December 2020) were excluded from the analysis. Beta distributions with discrete (integer) numbers were used for proportions of service users in the pathways (binomial data). Limitations associated with the use of beta distributions for three options are discussed in Section 7.6.4. The table below (Table 7.3) summarises the key parameters for the base case analyses.

Table 7.3. Base case distributions

Pathway	Description	Base-case value	Distribution and values	Source
Face-to-face	Sample taken after walk-in	0.99	Beta (10299, 10403)	Expert advice & routine clinic data
	Positive chlamydia diagnosis (F2F)[1]	0.087	Beta (9516, 829)	Expert advice & routine clinic data
OPSS	Return of self-sampling kit	0.564	Beta (2706, 4798)	Expert advice & Umbrella SHS
	Self-sampling kit not returned	# Remainder from above		
	Positive chlamydia diagnosis (OPSS)[1]	0.067	Beta (620, 9238)	Expert advice & routine clinic data
	Patient booked for face-to-face appointment due to other risk factors	0.093	Beta (787, 8493)	Expert advice & routine clinic data
Phone call	Patient was triaged to order self-sampling kit after phone call	0.422	Beta (4000, 9482)	Expert advice & Umbrella SHS
	Invited for face-to-face appointment after patient called SHS	# Remainder from call to OPSS triage and phone consultation		
Phone consultation	Phone consultation with health advisor	0.326	Beta (3090, 9482)	Expert advice & Umbrella SHS
	Referral to face-to-face service after phone consultation	0.3	Beta (927, 3090)	Expert advice & Umbrella SHS
	Advised to order self-sampling kit after phone consultation	0.6	Beta (1854, 3090)	Expert advice & Umbrella SHS
	Referral to other services after phone consultation	# Remainder from above		

Values of r and n are given for integer (discrete) beta distributions, where r are occurrences and n is the population size.

Parameters presented here were selected on the basis of impact on results.

[1]The same distributions were applied if patient called clinic / had a phone consultation and was triaged to a F2F, OPSS service.

F2F, Face-to-face; OPSS, Online postal self-sampling; SHS, Sexual health service

7.4.4. Cost data

Costs were analysed from a healthcare provider perspective using a combination of retrospective and prospective micro-costing approaches to collect data on staff, resource and time costs. This is because this model was designed specifically for local public health decision-makers who are interested in the direct budget impact of the different strategies rather than on indirect costs for the individual to travel to a SHS or wider societal costs, e.g., taking time off work to attend an appointment in the clinic. The prices are from the years 2021 to 2022 when this study was conducted if not stated otherwise. Cost considered in the model were the recurring direct cost for the

different strategies assessed. These included staff costs and other resources, such as the self-sampling kit for STIs. The costs were assessed for each of the pathways as specified above and are presented as unit cost and total cost. The service user was assumed to be a non-complex case requiring limited clinician time and using the standard treatment as recommend by the BASHH guidelines (BASHH, 2018; Dragovic and Nwokolo, 2018; Institute of Medicine, 2000). Overheads were not included in this analysis as it was assumed that the different pathways did not consume overall resources of the SHS. Costs for primary care, i.e., a service user accessing a GP for getting tested for a STI/HIV, were not considered. Implementation costs were not included because the pathways for face-to-face and OPSS existed for a number of years at Umbrella SHS Birmingham. The phone pathway had been newly introduced but this required staff relocation rather than the implementation of a completely new programme with additional staff required.

Cost data was retrieved directly from the Umbrella SHS Birmingham or the University Hospitals Birmingham Finance Department. Some costs were then further identified with reference to previous studies and data from the Personal Social Services Research Unit (PSSRU) (PSSRU, 2022). Data derived from other sources was then discussed and confirmed with experts from Umbrella SHS Birmingham. An overview of the cost parameters included is presented in Table 7.4.

Any parameters, which may have multiple options, such as swab costs, were tested for sensitivity in the uncertainty analyses. As recommended, a gamma distribution was used for cost data (Briggs, Claxton and Sculpher, 2006). This is because a gamma

distribution represents an interval between 0 and positive infinity and can reflect the uncertainty in cost parameters (Briggs, Claxton and Sculpher, 2006).

Table 7.4. Cost parameters

Parameter	Base-case value (£) (unit cost)	Time in minutes / resource use	Distribution and values	Source
Staff costs				
Reception	0.16	10	Gamma (1,1.6)	Mohiuddin et al. 2020
Health advisor triage	0.85	10	Gamma (1, 8.5)	UHB Finance Department, Nurse Band 6[$] & expert advice
Health advisor phone consultation	0.85	10	Gamma (1, 8.5)	UHB Finance Department, Nurse Band 6[$] & expert advice
Clinic attendance with clinician[$]	1.44	30	Gamma (1, 43.32)	PSSRU 2020/2021; own calculation based on expert advice
Clinic missed appointment*	Total costs: 11	NA	Gamma (1, 11)	Expert advice; assumption that UHB has to pay for this
Health advisor follow-up	0.85	10	Gamma (1, 8.5)	UHB Finance Department, Nurse Band 6 & expert consultation
Material related costs				
Self-sampling kit	4.05	1	Gamma (1, 4.05)	UHB Finance Department
Postage return from patient*	2.75	1	Gamma (1, 2.75)	UHB Finance Department & Royal Mail Postage;
NAAT in clinic	4.5	1	Gamma (1, 4.5)	UHB Finance Department
Text message	0.44	1	Gamma (1, 0.44)	Wise et al. 2017
Processing urine	3.00	1	Gamma (1,3)	UHB Finance Department
Treatment with doxycycline	0.17	2	Gamma (1, 1.35)	UHB Finance Department
Posting medication	3.20	1	Gamma (1, 3.2)	UHB Finance Department for doxycycline postage & UHB post room for parcel postage costs

*Assumption that UHB has to pay for this

[$]Band for nurses and clinician costs were derived from PSSRU 2020/2021.

NA, Not applicable; NAAT, Nucleic Acid Amplification Test; UHB, University Hospitals Birmingham

7.4.5. Data analysis

The data analysis comprised multiple steps. The first step was to present the patient volume data received from Umbrella SHS Birmingham for 2020 to 2021. The data was analysed to show the frequency of patients accessing the different pathways. The information reported on the number of patients calling the clinic, self-sampling kits ordered and return rate, and face-to-face consultations.

The second step was to analyse the costs of the pathways in the model in TreeAge. The costs per person screened were calculated and the net monetary benefit was assessed to show the incremental costs and expected resource savings (Laska et al., 1999). Costs were presented in terms of cost per person screened and cost per infection detected. The focus was on screening and detection of a chlamydia infection rather than on longer term treatment outcomes.

Sensitivity analyses

Deterministic sensitivity analyses, probabilistic sensitivity analysis (PSA), and scenario analyses followed the base case analysis. Deterministic sensitivity analyses were conducted to understand how individual parameters impacted the result. Seven cost parameters and eleven patient volume parameters were varied both on an independent level (univariate sensitivity analysis) and in tandem (multivariate sensitivity analysis). Scenario analyses were used to change the parameters to consider different scenarios, i.e., best case, worst case, when changing the parameters accordingly to answer some “what if” questions.

The following questions for the changes in patient volume were addressed:

a) *What happens to the results if the return rate of self-sampling kits would increase/decrease?*
b) *What happens to the results if not as many samples are processed when walking into the clinic?*
c) *What happens to the results if the chlamydia positivity rate increases for the service users accessing the face-to-face or online pathway?*

The parameters considered for the deterministic sensitivity and scenario analyses are listed in Table 7.5 for costs and Table 7.6 for probabilities. The cost parameters considered for the sensitivity analyses were self-sampling kit cost, staff cost, and treatment cost. Lower cost items, such as text messaging costs were not considered as these would probably not have an impact on overall results (Mohiuddin et al., 2020; Drummond et al., 2015). The probabilities were varied for selected parameters, such as the risk assumption expressed as chlamydia positivity rate or the return rate of self-sampling kits. The parameters were selected based on uncertainty of the base case values, expert advice, and the previous literature.

The PSA aimed to test the general parameter uncertainty of the model and to better understand the uncertainty around the cheapest pathway (Claxton et al., 2005). For the PSA, the model was sampled 1,000 times. Costs for the walk-in/face-to-face pathway were compared with costs for the OPSS and phone call pathways.

Table 7.5. Cost data for sensitivity analysis

Cost parameter	Worst case (£)	Source	Best case (£)	Source
Self-sampling kit	6.42	Mohiuddin et al. 2020	3.83	UHB Finance Department, costs before new bid
Treatment with doxycycline	11	Cost for in-clinic treatment, 10 minutes; UHB Finance Department	0.77	BASHH guidelines for chlamydia treatment; BNF, 2021
Health advisor triage	10.33	PSSRU 2020/2021 for nurse band 7	6.83	PSSRU 2020/2021 for nurse band 5
Clinic attendance	51.98	Varied base case value by 20% (Mohiuddin et al., 2020)	27.5	Mohiuddin et al. 2020 (non-complex female booked patient)
Health advisor follow-up	10.33	PSSRU 2020/2021 for nurse band 7	6.83	PSSRU 2020/2021 for nurse band 5
Health advisor phone consultation	10.33	PSSRU 2020/2021 for nurse band 7	6.83	PSSRU 2020/2021 for nurse band 5
Clinician phone consultation	14.33	PSSRU 2020/2021, own calculation based on expert advice: average of clinician costs for 10 minutes	11.46	Varied base case value by 20%: Mohiuddin et al., 2020

*For the scenario analysis parameters from the worst case/ best case scenario were varied simultaneously.

UHB, University Hospitals Birmingham

Table 7.6. Proportions for sensitivity analysis

Pathway	Parameter	Base case distribution and value	Sensitivity analysis distribution and value	Source
OPSS	Return of self-sampling kit	Beta (2706, 4798) 0.564	Beta (3838, 4798) 0.8 Beta (960, 4798) 0.2	Own calculations, scenario for more/less self-sampling
	Chlamydia positivity in OPSS pathway	Beta (620, 9238) 0.067	Beta (924, 9238) 0.1	Mitchell et al. (2020)
	Patient booked for F2F appointment due to other risk factors	Beta (787, 8493) 0.093	Beta (2548, 8493) 0.3	Expert advice
Face-to-face / Walk-in	Sample taken after walk-in	Beta (10299, 10403) 0.99	Beta (5202, 10403) 0.5	Own calculations, scenario for reduced samples processed when walking into the clinic
	Chlamydia positivity in F2F pathway	Beta (829, 9516) 0.087	Beta (952, 9516) 0.1	Mitchell et al. (2020)
Phone call	Patient was triaged to order SSK after phone call	Beta (4000, 9482) 0.422	Beta (2000, 9482) 0.210 Beta (4741, 9482) 0.5	Own calculations, scenario for more referrals to face-to-face services 50% according to Mohiuddin et al., 2020
	Invited for F2F appointment after calling	# Remainder from SSK triage and phone consultation		Own calculations, scenario for more referrals to face-to-face services
Phone consultation	Phone consultation	Beta (3090, 9482) 0.326	Beta (6180, 9482) 0.651 Changed proportion which ordered SSK after phone consultation to 20% to allow for this calculation: Beta (9482, 2000) 0.211	Own calculations, scenario for more phone consultations
	Referral to face-to-face service after phone consultation	Beta (927, 3090) 0.3	Beta (1545, 3090) 0.5 Changed proportion which ordered SSK after phone consultation to 30% to allow for this calculation: Beta (3090, 1000) 0.324	Own calculations, scenario for more referrals to face-to-face services
	Advised to order self-sampling kit after phone consultation	Beta (1854, 3090) 0.6	Beta (618, 3090) 0.2	Own calculations, scenario for more referrals to face-to-face services
	Referral to other services after phone consultation	# Remainder from F2F referral and advised to order SSK		Own calculations, scenario for more referrals to face-to-face services

F2F, Face-to-face; OPSS, Online postal self-sampling, SSK, Self-sampling kit

The table below shows an overview of the model objectives, scope, and methodology (Table 7.7).

Table 7.7. Overview of the model objectives, scope, and methodology

Model element	Description
Decision objective	To understand costs of different chlamydia screening strategies.
Policy context	This early costing model was used to inform future service models for SHS.
Disease	Chlamydia: All patients considered did not have any risk factors and were asymptomatic.
Perspective	Healthcare provider.
Target population	Asymptomatic women in the UK, aged 16 or older. No subgroups were defined.
Results measures	Cost per patient screened. Cost per infection detected.
Strategies/ comparators	Three main screening strategies: (1) Face-to-face, (2) online postal self-sampling, and (3) phone consultation.
Resources/ costs	Staff costs, costs for tests and treatment.
Time horizon	Not applicable as focus on short-term screening and treatment for infection. No sequelae (future outcomes) considered.

7.5. Results

The subsequent sections present the results of the analysis from the patient volume data and costa analysis as well as the sensitivity analyses, PSA, and scenario analyses.

7.5.1. Patient activity at Umbrella SHS Birmingham

Umbrella SHS in Birmingham provided activity data on patients accessing the service and the period considered is from June 2020 to March 2021. This period was selected due to the completeness of the data and to avoid the emergency phase of the pandemic when the services underwent rapid changes. For the complete data tables from June 2020 to March 2021, please consult Appendix 7.1.

Figure 7.8 shows patient activity data for the total number of calls, general enquiries and signposting, and the three main pathways: phone consultations, face-to-face consultations, and OPSS services for Umbrella SHS Birmingham, between June 2020 and March 2021. According to the patient volume data around 70% of patients accessed the service via phone call or online. The average number of incoming calls per month was 9,482 for this period, with October 2020 receiving the highest number of calls (12,268 calls). Out of those calls, most were general enquiries about the service or callers were signposted to other services. On average 3,090 phone consultations were conducted between June 2020 and March 2021. The services provided 1,529 face-to-face consultations and 811 service users were triaged from phone services to face-to-face consultations (not shown in graph). On average, there were 4,798 STI self-sampling kits issued between June 2020 to August 2020 and

January 2021 to March 2021. The activity presented in Figure 7.8 corresponds approximately to the COVID-19 phases as outlined in Section 7.3.2.

Additional details on the STI self-sampling kits for the June 2020 to March 2021 period are shown in Figure 7.9. All numbers presented here are averages, which correspond to the period June 2020 to August 2020 and January 2021 to March 2021 as stated above. Out of the 4,798 issued STI self-sampling kits, 57% (2,706 kits) were returned to the laboratories. When looking at 2018/2019 and 2019/2020 data from Umbrella SHS Birmingham, there was no difference in return rates (57%-59%) (see also Appendix 7.2). On average, there was a positivity rate of 10% (270 reactive results) for all STIs tested during this period.

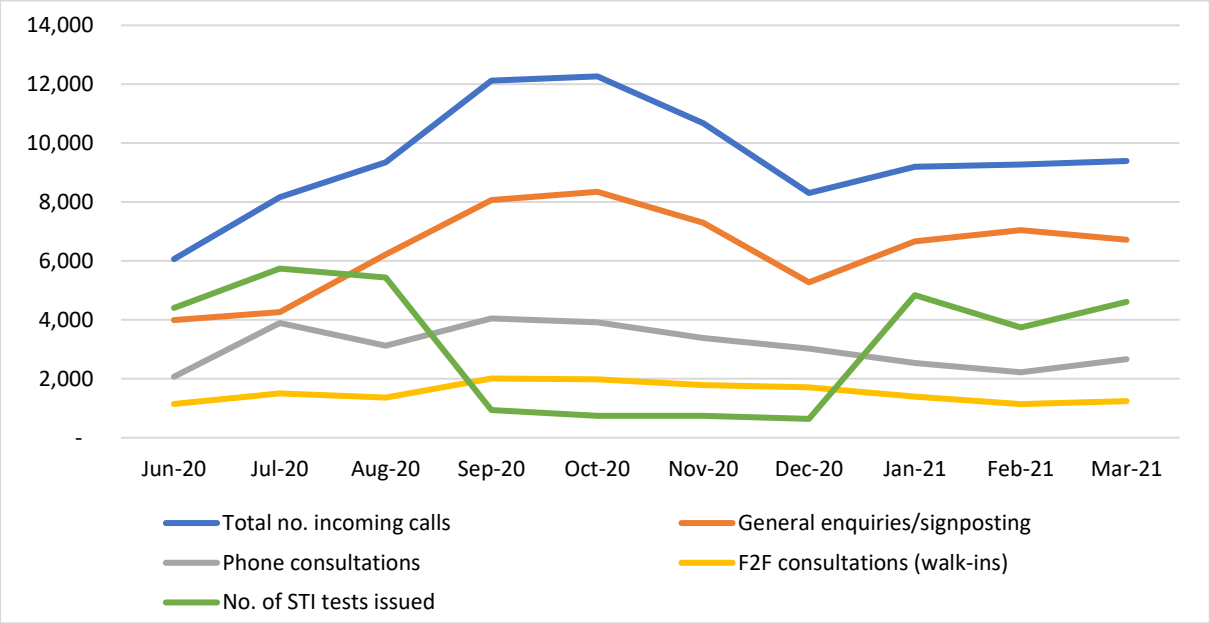

Figure 7.8. Patient activity data for total number of calls, general enquiries and signposting, and the three main pathways between June 2020 to March 2021.
Notes: F2F, Face-to-face; No, Number; STI, Sexually transmitted infection

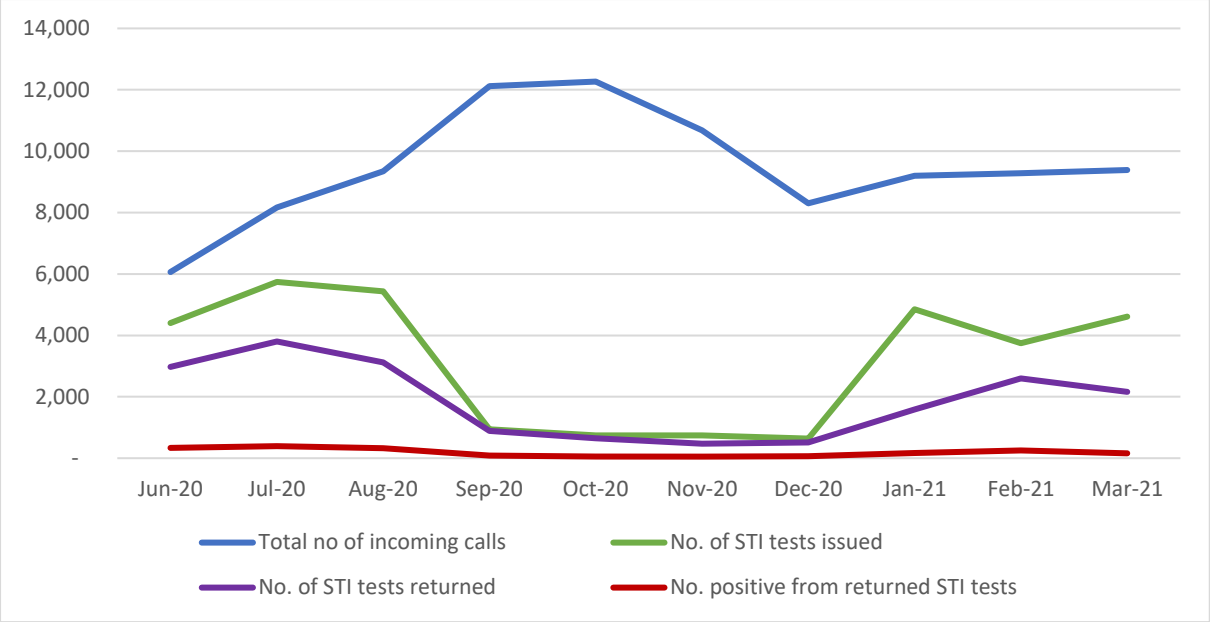

Figure 7.9. Patient activity data for incoming calls and STI self-sampling kits between June 2020 to March 2021.

Notes: No, Number; STI, Sexually transmitted infection

It should be noted that this data was recorded during the COVID-19 pandemic and therefore may be different in future periods.

7.5.2. Cost analysis and PSA

The results of the base case analysis are reported in Tables 7.8 to 7.10. Based on the available data, the average cost per person screened for chlamydia after walking into the SHS was £69 (see Table 7.8). Compared to the OPSS pathway (£10) and the patient calling the clinic (£34), face-to-face screening involved the highest costs. The cost per patient screened was highest for the face-to-face pathway (£69.70) and lowest for the OPSS pathway (£17.86). Screening a patient via the phone pathway for chlamydia would cost £51.52.

Table 7.8. Average costs (£) for the OPSS and phone call pathways and cost per patient screened compared with face-to-face services

Pathway	Pathway cost	Difference in costs by pathway	Probability of patient screened	Cost per patient screened	Difference in cost per patient screened
Face-to-face	69		0.99	69.70	
OPSS	10[1]	-59	0.56	17.86	-51.84
Phone	34	-35	0.66	51.52	-18.18

[1]Cheapest pathway when looking at costs only.

OPSS, Online postal self-sampling

Table 7.9 shows the average costs for the OPSS and phone pathway compared with the face-to-face pathway as well as the cost per infection detected. It would cost £492.86 to identify one chlamydia case in the face-to-face pathway. This was followed by the phone pathway with £485.71 per infection detected and the lowest cost was for a service user in the OPSS pathway (£250 per infection detected).

To illustrate this further, if 1,000 service users would be channelled through each of the pathways, 990 would be screened via the face-to-face pathway and 140 cases of chlamydia would be detected. For the phone pathway, out of 1,000 service users, 660 would be screened for chlamydia and 70 cases of chlamydia would be detected. OPSS is the pathway with the lowest number of service users screened (560) and with the lowest probability to detect a positive chlamydia case – out of 1,000 service users, 40 chlamydia cases would be identified.

Table 7.9. Average costs (£) for the OPSS and phone call pathways and cost per infection detected compared with face-to-face services

Pathway	Pathway cost	Difference in costs by pathway	Probability of positive chlamydia case	Cost per infection detected	Difference in cost per infection detected
Face-to-face	69		0.14[2]	492.86	
OPSS	10[1]	-59	0.04	250	-242.86
Phone	34	-35	0.07	485.71	-7.15

[1]Cheapest pathway when looking at costs only.

[2]Pathway with the highest probability to detect a chlamydia infection.

OPSS, Online postal self-sampling

Accessing OPSS directly via the SHS website remained the cheapest pathway when considering other pathways to access screening, e.g., via phone call or phone consultation (see Table 7.10). Within the phone call and phone consultation pathways, a service user being referred to order a self-sampling kit was the cheapest option (£20.37 and £46.30 per person screened) compared to face-to-face referrals. Table 7.10 also shows the differences in cost per chlamydia case detected for each of the telephone pathways compared to a service user directly accessing a face-to-face service. Overall, the differences in costs per infection detected were not as high as in the pathways in the previous tables. Costs were slightly higher when a service user was referred to order a self-sampling kit after a phone consultation (£500) compared to accessing the SHS directly via the face-to-face pathway (£492.86). The cost per infection detected reduced slightly when a service user would call the SHS before accessing it directly (£492.31 vs. £492.86).

Table 7.10. Average costs (£) for phone triage pathways, cost per patient screened and cost per infection detected compared with face-to-face services

Pathway	Cost of the pathway	Difference in costs for each pathway	Probability of patient screened	Cost per patient screened	Difference in cost per patient screened	Probability of chlamydia infection detected	Cost per infection detected	Difference in cost per infection detected
Face-to-face	69		0.99	69.70		0.14	492.86	
Patient calls clinic and is invited for a phone consultation	40	-29	0.62	64.52	-5.18	0.07	571.43	78.57
Patient calls clinic and is triaged to order OPSS	11[1]	-58	0.54	20.37[1]	-49.33	0.04	275[1]	-217.86
Patient calls clinic and is invited for F2F appointment	64	-5	0.91	70.33	0.63	0.13	492.31	-0.55
After phone consultation: Triaged to order self-sampling kit	25	-44	0.54	46.30	-23.40	0.05	500	7.14
After phone consultation: Further assessment needed F2F	78	9	0.99	78.79	9.09	0.14	557.14	64.28
After phone consultation: Referral to other services	10[2]	59	NA	NA	NA	NA	NA	NA

[1]Cheapest pathway when looking at costs only.

[2]Not considered cheapest pathway for screening of chlamydia. The pathway ends with the service user being referred to other services.

F2F, Face-to-face; NA, Not available; OPSS, Online postal self-sampling

Tables 7.8 to 7.10 presented average costs only and did not consider the potential value of finding the most chlamydia cases. This is reflected in the net monetary benefit approach as reported in Table 7.11. When considering a willingness to pay threshold of £500, the pathway with the highest net monetary benefit per patient screened was the face-to-face pathway (£426.05). The pathway with the lowest net monetary benefit per patient screened was the OPSS pathway (£272.24). This changes when looking at the net monetary benefit per infection detected. The OPSS pathway had the highest (£8.28) and the face-to-face pathway the lowest net monetary benefit (£-0.98).

Table 7.11. Net monetary benefit (£) for two results measures

Pathway	NMB per patient screened[1]	NMB per infection detected[1]
Face-to-face	426.05†	-0.98
OPSS	272.24	8.28†
Phone	295.99	0.93

[1]The willingness to pay threshold was £500.

†Highest net monetary benefit.

For a detailed calculation, see Appendix 7.3.

NMB, Net monetary benefit; OPSS, Online postal self-sampling

To allow for a comparison between the different pathways, the face-to-face pathway functioned as the baseline for STI/HIV screening and OPSS and phone pathways were compared to this pathway (see Table 7.12). The incremental net monetary benefit calculations show that both OPSS and phone pathway have a reduced incremental net monetary benefit per patient screened but a higher incremental net monetary benefit per infection detected when compared to the face-to-face pathway.

Table 7.12. Incremental net monetary benefit (£) for two results measures

Pathway	NMB per patient screened[1]	NMB per infection detected[1]
Face-to-face		
OPSS	-156	9
Phone	-130†	24†

[1]The willingness to pay threshold was £500.

†Highest incremental net monetary benefit.

For a detailed calculation, see Appendix 7.3.

NMB, Net monetary benefit; OPSS, Online postal self-sampling

These results should not be interpreted without considering the PSA. For the PSA, it was assumed to have a £500 willingness to pay threshold and the model was run 1,000 times. The results show that the pathways for the OPSS and service user calling the SHS were cheaper than the face-to-face pathway (see Tables 7.13 and 7.14). There was a significant difference between the costs of face-to-face vs. OPSS pathways and face-to-face vs. phone call pathways. The mean cost per patient screened and mean cost per infection detected were lowest for the OPSS pathway. The difference between the phone pathway compared to the face-to-face pathway decreased when looking at the mean cost per infection detected.

Table 7.13. Results of PSA: Average costs (£) for the online self-sampling and phone call pathways including mean cost per patient screened compared with face-to-face services

	Cost (95% CI)			
Pathway	**Mean**	**Difference**	**Mean probability patient screened** (95% CI)	**Mean cost per patient screened** (95% CI)
Face-to-face	71 (3 – 417)		0.99 (0.99 – 0.99)	71.72 (3.03 – 421.21)
OPSS	10 (1 – 43)	-61	0.56 (0.54 – 0.59)	17.86 (1.85 – 72.88)
Phone	35 (4 – 166)	-36	0.66 (0.64 – 0.68)	53.03 (6.25 – 244.12)
OPSS, Online postal self-sampling				

Table 7.14. Results of PSA: Average costs (£) for the online self-sampling and phone call pathways including mean cost per infection detected compared with face-to-face services

	Cost (95% CI)			
Pathway	**Mean**	**Difference**	**Mean probability infection detected** (95% CI)	**Mean cost per infection detected** (95% CI)
Face-to-face	67 (5 – 375)		0.14 (0.13 – 0.15)	487.57 (38.46 – 2,500)
OPSS	10 (1 – 38)	-57	0.04 (0.03 – 0.04)	250 (33.33 – 950)
Phone	33 (4 – 150)	-34	0.07 (0.07 – 0.07)	471.43 (57.14 – 2,142.86)
OPSS, Online postal self-sampling				

The results of the PSA for the net monetary benefit (per patient screened and per infection detected) confirm those of the point estimates (see Table 7.15). There was a significant difference between the net monetary benefit for when a patient walks into the SHS vs. accessing the service via OPSS or phone call. The OPSS pathway had the highest mean net monetary benefit per infection detected. However, the range of the net monetary benefit per infection detected for the face-to-face pathway was

£-307 – £66 compared to £-18 – £18 for the OPSS and £-116 – £31 for the phone pathways. This shows that the face-to-face pathway could be the pathway with the highest net monetary benefit per infection detected for both results measures.

Table 7.15. Results of PSA: Net monetary benefit (£) for two results measures

	Mean (95% CI)	
Pathway	**NMB per patient screened[1]**	**NMB per infection detected**
Face-to-face	424† (76 – 492)	1 (-307 – 66)
OPSS	272 (237 – 285)	8† (-18 – 18)
Phone	295 (163 – 326)	2 (-116 – 31)

[1]The willingness to pay threshold was £500.

†Highest mean net monetary benefit.

OPSS, Online postal self-sampling

7.5.3. One-way sensitivity analysis

Several parameters were considered for the sensitivity analyses as described in Section 7.4.5. First, the costs were varied and worst case (lowest cost) and best case (highest cost) scenarios were analysed (see Tables 7.16. – 7.18). The univariate sensitivity analysis for selected cost parameters had no effect on the most dominant pathway (see Table 7.16). This meant that the OPSS pathway remained the pathway with the lowest cost (£9 - £12) and had the lowest net monetary benefit per patient screened (£269.87 - £272.46). The face-to-face pathway continued to be the pathway with the highest cost (£48 - £80) but also the pathway with the highest net monetary benefit per patient screened (£414.58 - £446.99).

The OPSS pathway was the pathway with the highest net monetary benefit per infection detected, which confirms the results of the cost analysis presented in Section 7.5.2. However, if clinic attendance costs were lowered, the pathway with the highest net monetary benefit per infection detected was the face-to-face pathway.

When changing costs for the clinic attendance to a higher value, the costs for the face-to-face and phone pathways increased and the net monetary benefit decreased. Although there was no change in the OPSS pathway costs when increasing clinic attendance costs, there was a reduction in net monetary benefit.

When increasing the costs of the self-sampling kit (worst case), the average costs for the two pathways OPSS and phone increased (£12 and £35). The lowest considered costs for the self-sampling kit had no effect on the average costs for all three pathways. The net monetary benefit of OPSS and phone pathways was affected if costs for the self-sampling kit were increased or decreased. Increasing the treatment cost did affect costs for the face-to-face pathway and the net monetary benefit for all three pathways, which decreased for all pathways.

The phone pathway costs were affected by the increase in costs (higher health advisor costs or clinician answered phone call). Net monetary benefits for all pathways were affected when altering the phone consultation costs. Additional parameters were varied but these did not change that for costs only OPSS remained the least costly pathway and the face-to-face pathway continued to have the highest net monetary benefit per patient screened (see Appendix. 7.4).

Table 7.16. Univariate sensitivity analysis results for pathway costs and net monetary benefit

	Results univariate worst case			Results univariate best case		
Cost parameter	**Pathway costs**	**NMB per patient screened**	**NMB per infection detected**	**Pathway costs**	**NMB per patient screened**	**NMB per infection detected**
Self-sampling kit	F2F 69 OPSS 12* Phone 35*	F2F 426.05 OPSS 269.87* Phone 294.53*	F2F -0.98 OPSS 5.91* Phone -0.53*	-	F2F 426.05 OPSS 272.46* Phone 296.12*	F2F -0.98 OPSS 8.50* Phone 1.07*
Treatment with doxycycline	F2F 70* OPSS 10 Phone 34	F2F 424.75* OPSS 271.90* Phone 295.33*	F2F -2.28* OPSS 7.95* Phone 0.28*	-	F2F 426.13* OPSS 272.26* Phone 296.03*	F2F -0.90* OPSS 8.30* Phone 0.97*
Clinic attendance	F2F 80* OPSS 10 Phone 38*	F2F 414.58* OPSS 271.88* Phone 291.56*	F2F -12.44* OPSS 7.93* Phone -3.50*	F2F 48* OPSS 9* Phone 26*	F2F 446.99* OPSS 272.89* Phone 304.08*	F2F 19.97* OPSS 8.94* Phone 9.02*
Health advisor phone consultation	-	F2F 425.90* OPSS 272.18* Phone 295.35*	F2F -1.13* OPSS 8.22* Phone 0.30*	F2F 69 OPSS 10 Phone 33*	F2F 426.19* OPSS 272.29* Phone 296.57*	F2F -0.84* OPSS 8.34* Phone 1.51*
Clinician phone consultation[1]	F2F 69 OPSS 10 Phone 36*	F2F 425.56* OPSS 272.05* Phone 293.96*	F2F -1.46* OPSS 8.09* Phone -1.10*	F2F 69 OPSS 10 Phone 35*	F2F 425.80* OPSS 272.14* Phone 294.96*	F2F -1.22* OPSS 8.19* Phone -0.10*

Willingness to pay threshold was £500.

- No change compared to base case.

*Change compared to base case.

[1]Health advisor phone consultation was replaced by a clinician.

F2F, Face-to-face; NMB, Net monetary benefit; OPSS, Online postal self-sampling

Tables 7.17 and 7.18 present the results from the scenario analyses. When changing the costs to the worst case considered, the costs increased and the net monetary benefit decreased for all pathways (see Table 7.17). The face-to-face pathway remained the pathway with the highest cost but also the pathway with the highest net monetary benefit per person screened. The net monetary benefit per infection detected remained highest in the OPSS pathway followed by the face-to-face and phone pathways. If all costs for the selected parameters were reduced (best case scenario), this would decrease the average costs for each pathway and increase the net monetary benefit for each pathway respectively (see Table 7.18). This had no effect on the most dominant pathway for lowest costs (OPSS) and highest net monetary benefit (face-to-face).

Table 7.17. Scenario analysis of worst case costs and net monetary benefit (£) for the three pathways

Path-way	Costs, worst-case scenario[1]	Cost difference to base case	NMB per person screened in worst case scenario	NMB difference to base case	NMB per infection detected	NMB difference to base case
F2F	82	13	412.64	-13.41	-7.74	-6.76
OPSS	13	3	268.98	-3.26	5.03	-3.25
Phone	42	8	287.32	-8.67	-14.39	-15.32

[1]For the scenario analysis parameters from the worst case/ best case scenario were varied simultaneously.

Clinician phone consultation costs were used instead of health advisor phone consultation costs.

Willingness to pay threshold was £500.

F2F, Face-to-face; NMB, Net monetary benefit; OPSS, Online postal self-sampling

Table 7.18. Scenario analysis of best case costs and net monetary benefit (£) for the three pathways

Path-way	Costs, best case scenario[1]	Cost difference to base case	NMB per person screened in best case scenario	NMB difference to base case	NMB per infection detected	NMB difference to base case
F2F	48	-21	447.35	21.30	20.33	21.31
OPSS	9	-1	273.19	0.95	9.24	0.96
Phone	25	-9	304.92	8.93	9.86	8.93

[1]For the scenario analysis parameters from the worst case/ best case scenario were varied simultaneously.

Health advisor phone consultation was used.

Willingness to pay threshold was £500.

F2F, Face-to-face; NMB, Net monetary benefit; OPSS, Online postal self-sampling

Table 7.19 shows the results for the deterministic sensitivity analyses including univariate and multivariate sensitivity analyses of the proportions considered. First, all parameters were changed individually. The OPSS pathway remained the pathway with the lowest cost but also lowest net monetary benefit per patient screened throughout the sensitivity analyses. This was changed by three parameters, the return rate of self-sampling kits, the face-to-face service sampling rate, and the triage rate to OPSS services after a phone consultation. If 80% of all self-sampling kits were returned, the costs for the OPSS pathway would increase slightly (base case: £10, sensitivity analysis: £12) and the net monetary benefit would increase significantly (base case: £272.24, sensitivity analysis: £387.82). However, the face-to-face pathway would still have the highest net monetary benefit (£426.05). If only 50% of service users who use face-to-face services had their sample taken (base case: 99%), it would impact the results: The pathway with the highest net monetary benefit per patient screened would be the OPSS pathway (£272.24). For the phone and face-to-face pathways, the costs and the net monetary benefits would decrease. If the rate of advising patients to order

a self-sampling kit after a phone consultation was increased, the OPSS pathway had the second highest net monetary benefit per patient screened (£272.24) followed by the phone pathway (£272.08). For the net monetary benefit per infection detected, the OPSS remained the pathway with the highest net monetary benefit for the univariate sensitivity analysis of proportions.

When changing the chlamydia positivity rate to 10% for the returned self-sampling kits, the pathway costs remained the same but the net monetary benefit per patient screened decreased for the phone and OPSS pathways (see Table 7.19). The net monetary benefit per infection detected increased significantly for the OPSS and phone pathways. The same result was observed when increasing the chlamydia positivity rate in the face-to-face pathway: the net monetary benefit for both result measures increased for both face-to-face and phone pathways. If more patients were requested for a face-to-face appointment after self-sampling for chlamydia via the OPSS and phone call triage pathways, the net monetary benefit would decrease for both of these pathways respectively. For the further information on distributions, values, and probabilities see Appendix 7.5.

The willingness to pay threshold was also varied (500; 1,000; 5,000). The face-to-face pathway had the highest net monetary benefit for both results measures except when the results measure was net monetary benefit per infection detected with a willingness to pay threshold of £500 (see also Appendix 7.6).

Table 7.19. Deterministic sensitivity analysis of proportions showing pathway costs and net monetary benefit (£) for two results measures

Pathway	Parameter	Sensitivity analysis value	Pathway costs	Results NMB per patient screened[6]	NMB per infection detected[6]
OPSS	Return of self-sampling kit[1]	80%	F2F 69 OPSS 12* Phone 36*	F2F 426.05 OPSS 387.82* Phone 363.40*	F2F -0.98 OPSS 13.44* Phone 4.01*
		20%	F2F 69 OPSS 6* Phone 31**	F2F 426.05 OPSS 93.97* Phone 192.02*	F2F -0.98 OPSS 0.33* Phone -3.82*
	Chlamydia positivity rate[2]	10%	-	F2F 426.05 OPSS 295.87* Phone 272.09*	F2F -0.98 OPSS 16.98* Phone 4.54*
	Patient booked for F2F appointment[3]	30%	F2F 69 OPSS 14* Phone 35*	F2F 426.05 OPSS 268.10* Phone 294.24*	F2F -0.98 OPSS 4.15* Phone -0.81*
Face-to-face	Sample taken[4]	50%	F2F 35* OPSS 10 Phone 28*	F2F 214.70* OPSS 272.24 Phone 225.28*	F2F -0.99* OPSS 8.28 Phone -3.99*
	Chlamydia positivity rate[4]	10%	-	F2F 426.00* OPSS 272.24 Phone 305.08*	F2F 5.02* OPSS 8.28 Phone 3.95*
Phone call	Patient was triaged to order OPSS after phone call	20%	F2F 69 OPSS 10 Phone 46*	F2F 426.05 OPSS 272.24 Phone 341.26*	F2F -0.98 OPSS 8.28 Phone 0.83*
		50%	F2F 69 OPSS 10 Phone 30*	F2F 426.05 OPSS 272.24 Phone 291.67*	F2F -0.98 OPSS 8.28 Phone 2.20*
Phone consultation	Phone consultation[5]	65%	F2F 69 OPSS 10 Phone 37*	F2F 426.05 OPSS 272.24 Phone 289.40**	F2F -0.98 OPSS 8.28 Phone -1.61*
	Referral to F2F service[5]	50%	F2F 69 OPSS 10 Phone 37*	F2F 426.05 OPSS 272.24 Phone 310.05**	F2F -0.98 OPSS 8.28 Phone 1.08*
	Advised to order self-sampling kit	20%	F2F 69 OPSS 10 Phone 32*	F2F 426.05 OPSS 272.24 Phone 272.08**	F2F -0.98 OPSS 8.28 Phone 0.83*
General	Willingness to pay threshold	1,000	-	F2F 921.05 OPSS 554.23 Phone 625.70	F2F 67.00 OPSS 26.32 Phone 35.59
		5,000		F2F 4,881.06 OPSS 2,810.17 Phone 3,263.40	F2F 610.80 OPSS 170.63 Phone 312.83

- No change compared to base case.

*Change compared to base case.

[1]Changed this value in the following pathways SSK, CSSK, PCSSK.

[2]Changed the chlamydia positivity rate for the OPSS pathway and after phone call triage (SSK/CSSK).

[3]Changed the value for F2F appointment booked in the OPSS pathway and phone call triage to order SSK (SSK/CSSK).

[4]Sample taken after walk-in was changed for the CF2F and WAC pathways.

[5]Involved reducing the probability of service users being referred to OPSS after the phone consultation.

[6]Willingness to pay threshold was £500.

CSSK, Call to be triaged to order a self-sampling kit; CF2F, Call to be triaged to a face-to-face appointment; F2F, Face-to-face; NMB, Net-monetary benefit; OPSS, Online postal self-sampling; PCSSK, Called reception + phone consultation followed by triage to order a self-sampling kit; SSK, Self-sampling kit; WAC, Walk into clinic / face-to-face appointment

For the proportion multivariate sensitivity analyses, one scenario considered was to increase face-to-face referrals through triaging efforts (see Table 7.20). This had no impact on the most favourable pathways by costs (OPSS) or on the pathway with the highest net monetary benefit per patient screened (face-to-face) / per infection detected (OPSS). However, it did increase the costs and net monetary benefit of the phone pathway: The phone pathway costs increased by £14 (base case: £34 vs. face-to-face scenario: £48) and the net monetary benefit per patient screened increased by £22.50 (base case: £295.99 vs. face-to-face scenario: £318.49) but decreased for the net monetary benefit per infection detected (base case: £0.93 vs. face-to-face scenario: £-2.74). In this face-to-face scenario, the OPSS pathway's costs increased by £4 (base case: £10 and face-to-face scenario: £14) and the net monetary benefit decreased for both results measures (base case: £272.24 / £8.28 vs. face-to-face scenario: £268.10 / £4.15). For additional details on the analysis, please consult Appendix 7.7.

Table 7.20. Multivariate sensitivity analysis of proportions for increased use of face-to-face services

Pathway	Parameter	Sensitivity analysis value	Results Pathway costs	Results NMB per patient screened[2]	Results NMB per infection detected[2]
OPSS	Patient booked for F2F appointment due to other risk factors[1]	30%	F2F 69 OPSS 14* Phone 48*	F2F 426.05 OPSS 268.10* Phone 318.49*	F2F -0.98 OPSS 4.15* Phone -2.74
Phone call	Patient was triaged to order self-sampling kit after phone call	20%			
Phone consultation	Referral to F2F service after phone consultation	50%			
	Advised to order a self-sampling kit	20%			

All costs in £.

[1]Changed the value for F2F appointment booked in the OPSS pathway and phone call triage to order SSK (SSK/CSSK).

[2]Willingness to pay threshold was £500.

*Change compared to base case.

CSSK, Call to be triaged to order a self-sampling kit; F2F, Face-to-face; NMB, Net-monetary benefit; OPSS, Online postal self-sampling; SSK, Self-sampling kit

For all pathways, the chlamydia positivity rate was increased in a multivariate sensitivity analysis to see whether changing the population risk would impact the results (see Table 7.21). First, the chlamydia positivity rate was increased for all service users accessing the face-to-face pathway. This increased the net monetary benefit for both results measures for the face-to-face and phone pathways. Second, the chlamydia positivity rate for people who access OPSS services was increased. If the chlamydia positivity rate would be increased to 10% for people accessing the screening service via OPSS, it would reduce the net monetary benefit per patient screened but increase the net monetary benefit per infection detected for both OPSS and phone pathways (see Appendix 7.8. for distributions used).

Table 7.21. Multivariate sensitivity analysis of proportions for increased risk of chlamydia

Pathway	Parameter	Sensitivity analysis value	Pathway costs	Results NMB per patient screened[2]	NMB per infection detected[2]
F2F[1]	Chlamydia positivity in F2F pathways	10%	F2F 69 OPSS 10 Phone 34	F2F 426.00* OPSS 272.24 Phone 296.00*	F2F 5.02* OPSS 8.28 Phone 2.92*
OPSS[1]	Chlamydia positivity in OPSS pathways	10%	F2F 69 OPSS 10 Phone 34	F2F 426.05 OPSS 272.09* Phone 295.87*	F2F -1.37* OPSS 16.98* Phone 5.12*

All costs in £.

[1]Changed this value in all respective pathways (phone call/phone consultation triage for self-sampling / face-to-face referral respectively: CSSK, PCSSK, CF2F, PCF2F)

[2]Willingness to pay threshold was £500.

*Change compared to base case.

CF2F, Call to be triaged to a face-to-face appointment; CSSK, Call to be triaged to order a self-sampling kit; F2F, Face-to-face; NMB, Net-monetary benefit; OPSS, Online postal self-sampling; PCF2F, Called reception + phone consultation followed by triage to F2F services; PCSSK, Called reception + phone consultation followed by triage to order a self-sampling kit

7.6. Discussion

This care pathway costing model provided an overview of the pathways for accessing chlamydia screening through face-to-face, online, or phone services for asymptomatic women. Accessing online services directly via the website was identified as the cheapest pathway when looking at the cost per person screened only, followed by accessing services via phone and face-to-face services. Accessing chlamydia screening via the face-to-face pathway had the highest net monetary benefit per patient screened for a £500 willingness to pay threshold. The highest net monetary benefit per infection detected was observed for the OPSS pathway. Most of the sensitivity analyses did not alter the results from the base case substantially. The main parameters influencing the overall costs of the pathways were, staff costs, the return rate of self-sampling kits, the chlamydia positivity rate, and the samples taken when a service user accesses the face-to-face pathway. There may have been additional parameters, which could have impacted the result, but these were not identified based on this analysis. Three parameters were identified, which changed the recommended

pathway based on the net monetary benefit. If the sample is taken from 50% of the service users accessing the SHS face-to-face, the pathway with the highest net monetary benefit would be the OPSS pathway followed by the phone pathway.

Further, the OPSS pathway became the pathway with the second highest net monetary benefit per patient screened after the face-to-face pathway when changing the return rate of self-sampling kits from currently 57% to 80% as well as when reducing the triage from phone consultation to self-sampling kits from 60% to 20%. Finally, the face-to-face pathway becomes the preferred pathway in terms of the net monetary benefit of the two results measures when increasing the willingness to pay threshold to £1,000.

The results show that just by considering the costs, the pathway with the highest net monetary benefit per patient screened would not be chosen. The use of net monetary benefit provides a simple measure to compare the cost-effectiveness of multiple interventions. This study did not consider longer term benefits or full outcomes. Therefore, this measure should be interpreted with caution but can be taken as an indicator. Based on these results, alternative pathways should not be excluded as an option.

7.6.1. The future of sexual health services

The changing nature of SHS and the influence of the most recent pandemic did impact the care pathways for STI screening. It is difficult to assume how SHS will evolve in the future, but the importance of face-to-face services has been highlighted by this analysis. The services may further evolve and invent a new system on how to triage

the service users for each pathway. Acknowledging existing barriers, e.g., low language skills, people with disabilities, to the use of phone and online services is therefore of importance.

The overall aim of a public health intervention is to reduce inequalities (PHE, 2020a). One study found that service users who access OPSS services were mainly white women aged between 20 – 30 years who lived in less deprived areas (Sumray et al., 2022). In addition, other population groups, e.g., people who cannot access online services due to low digital literacy or people with learning difficulties, may be excluded from these services, which may negatively affect the number of infections detected as well as potentially increase inequalities. This shows that although equity considerations were beyond the scope of this analysis, further research in this area is required.

7.6.2. Comparison with other literature

To the knowledge of the author from this thesis, this is the first detailed cost analysis comparing three distinct pathways for chlamydia screening or of a similar STI.

One study evaluated the costs of different recall methods to provide information on the optimal delivery for retesting chlamydia within the NCSP (Looker et al., 2019). The authors found that to be retested via one of the six recall methods (client-led, reminder card, text message invite, automated self-sampling kit, advice at follow-up and text message) for chlamydia would cost £45 to £70. The automated self-sampling was found to be the least costly recall method. This would confirm the results of the early

costing model presented here (range of pathway costs), although the study by Looker et al. (2019) did focus on a different pathway (recall for retesting chlamydia).

A study by Turner et al. (2019) evaluated the impact of OPSS on costs across SHS in two London boroughs. The authors discovered an increase in total annual cost for STI screening and testing since the introduction of OPSS. However, OPSS did decrease the average cost per test and diagnosis. Therefore, they concluded that OPSS should not be provided in isolation from other services for STI testing and screening (Turner et al., 2019). One explanation for the increased costs would be the increase in demand and a low return rate of self-sampling kits.

Another study looked at programme costs for the NCSP at a national level (Turner et al., 2011). In 2008-9 the cost per chlamydia infection treated was estimated to be £506. The pathway for how services were accessed was not specified and the authors did not consider cost per patient screened or cost per infection detected, which makes comparison with the current research difficult.

A study from the USA in 2011 investigated the cost-effectiveness of OPSS for chlamydia (Huang et al., 2011). The authors conducted a full CEA including MOAs in the form of PID. The study found that OPSS would prevent more PID cases and save more costs than face-to-face screening services. The costing model from this research did not consider any major outcomes, the potential reduction in PID cases as well as cost-savings may be assessed in the future. It should be noted that service users accessing OPSS services typically have a lower proportion of receiving a positive chlamydia test compared with service users who present via face-to-face pathways

(Sumray et al., 2022; Turner et al., 2019; Banerjee, Thorley and Radcliffe, 2018; Barnard et al., 2018). Therefore, the odds to prevent more PID cases via the OPSS pathway may be lower compared to face-to-face pathways.

7.6.3. Recommendations

The interviews with decision-makers at a local level, such as SHS commissioners and service providers, explained that they are operating within a fragmented system of commissioning responsibilities, and this influences the economic evidence in which they are interested. There was an interest in understanding the costs associated with each of these pathways and how these may be impacted.

The analyses within this chapter showed that service providers should not make the decision to channel all asymptomatic patients to online services on the basis of costs alone. This would be detrimental to patient outcomes who cannot access these services. Rather this analysis suggests that based on the net monetary benefit a combined service model for STI screening is required. It is important to understand that even though online services provide an opportunity for some populations who may not access STI/HIV screening otherwise, they cannot wholly replace traditional face-to-face services. By screening people through OPSS only, the screening pathway may be cheaper, but it is likely that people of lower sexual risk will be screened and therefore the probability to successfully detect chlamydia cases could be reduced. In order to advance OPSS pathways, attention to improving access for high-risk groups and increasing the return rates of OPSS kits, would increase the net monetary benefit of the OPSS pathway.

7.6.4. Strengths and limitations

Strengths

This costing model has several strengths. The model was designed in close collaboration with a local SHS provider and analysed the direct costs of standard and new modes of delivery for chlamydia screening and testing. This analysis followed SHS decision-maker preferences for a costing analysis using data from a local SHS. To the knowledge of the author of this thesis, this was a first attempt to consider three different pathways and to provide the granular details on costs associated with the follow-up for service users. It was aimed to achieve high data accuracy and detailed pathways by working closely with the experts from the SHS when designing the pathways. All assumptions were clearly stated. The primary reason for some assumptions was to be able to finalise the model in a timely manner to provide timely evidence and showcase the three pathways. The model underwent comprehensive uncertainty analyses to test the validity of the results.

Limitations in general

The model has limitations both in terms of using a decision tree and specifically concerning the interpretation of results. The main limitation is that this early costing model is a cost analysis which cannot inform on the cost-effectiveness or the full value of each pathway since consequences (benefits, outcomes) were not fully considered. It is a one-sided decision-aid focusing on costs and changes following the introduction of different pathways for STI screening. Therefore, no statement on the value of the pathways is included in this study. However, it follows a local disaggregated model, which was suggested by decision-makers. Ideally, health outcomes, such as PID and infertility would be included in the analysis. At the time of this assessment, a number

of assumptions needed to be included and along with the lack of resources, including full health outcomes was beyond the scope of this study.

Model structure limitations

Using a decision tree as a model did allow to show the pathways in detail. However, it is difficult to handle re-occurrence, i.e. chlamydia reinfection, which is especially relevant for infectious diseases and the timing of each stage is not considered (Drummond et al., 2015). For the purpose of this analysis, a decision tree was determined to be appropriate to analyse the costs of the three chlamydia screening pathways. Further, this decision tree did not consider wider contextual factors and neglected individual behaviour (Brousselle and Lessard, 2011). Most of the pathways had two options at each chance node on how the service user would continue in the pathway. However, there were three chance nodes in the whole model, which had three options. For more than two options at a chance node in a pathway one would ideally apply a Dirichlet distribution (Briggs, Claxton and Sculpher, 2006). However, this would require more detailed outcome data and for the purpose of this analysis and consistency throughout the tree, a beta distribution was applied (Rogozińska et al., 2017). The disadvantage of applying a beta distribution for three options is that the correlation between the parameters may not be considered. It is assumed that for this model, this did not have an impact on the overall results.

Data limitations

The data was mainly limited to the proportions of services users for which multiple assumptions had to be made. In general, it was difficult to estimate the demand for the SHS, which also has been influenced by the COVID-19 pandemic and subsequent

measures, such as lockdowns. For example, the number of STI self-sampling kits issued depended on both demand and capacity, i.e., capacity of healthcare staff, and it is difficult to say, which influenced the number more without the available data. Ideally, there would have been post-COVID-19 patient data to consider outcomes.

Limitations associated with a healthcare provider perspective

The costs considered were only those for the healthcare provider and neglected broader costs incurred by the patient and society. For example, when a service user would pick up the medication from a pharmacy or they would have to travel to the SHS for a face-to-face appointment, it would involve travelling costs and costs associated with productivity loss. Guidance for the economic evaluation of public health programmes states that economic evaluations should apply a societal perspective (NICE, 2014). This may be relevant to national stakeholders but based on the findings from interviews with decision-makers, it was highlighted that it is important to differentiate between the costs directly incurred by the service provider vs. those falling on national commissioners, e.g., costs saved when preventing PID through screening of STIs.

Important factors which were not considered

Chlamydia is an infectious disease and it is recommended that when a service user is diagnosed with an STI that they inform their sex partners about the exposure to an infection so that they can be tested and/or treated; also known as partner notification (Society on Sexual Health Advisers, 2015). Further, service users who have been diagnosed ones can be reinfected and may have certain risk factors, such as regular change of sex partners. These factors, partner notification, reinfection, and risk

behaviour, were not considered in this model due to simplification reasons and time constraints. These aspects would probably affect overall results and therefore should be considered in the future.

Limitations for the dissemination of results

At this point, the model developed in TreeAge is not user friendly for decision-makers in SHS. The model could be transferred to Excel to facilitate adaptation of data to other contexts. This was mentioned as important by both groups of interview participants to facilitate the access of economic evidence.

7.6.5. Reflections

The model building process was complex and showed the difficulty and complexity to conduct a full economic evaluation of a public health programme and a SHS in particular. Besides the limitations associated with the availability of data, the current standard tools for health economists are difficult to adapt to the evidence needs for sexual health decision-makers. One additional aim was to show what the best combination of service pathways would look like, i.e., the proportions of people accessing each pathway. This was not possible due to resources and time constraints.

7.7. Conclusion

Understanding the changes in service delivery and how these impact public health and especially sexual health budgets is important to further develop SHS with a focus on effective and efficient resource allocation. This early costing model showed that OPSS was the cheapest pathway when looking at costs only. However, the face-to-face pathway had the highest net monetary benefit per patient screened. The costing

model did not account for differences in risk of infection. Since evidence suggests that there are demographic differences between those who access OPSS services and face-to-face services (for example, higher rates of use of OPSS services have been identified for white women aged between 20 to 30 years (Sumray et al., 2022)), decision-makers for SHS need to consider all pathways when planning future services to ensure that all population groups can access SHS.

CHAPTER 8
Discussion and conclusion

8.1. Introduction

This thesis aimed to understand the costs and outcomes of control programmes for STIs and HIV to generate meaningful evidence for local decision-makers in England. STI control programmes have been commissioned at the local level in England since 2013. The changes in service delivery for SHS, increased budget pressures, and evidence on low utilisation of economic evidence by public health decision-makers were the reasons this research was undertaken.

The evidence generated from this PhD research showed that

I. Economic evaluations of control programmes for STIs/HIV are mainly cost-effectiveness and cost-utility analyses using MOAs and QALYs as outcome measures respectively;
II. Decision-makers in sexual health prefer evidence on STI control programmes to include disaggregated cost data, and public health and health economics researchers would support these needs;
III. With respect to costs only, online screening is the cheapest pathway when compared with the service user accessing chlamydia screening via phone or face-to-face services, but the face-to-face pathway has the highest net monetary benefit per person screened.

This chapter revisits the objectives of this thesis and summarises the principal findings from the empirical studies, which are then synthesised and reflected on. The general strengths and limitations of the thesis are discussed, and the findings are compared with other studies. The chapter also includes an overview on what this research contributes to the literature as well as discusses the implications for economic evaluations of STI control programmes and for future research. Finally, some final reflections on the thesis are presented and the chapter ends with a general conclusion.

8.2. Overview and thesis objectives

The main aims of the thesis were to

1) Critically appraise the economic evidence of control programmes for STIs;
2) Identify decision-maker priorities for the development of economic evidence;
3) Analyse the views and recommendations of heath economists and public health researchers for the development of economic evidence in this area; and to
4) Design an economic evaluation for an STI control programme, which meets the needs of local decision-makers.

For a complete list of the objectives see Section 1.6.

This thesis aimed to answer the following research question:

How should economic evidence relating to control programmes for sexually transmitted infections be developed and collected so that it is meaningful for local decision-makers?

8.3. Summary of principal findings

The subsequent sections summarise the main findings from the three research phases.

8.3.1. Findings from the systematic review

The systematic review of economic evaluations demonstrated heterogeneity in approaches to evaluate costs and outcomes, mainly using cost-utility and cost-effectiveness analyses, for STI/HIV control programmes. The low quality of available studies along with the limited focus highlighted the need for high-quality economic evaluations to inform the commissioning of SHS.

8.3.2. Findings from the interviews

This thesis identified important areas which affected decision-making processes and how this may have influenced the current climate for delivering SHS. Decision-makers and researchers were in agreement that the changes from the 2012 Health and Social Care Act where public health services commissioning were transferred from national decision-makers to local authorities, should not be reversed. However, fragmentation of services and finances are a result of this change, which needs to be addressed in the future. Local decision-makers' needs for economic evidence relating to SHS were identified through this research. Sexual health decision-makers from an English national and local level understood economic evidence in terms of ideas relating to return on investment. Outcomes were not of a high priority to the decision-makers who were interviewed especially not those falling outside their service commissioning area, e.g., treatment of PID, which would be measured as a major outcome in a cost-effectiveness analysis. Although broader outcomes, such as impacts on inequalities

were seen as relevant, this was often overshadowed by cost and cost-saving concerns. Helpful evidence was described as being adaptable to the local population and including costs relevant to local areas.

Health economists and public health researchers in the UK recommended to consider the timing when developing economic evidence as well as the importance of understanding what outcomes are of interest to decision-makers. Timing in this case refers to the need to understand when economic evidence is particularly needed, i.e., when developing a new bid for a SHS.

8.3.3. Findings from the early economic model

The early costing model, which was developed drawing on insights from the decision-maker and researcher interviews, showed three care pathways for accessing chlamydia screening and analysed the associated costs for each pathway. The model illustrated the complexity of current care pathways as well as their changing nature, which was heightened by the COVID-19 pandemic. OPSS was found to be the cheapest pathway when looking at costs only. The face-to-face pathway had the highest net monetary benefit, which highlighted the need for caution when focusing on costs only for service planning. The findings from this thesis show that when considering costs alone, resources may be saved through the provision of online and phone services to access chlamydia testing. However, evidence suggests that those with higher rates of accessing OPSS services do not necessarily belong to the most vulnerable groups for STIs, which highlights the importance of providing a range of pathways so that different population groups can access SHS. The main results from the early economic model should be treated with caution as it is an early costing model.

In addition, a range of assumptions had to be made for some parameters and the true value of the pathways needs to be fully considered, such as in terms of service users diagnosed and successfully treated.

8.4. Synthesis and reflections on the main findings

To the knowledge of the author of this thesis, this was a first attempt to understand costs and outcomes of STI control programmes with the aim to develop economic evidence which is more meaningful for English local decision-makers. This thesis found that there is a plethora of approaches for conducting economic evaluations of STI control programmes. However, existing evidence rarely considered the local context and new modes of delivery, e.g., OPSS services. Economic evidence based on national data would be helpful to some extent for local decision-makers. Those decision-makers who expressed their views during the interviews requested disaggregated cost data to better understand budget allocations in a local resource constraint environment.

The interviews with decision-makers suggested that it was often assumed that online screening would provide a straightforward opportunity to generate cost-savings, and some national decision-makers working with local decision-makers noted that this assumption was regularly discussed among sexual health decision-makers. However, this was contested by other decision-makers and researchers who indicated that the evidence is not clear on cost and resource savings for online services. This was stated in the context that online services may create additional demand or a service user may access the SHS face-to-face in addition to having self-sampled via online services, e.g. due to insecurities regarding the result or other factors (Turner et al., 2019).

A recent study was conducted in Birmingham and found that 6% of asymptomatic patients who have used OPSS services would access face-to-face services within a 90-day period of receiving a negative STI result (Ayinde et al., 2022). This finding along with the decision-makers requesting a disaggregated cost analysis provided the rationale for an early costing model in the form of a decision tree. From the three pathways analysed, OPSS was identified as the cheapest pathway and face-to-face screening had the highest net monetary benefit. It is important to remember that not all population groups and especially vulnerable groups are equally able to access OPSS (Sumray et al., 2022). Therefore, a range of options for accessing services for STI screening should be provided. The value of the pathways for accessing chlamydia screening cannot be determined without data on outcomes. The net monetary benefit in the costing model was based on an assumed willingness to pay threshold. To determine a threshold concerning the maximum amount to be spent on SHS was also discussed by the interview participants in the decision-maker interviews (Chapter 5) as well as by Robertson et al. (2017). This shows that there may be an interest to further conduct research in this area.

The interview findings suggested that local decision-makers for SHS in England would be interested in a range of outcomes, except for QALYs. However, it was highlighted that the costs for preventing for example PID would fall on the local service provider whilst the benefits would fall on health commissioners. SHS as explained in Chapter 2 are commissioned by local authorities. However, sequelae, such as PID, and their treatment are commissioned by the NHS. Therefore, benefits when preventing PID or other sequelae as a result from a STI would fall on the NHS instead of on the local authorities.

The complexity of evaluating SHS has been demonstrated in this PhD research. This was highlighted by the decision-makers during the interviews and the fact that there are not enough tools to support decision-making. One reason relates to the epidemiology of STIs (see Table 8.1). Infectious diseases are dynamic and have interconnected transitions, feedback loops, due to reinfection, as well as may vary depending on individual and service (testing/screening) activity and other resources. Another reason for the complexity involved with evaluating SHS may be due to the organisation of SHS. The complexities consist of the variability of SHS and how they are commissioned across England, technological and commissioning changes, and the geographic fragmentation of budgets. A final aspect making the evaluation of SHS complex may be the lack of prior health economics focus in this area. To address this complexity, there needs to be further analysis on funding for services, budget flows, and commissioning responsibilities. These aspects explained above need to be considered by those evaluating SHS.

Table 8.1. List of complexities involved with SHS

Area	Complexity
STIs	- Dynamic of STIs, including re-infection.
	- Changes in sexual activity including due to technological change and impact of the COVID-19 pandemic.
	- Changes in service provision/ resources to test/ screen for STIs which may impact the number of people being diagnosed with an STI.
Organisation of SHS	- Complexity of public health programmes, which encompass prevention, screening, treatment as well as consultancy services.
	- Public health aims to improve health and reduce inequalities.
	- Diversity of service providers.
	- A variety of services are provided across England, e.g., some services provide online screening for STIs others have physical services only; some local authorities have one provider for OPSS and one provider for physical SHS, others have one provider for both.
	- Technological change leading to more opportunities to get tested, e.g., point-of-care testing, to receive notifications of test results via text message etc.
	- Fragmented commissioning as a result from the commissioning changes (2012 Health and Social Care Act): Local authorities commission SHS but NHS England does commission services for treating sequelae of STIs, such as PID as well as other services for HIV.
	- Geographic fragmentation of budgets: Public health budgets have mostly been reduced across England and this also includes budgets for SHS. There is a variation across the regions in the budgets for public health and SHS.
Lack of health economics focus	- There has been a lack of focus in health economics on this area. This again may lead to a lack of resources to explore methods for economic evaluation in this area.

This list exemplifies different aspects highlighting the complexities when evaluating SHS. This list may not be exhausted and there may be additional factors, which need to be considered.

SHS, Sexual health services; STIs, Sexually transmitted infections

Future developments for sexual health services

The past decade has substantially changed how SHS are provided due to technological change, commissioning changes, public health budget pressures, the need for integrated services, and the impact of the COVID-19 pandemic. Online screening services may lead to higher accessibility of STI/HIV screening for some populations but also may create additional barriers for other groups and contradict the main requirement for SHS to be an open door service. The research conducted suggests that commissioning of SHS by local authorities has a number of advantages, but there needs to be more harmonisation around service provision. In addition, there needs to be an agreement on budgets between local authorities, including service user access to a SHS outside of their area of residence. These changes could potentially reduce both administerial and financial pressures as well as harmonise the geographically fragmented provision of SHS.

8.5. Strengths and limitations of the thesis

Several strengths and limitations were identified for the different phases of this thesis.

8.5.1. Strengths

This thesis applied comprehensive methods to answer the main research question. It considered the economic evidence available and explored the needs of local decision-makers for SHS for economic evidence on STI control programmes. This was one of the first attempts to gain an understanding of the needs of local sexual health decision-makers for economic evidence. It highlighted the discrepancies between health economics research and the realities faced by decision-makers in SHS and the potential need for new measures and further research into this area.

The systematic review provided a detailed overview on the methods of current economic evaluations of STI/HIV control programmes by applying a robust search strategy to conduct a comprehensive literature review involving seven databases.

The main strengths of the interviews were that they were in-depth semi-structured interviews conducted with a range of sexual health decision-makers and leading health economics and public health researchers. The interview method generated a deeper understanding of the needs of sexual health decision-makers for economic evidence and provided insights into the development of economic evidence in this area. The nature of findings from qualitative research is that these are not generalisable but some of the findings may be transferable to other contexts. The reliability of the findings was also supported by comparing these to those of similar research studies.

The costing model was designed to support local decision-makers in sexual health, which was based on the findings from the interviews. By utilising disaggregated cost data and assessing different care pathways, it generated novel insights on costing of pathways for chlamydia screening. Different stakeholders were involved in the development of the costing model and the model underwent comprehensive uncertainty analyses both increasing the validity of the results.

8.5.2. Limitations

The different research phases of this thesis involved several limitations. The focus of the systematic review was on young people and research involving other high-risk groups, such as MSM, was excluded. The review therefore may have neglected other important considerations for economic evaluations for STI control programmes.

The interview participants were from the UK and preferences for economic evidence for STI control programmes may be different for decision-makers from other contexts. The participants were selected through a scoping review, via supervisor contacts and snowballing, which might have excluded some decision-makers or researchers. All interviews were conducted online or via phone, due to the restrictions following the COVID-19 pandemic. This allowed for more flexible time and place for the interview to be held, but also led to some interview recordings being of lower audio quality. In addition, by conducting the interviews remotely, some observations may have been missed. Further, using one-to-one interviews might have a limited focus. Focus groups with both national and local decision-makers for SHS could have contributed to additional findings. However, focus groups may be more challenging to organise compared to individual interviews as the commitments from participants may be difficult to align. Further, some participants may not feel comfortable to openly voice their opinion when participating in a focus group discussion.

Initially, the thesis had a broader focus on all STIs and HIV. In the economic model the focus was narrowed to one STI (chlamydia) to exemplify how a person can access screening services. Considering other STIs or HIV may change the results of the early costing model. One of the reasons to narrow the focus of the costing model was that due to the COVID-19 pandemic, the resources for developing the model were limited. The pandemic led to barriers in accessing staff as well as data. The re-deployment of healthcare personnel from SHS to other health and care services during the pandemic, resulted in limited access when conducting the interviews with sexual health decision-makers. This again led to the postponement of developing the costing model. It is crucial to recognise that the costing model was exploratory in nature, which lead to

several assumptions to allow to finalise the analysis. Although the data and pathways were informed by experts, it is still a simplification of reality and may therefore underestimate costs involved in the pathways assessed. The focus of the costing model was on young people. If the focus would have been on other risk groups, such as MSM, it may have generated different results as sexual risk may be higher than in the general young population.

Although the findings are not generalisable due to the utilisation of local data, the method may be transferrable to other contexts. Another limitation is that the early economic model is a cost analysis only and not a full economic evaluation. However, this was requested by local decision-makers for SHS. It is important to note that considering costs only should not be taken as the main argument for a decision on service provision as it does not consider the value of the different care pathways analysed. The data included in the model had a number of assumptions, which were stated clearly and were mitigated through several sensitivity analyses.

Although the PhD research did have limitations, at each stage, efforts to mitigate these limitations as best as possible were made. This included the application of a range of methods, critical reflections, and clearly stating the limitations and how these may have impacted the findings.

8.6. Comparison with other studies

Several studies have highlighted that to conduct an economic evaluation of a public health or a complex intervention is challenging (Edwards, Charles and Lloyd-Williams, 2013; Eddama and Coast, 2009; Weatherly et al., 2009). In addition, a number of

studies have shown that due to low availability and accessibility of evidence, the use of national data, and methods as well as time constraints decision-makers in general currently seem to underutilise economic evidence (Eddama and Coast, 2009; Chen, Ashcroft and Elliott, 2007). These factors were also confirmed by sexual health decision-makers in this study.

One aspect, which was recommended for public health economic evaluations from previous literature, was to consider equity aspects (Lorgelly et al., 2010; Eddama and Coast, 2009) and it is also recommended by the NICE guidelines for public health economic evaluations (NICE, 2014). However, the sexual health decision-makers who took part in the interviews for this research did not emphasise considerations of equity when discussing the use of economic evidence to support their decision-making. Their main priority was on budget pressures and potentially generating cost-savings within a short timeframe and there was less consideration of long-term outcomes. This does not mean that future economic evaluations should neglect distributional or other aspects of equity, but that this was not a priority for local sexual health decision-makers in England at the time of this research. Previous research has looked at the importance of considering equity aspects in relation to screening programmes (Cookson, Drummond and Weatherly, 2009). Since the overall aim is to increase population health, some (vulnerable) groups may be excluded from accessing certain screening programmes, which has also been discussed in this thesis. To the knowledge of the author of this thesis, there is no research available with a specific focus on economic evaluations, equity, and sexual health. This is an area which warrants for more research in the future. Methods to consider subgroups and specific vulnerable groups in economic evaluations do exist, such as distributional cost-effectiveness analysis,

and could be applied and adapted to the area of sexual health in collaboration with decision-makers (Cookson et al., 2020). In addition, the design of screening programmes should be considered to increase accessibility, e.g. using simple language and additional languages besides English for the self-sampling kit manual for OPSS.

Previous studies have highlighted the need to consider broader outcomes beyond health, such as educational attainment (Edwards, Charles and Lloyd-Williams, 2013; Marsh et al., 2012). This may be the case for national decision-makers or decision-makers for public health in a broader context. This research could not confirm the findings from previous studies concerning broader outcomes to be included in an economic evaluation. The findings from this research clearly showed an interest from decision-makers in sexual health in outcomes or benefits, which fall within the commissioning remit of local authorities and not beyond that, e.g., successful diagnosis of an STI vs. treatment of PID. With regard to QALYs as an outcome measure, previous studies have argued that this may not be appropriate for complex interventions in public health (Edwards, Charles and Lloyd-Williams, 2013; Payne, McAllister and Davies, 2013). This study confirmed that QALYs were not generally seen as relevant evidence for local sexual health decision-makers.

One review found that OPSS for STIs increased testing demand as well as access to SHS (Sumray et al., 2022). The review concluded that overall test positivity and return rate, which ranged from 48% to 78%, were low from OPSS services. The interviews with decision-makers in sexual health presented in this thesis found that with

introducing OPSS services, there was an assumption that this may free up resources elsewhere, but that there was a lack of evidence overall.

Robertson et al. (2017), have highlighted that economic evidence may be used and understood differently on a local level compared to the national level. The authors also highlighted that budgets for sexual health commissioning compete for funding with other priorities (Robertson et al., 2017). These findings are similar to the ones specifically from the decision-maker and researcher interviews presented in this thesis. The participants repeatedly stated that it would be difficult to understand the costs of sexual health programmes since budgets are fragmented and different services are commissioned by different decision-makers, e.g., HIV testing is commissioned on the local level whereas the treatment is commissioned on the national level.

8.7. Contribution to the literature and impact

This thesis has provided a unique insight into the needs of sexual health decision-makers concerning economic evidence. This study is different to the studies conducted previously, which focused on public health decision-makers more generally. It confirmed some of the findings from previous studies but also highlighted differences between the needs of public health and sexual health decision-makers. It provided a unique insight into what researchers think is useful when developing economic evidence and showed similarities and differences for priorities from a decision-maker as well as from a researcher perspective. The findings were then applied to develop an early costing model, which allowed for timely production of evidence and the comparison of three pathways to access chlamydia screening,

focusing on costs. This did fulfil the requirements of sexual health decision-makers as they were interested in a disaggregated cost analysis. The least costly pathway for chlamydia screening was shown to be the OPSS pathway. Simultaneously, the face-to-face pathway had the highest net monetary benefit per person screened. It should be noted however, that more data on outcomes would be needed to fully evaluate the value of the different pathways.

8.7.1. Dissemination of findings

The key findings of this PhD research were presented to a group of national commissioners in June 2022. The group was particularly interested in the results of the interviews with sexual health decision-makers and views on value for money in the context of delivering SHS.

The audience provided feedback on the model and the fact that a cost analysis does not reflect the actual value of the service provided. The audience showed an interest in the cost per diagnosis results as this would reflect the value of the service more than cost per patient screened. Another point mentioned was that it would be important to consider who is accessing online services as for example those with no access to the internet, low digital literacy or physical disabilities and mental health issues may be less able to access such services.

Finally, the discussion with national commissioners confirmed the challenges associated with conducting an economic evaluation in this area due to the complexity of pathways, costs involved, and limitations in data availability.

The following section provides several recommendations on what to consider when conducting economic evaluations of STI control programmes.

8.8. Recommendations for economic evaluations of STI control programmes

Based on the findings of this thesis, there are several aspects to consider when conducting an economic evaluation for SHS. A summary of the recommendations is presented in Figure 8.1. When beginning an economic evaluation, it is recommended to work closely with the decision-makers from the start. This is to ensure that the decision-makers' objectives for the evaluation are understood and that the timing for when the evidence needs to be delivered is agreed. The person conducting the economic evaluation needs to ensure that timely evidence can be delivered, and balance this against data availability and data quality. The economic evaluation should include disaggregated cost data to ensure that the context of the SHS is considered and explore a range of outcomes.

This research also suggests that there needs to be careful consideration around outcome measures for economic evaluations to allow for a comparison of different health interventions in this area. QALYs are often viewed as appropriate outcome measures in standard economic evaluations. However, this PhD research has shown that QALYs and other outcome measures may have important limitations in this context. In addition, due to the fragmented system for the provision of SHS, many health outcomes would fall on the English NHS instead of on those with local commissioning responsibilities. Therefore, future economic evaluations, which aim to inform English sexual health decision-makers, should consider outcomes carefully.

There has been a movement towards integrated care systems, which would align budgetary responsibilities within the system (NHS England, 2022). Integrated care systems may therefore influence sexual health decision-makers' preferences for outcomes to be included in economic evaluations in the future.

- There should be a close collaboration between a person conducting the economic evaluation and decision-makers from the start;
- It should be ensured that the delivery of evidence is timely, and this should be balanced against data availability and quality;
- The economic evaluation should include disaggregated cost and outcome data;
- Economic evaluations should explore a range of outcome measures.

Figure 8.1. List of recommendations for economic evaluations of STI control programmes.

8.9. Future research recommendations

There are three main domains where future research could contribute to further develop methods for economic evaluations of STI control programmes to make these more meaningful to decision-makers in England.

First, it would be appropriate to further explore which outcome measures local decision-makers for SHS are interested in. This could be done by conducting a series of focus group discussions. The focus groups could consist of health economists and public health researchers as well as sexual health decision-makers from national, regional and local levels. This would allow the participants to generate a better mutual

understanding between researchers and decision-makers, especially those who need to manage budgets for SHS at the local level. The aim would be to generate a shared understanding of priorities for outcome measurements.

Second, further research could be undertaken on appropriate methods for economic evaluation. The costing model developed for this PhD research presents an example of a collaboration with a local SHS and could be expanded further. The fragmentation of current systems and the inclusion of a range of short- and long-term outcomes would need to be part of this work. There is a general need for more economic evaluations in this area to explore a range of methods to examine the value of interventions and care pathways.

Third, as explained above, it is important that a choice of pathways for accessing STI/HIV screening is available. In order to understand the best mix of services, further research would need to be undertaken to identify the preferences and barriers for different population groups in terms of different pathways for accessing screening. In addition, economic evaluations would need to be undertaken which incorporate distributional aspects when considering the optimum use of available resources.

8.9.1 Next steps

This research showcased the difficulties associated with evaluating SHS and warrants further exploration of methods to assess the costs and outcomes associated with control programmes for STIs in England. The costing model produced for this PhD research could be further explored in the context of service provision across different local authorities. It would require some adaptation for other local authorities but may

be relevant in similar contexts. The work presented here to illustrate the costs could also feed into a cost-effectiveness model at a later stage. A fuller economic evaluation would require updated data and consideration of longer-term outcomes.

8.10. Final reflections

The process to develop this thesis involved three literature reviews (one systematic and two scoping reviews as part of the interview preparations) and led to very fruitful and interesting discussions with researchers in public health and health economics as well as sexual health decision-makers across England. The need to better understand costs and outcomes of STI control programmes due to increasing diagnoses, demand for services, and budgetary pressures was recognised by the stakeholders. Whilst budget pressures for local sexual health decision-makers are a reality and OPSS services seem to be an attractive alternative to save costs, it is important that online services are not viewed as a solution for all, but as a valuable addition to existing pathways for accessing STI/HIV screening and testing. A hybrid SHS model allows for service users to choose the most appropriate pathway for them to access screening. The COVID-19 pandemic contributed to increased health literacy in self-sampling and self-testing. This is a momentum, which may be utilised by SHS to further promote self-sampling whilst ensuring to leave no one behind who may be struggling to access online services.

8.11. Conclusion

This thesis assessed the previous literature on economic evaluations of STI control programmes and found that these had important limitations as the studies rarely considered the context of decision-making for SHS. The qualitative interviews highlighted the priorities of local decision-makers for evidence in this area, alongside the views and experiences of those involved in producing such evidence. Sexual health decision-makers were interested in evidence, which included local data and had a focus on cost aspects. Researchers in health economics and public health recommended to apply a disaggregated approach whilst stressing the importance to understand decision-makers' needs. The research demonstrated that conducting economic evaluations of public health programmes, such as STI control programmes, is complex. An example of a costing analysis for face-to-face, online and phone pathways to access chlamydia screening was produced to try to more closely meet the requirements of local decision-makers for SHS. The research suggests that there is a need to further explore methods to assess the costs and outcomes associated with control programmes for STIs in England to allow for comparisons of values across health programmes whilst working at a policy level to harmonise commissioning of SHS and budgets, as well as ensuring access to STI and HIV screening for all.

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Appendices

Chapter 4 Appendices

Appendix 4.1. Systematic review publication

Review

Assessing the costs and outcomes of control programmes for sexually transmitted infections: a systematic review of economic evaluations

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Abstract

Objective To identify economic evaluations of interventions to control STIs and HIV targeting young people, and to assess how costs and outcomes are measured in these studies.

Design Systematic review.

Data sources Seven databases were searched (Medline (Ovid), EMBASE (Ovid), Web of Science, PsycINFO, NHS Economic Evaluation Database, NHS Health Technology Assessment and Database of Abstracts of Reviews of Effects) from January 1999 to April 2019. Key search terms were STIs (chlamydia, gonorrhoea, syphilis) and HIV, cost benefit, cost utility, economic evaluation, public health, screening, testing and control.

Review methods Studies were included that measured costs and outcomes to inform an economic evaluation of any programme to control STIs and HIV targeting individuals predominantly below 30 years of age at risk of, or affected by, one or multiple STIs and/or HIV in Organisation for Economic Co-operation and Development countries. Data were extracted and tabulated and included study results and characteristics of economic evaluations. Study quality was assessed using the Philips and BMJ checklists. Results were synthesised narratively.

Results 9530 records were screened and categorised. Of these, 31 were included for data extraction and critical appraisal. The majority of studies assessed the cost-effectiveness or cost-utility of screening interventions for chlamydia from a provider perspective. The main outcome measures were major outcomes averted and quality-adjusted life years. Studies evaluated direct medical costs, for example, programme costs and 11 included indirect costs, such as productivity losses. The study designs were predominantly model-based with significant heterogeneity between the models.

Discussion/Conclusion None of the economic evaluations encompassed aspects of equity or context, which are highly relevant to sexual health decision-makers. The review demonstrated heterogeneity in approaches to evaluate costs and outcomes for STI/HIV control programmes. The low quality of available studies along with the limited focus, that is, almost all studies relate to chlamydia, highlight the need for high-quality economic evaluations to inform the commissioning of sexual health services.

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Appendix 4.2. Search strategy for the systematic review of economic evaluations for control programmes of STIs/HIV (chapter 4)

4.2.1. Search strategy in MEDLINE database

The original search strategy, which was developed for the MEDLINE database in Ovid, is presented in this section. The first five search terms refer to the sexual health context. The terms seven to twelve concentrate on economic evaluations, and the final five are search terms relating to public health and STI control.

Database: Ovid MEDLINE(R) and In-Process & Other Non-Indexed Citations 1946 to April 08, 2019.

#	Searches	Results
1	sexually transmitted diseases/ or *sexually transmitted diseases, bacterial/ or STDs.mp. or sexually transmitted infections.mp. or STIs.mp. or sexually transmissible disease.mp. or sexually transmissible infection.mp. or sexually transmitted disorder.mp. or sexually transmissible disorder.mp.	31,588
2	chlamydia.mp. or exp Chlamydia/ or chlamydia infections.mp.	28,331
3	gonorrh?ea.mp. or exp Gonorrhea/ or neisseria gonorrhoeae.mp.	23,504
4	syphilis.mp. or exp Syphilis/ or treponema pallidum.mp.	37,116
5	human immunodeficiency virus.mp. or exp Human Immunodeficiency Virus/ or HIV.mp.	342,150
6	1 or 2 or 3 or 4 or 5	428,119
7	exp "costs and cost analysis"/ or exp Health Care Costs/	222,777
8	exp Cost Benefit Analysis/	75,712
9	quality-adjusted life year$.ti,ab,kw. or exp Quality-Adjusted Life Years/	15,722
10	(cost$ adj2 (effective$ or utilit$ or benefit$ or consequence$ or minimi$)).ti,ab,kw.	140,559
11	(decision adj (analy$ or model$ or tree$)).ti,ab,kw.	15,195
12	economic evaluation$.ti,ab,kw.	10,744
13	7 or 8 or 9 or 10 or 11 or 12	326,148
14	public health.mp. or Public Health/	281,942
15	screen$.ti,ab,kw.	661,235
16	diagnostic tests.ti,ab,kw. or Diagnostic Tests, Routine/	30,135
17	Mass screening.ti,ab,kw.	5707
18	diagnosis.ti,ab,kw. or Diagnosis/	1,379,040
19	14 or 15 or 16 or 17 or 18	2,230,991
20	6 and 13 and 19	2,977
21	limit 20 to humans	2,721
22	limit 21 to yr="1999 -Current"	2,113

4.2.2. Search Strategy in Embase in Ovid, 1974 to 2019 March 22

#	Searches	Results
1	sexually transmitted diseases/ or *sexually transmitted diseases, bacterial/ or STDs.mp. or sexually transmitted infections.mp. or STIs.mp. or sexually transmissible disease.mp. or sexually transmissible infection.mp. or sexually transmitted disorder.mp. or sexually transmissible disorder.mp.	33600
2	chlamydia.mp. or exp Chlamydia/ or chlamydia infections.mp.	35858
3	gonorrh?ea.mp. or exp gonorrhea/ or neisseria gonorrhoeae.mp.	28371
4	syphilis.mp. or exp syphilis/ or treponema pallidum.mp.	31840
5	(Human immunodeficiency virus or hiv).mp. or exp Human immunodeficiency virus/	466292
6	1 or 2 or 3 or 4 or 5	544055
7	economic evaluation$.ti,ab,kw.	15928
8	exp "cost and cost analysis"/ or exp "health care cost"/	272135
9	exp "cost benefit analysis"/	80091
10	quality-adjusted life year$.ti,ab,kw. or exp quality adjusted life year/	25952
11	(cost$ adj2 (effective$ or utilit$ or benefit$ or consequence$ or minimi$)).ti,ab,kw.	198970
12	(decision adj (analy$ or model$ or tree$)).ti,ab,kw.	23298
13	7 or 8 or 9 or 10 or 11 or 12	495844
14	public health.mp. or Public Health/	390358
15	mass screening.ti,ab,kw.	7639
16	diagnosis.ti,ab,kw. or Diagnosis/	2742537
17	diagnostic test$.ti,ab,kw. or diagnostic test, routine/	60106
18	screening.ti,ab,kw.	667269
19	14 or 15 or 16 or 17 or 18	3642722
20	6 and 13 and 19	5332
21	limit 20 to human	4819
22	limit 21 to yr="1999 -Current"	4312

4.2.3. Search strategy in Web of Science

Set	Results	Search string
# 20	2,544	#19 AND #13 AND #6 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 19	1,990,470	#18 OR #17 OR #16 OR #15 OR #14 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 18	1,184,140	TS=(diagnosis) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 17	3,748	TS=("mass screening") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 16	18,819	TS=(("diagnostic tests") OR ("diagnostic tests, routine")) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 15	717,402	TS=(screen*) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 14	190,413	TS=("public health") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 13	298,583	#12 OR #11 OR #10 OR #9 OR #8 OR #7 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 12	46,094	TS=(("decision analy*") OR ("decision model*") OR ("decision tree*")) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 11	228,029	TS=(("cost* effective*") OR ("cost* utilit*") OR ("cost* benefit*") OR ("cost* consequence*") OR ("cost* minimi*")) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 10	9,656	TS=("Quality-Adjusted Life Year$") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 9	10,238	TS=("Cost Benefit Analysis") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 8	25,089	TS=((costs AND "cost analysis") OR ("Health Care Costs")) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019

# 7	18,567	TS=("economic evaluation$") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 6	330,271	#5 OR #4 OR #3 OR #2 OR #1 Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 5	294,545	TS=("Human Immunodeficiency Virus" OR HIV) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 4	10,387	TS=(Syphilis OR "Treponoma Pallidum") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 3	8,060	TS=(Gonorrh?ea OR "Neisseria Gonorrhoeae") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 2	21,282	TS=(Chlamydia OR "Chlamydia Infections" OR "Chlamydia Trachomatis") Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019
# 1	22,046	TS=("sexually transmitted diseases" OR "sexually transmitted infections" OR "sexually transmissible disease" OR "sexually transmissible infection" OR "sexually transmitted disorder" OR "sexually transmissible disorder" OR STIs OR STDs) Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan=1999-2019

4.2.4. Search in NHS EED (including HTA)

Figure 1 shows 72 hits for literature including the search terms ‘sexually transmitted disease’, ‘economic evaluation’, and ‘screening’ in NHS EED and HTA.

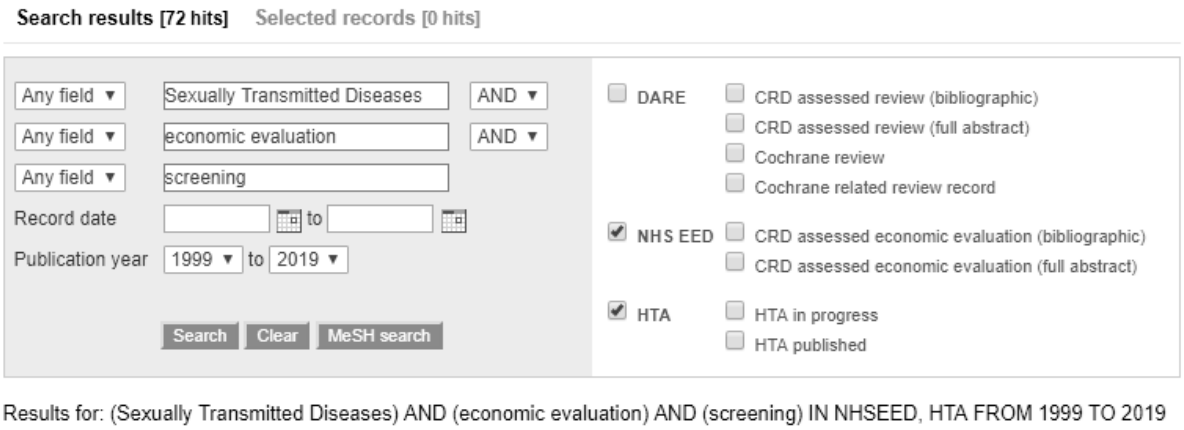

Figure 1: Results of literature search around screening in NHS EED and HTA.

Figure 2 shows 42 hits for literature including the search terms ‘sexually transmitted disease’, ‘economic evaluation’, and ‘testing’ in NHS EED and HTA.

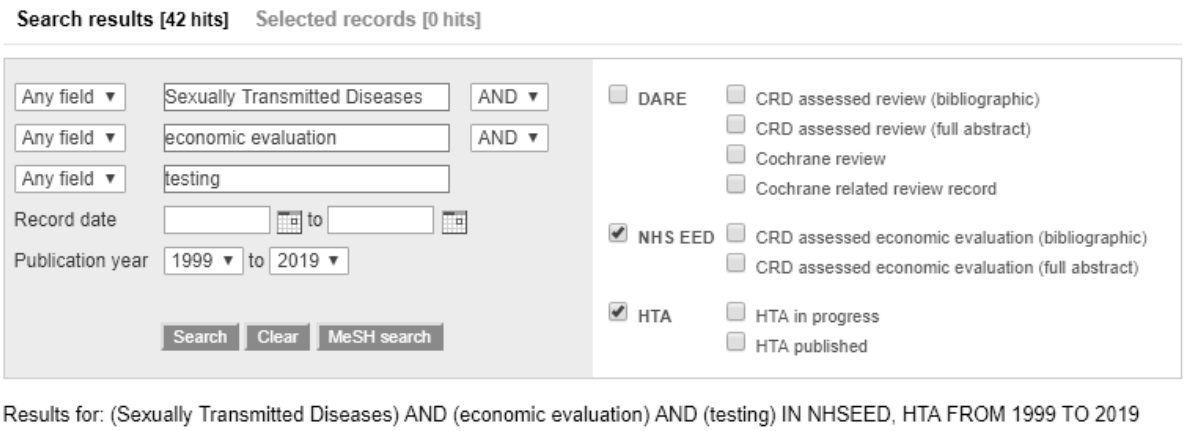

Figure 2: Results of literature search around testing in NHS EED and HTA.

4.2.5. Search in NHS DARE

There were 0 hits when searching for ‘testing’ or ‘screening’ of sexually transmitted diseases and economic evaluations in NHS DARE.

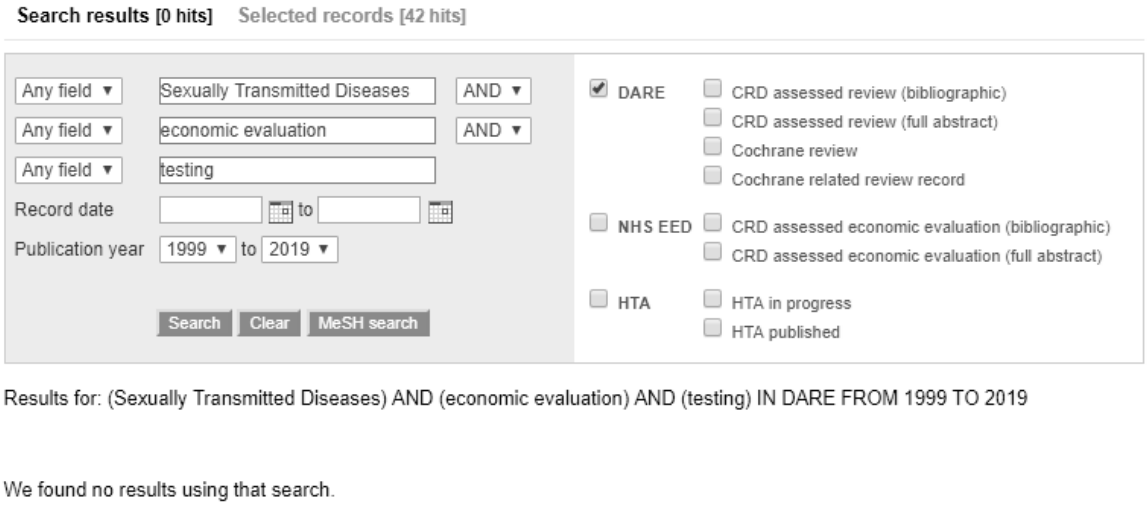

Figure 1: NHS DARE results for testing or screening of sexually transmitted diseases and economic evaluations.

One search was conducted in NHS DARE including only ‘sexually transmitted diseases’ and ‘economic evaluations’ which resulted in one record.

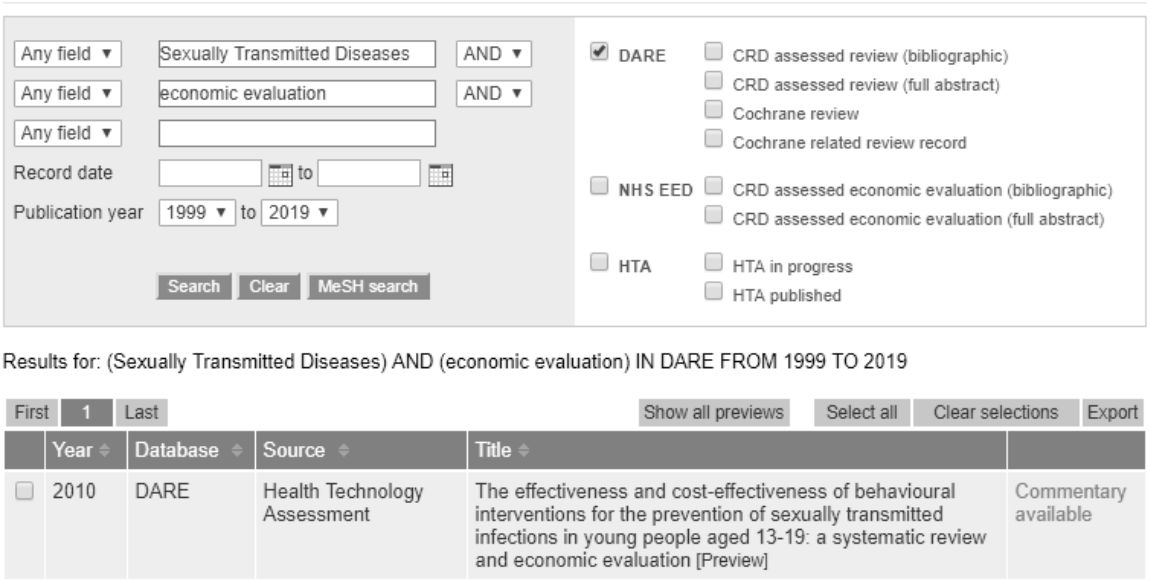

Figure 2: NHS DARE results for sexually transmitted diseases and economic evaluations.

4.2.6. Search in PsycInfo

Database(s): PsycINFO in Ovid, 1967 to March Week 3 2019

#	Searches	Results
1	exp Sexually Transmitted Diseases/	43707
2	exp HIV TESTING/ or exp HIV/ or HIV.mp.	53781
3	chlamydia.mp.	866
4	gonorrh?ea.mp. or exp GONORRHEA/ or neisseria gonorrhoeae.mp.	718
5	(syphilis or treponema pallidum).mp.	1210
6	1 or 2 or 3 or 4 or 5	56547
7	economic evaluation$.mp.	1669
8	(exp Costs/ and Cost Analysis/) or exp Health Care Costs/ or exp Health Care Economics/	9966
9	cost benefit analysis.mp.	985
10	quality-adjusted life year?.mp. or exp quality of life/	40292
11	((cost$ adj2 effective$) or (cost$ adj2 utilit$) or (cost$ adj2 benefit$) or (cost$ adj2 consequence$) or (cost$ adj2 minimi$)).mp.	23294
12	((decision adj analy$) or (decision adj model$) or (decision adj tree$)).mp.	3793
13	7 or 8 or 9 or 10 or 11 or 12	73081
14	public health.mp. or Public Health/	48565
15	screen$.mp.	106910
16	diagnostic test.mp. or Medical Diagnosis/	9531
17	mass screening.mp.	148
18	diagnosis.mp. or diagnosis/	178265
19	14 or 15 or 16 or 17 or 18	314928
20	6 and 13 and 19	483
21	limit 20 to human	473
22	limit 21 to yr="1999 -Current"	439

4.2.7. Search in BASHH/NICE

Both databases of the British Association for Sexual Health and HIV (BASHH) and the National Institute for Health and Care Excellence (NICE) were searched for “economic evaluation screening sexually transmitted diseases” which delivered eight records.

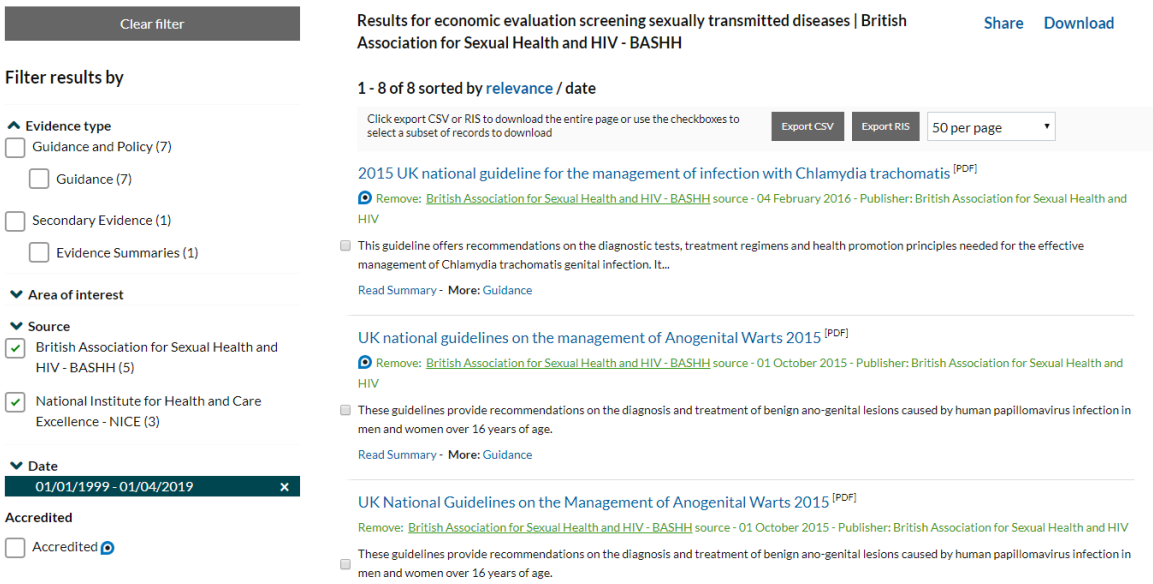

Figure 1: Search in NICE and BASHH databases

Appendix 4.3. List of data extraction categories

1 Lead author, year
2 Country
3 Sample size, patient population
4 Demographics (ethnicity, age, area, spectrum of risk)
5 Evaluation aims
6 Prevalence of infection
7 Reported risk level (high, medium, low)
8 Intervention focus (testing, screening)
9 Infections included (chlamydia, gonorrhoea, syphilis, HIV)
10 Outcomes (life-years gained, QALY, MOA, monetary outcome, other)
11 Perspective
12 Type of economic evaluation
13 Model/trial based
14 Time period
15 Comparator
16 Costs included
17 Discounting/year
18 Primary/secondary data
19 Information presented about the outcomes (literature, trial/intervention, clinic/patient database)
20 Information presented about the costs (literature, trial/intervention, clinic/patient database)
21 Costing approach (bottom up, broad)
22 Sensitivity analysis (univariate, threshold, multivariate, scenario / probabilistic)
23 Results
24 Funder of intervention
25 Limitations

Appendix 4.4. Critical appraisal of modelling studies using Philips checklist

(Philips et al., 2004)

Author (year)	Structure 1-3 (statement of decision, problem, objective; scope/perspective; rationale)	Structure 4-6 (assumptions; comparators; model type)	Structure 7 (time horizon)	Structure 8 (disease pathways)	Structure 9 (cycle length)	Data 1 (identification)	Data 2 & 2a (data modelling; baseline data justified)	Data 2b, 2c, 2d (treatment effects; costs justified; QoL weights)	Data 3 (incorporation)	Data 4 (uncertainty assessment)	Data 4a-4d (methodological; structural; heterogeneity; parameter)	Consistency 1 & 2 (internal & external)
Eckman (2021)	✓,✓,✓	✓,✓,✓	X	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,X, ✓,✓	X, ✓
Stoecker (2021)	✓,✓,✓	✓,✓,✓	✓	✓	✓	✓	✓,✓	✓,✓,X	✓	✓	X,X,X,✓	X, ✓
Looker (2019)	✓,✓,✓	✓,✓,NA	✓	✓	NA	✓	✓,✓	NA, ✓,NA	✓	✓	X,X,X,✓	X,X
Neilan (2018)	✓,✓,X	✓,✓,X	✓	✓	X	✓/X	X/✓,✓	✓,X,NA	X	✓	X,✓,✓,✓	X, ✓
Owusu-Edusei (2016)	✓,✓,✓	✓,✓,✓	✓	✓	X	✓	✓,✓	✓,✓,✓	✓	✓	X,✓,✓,✓	✓,✓
de Wit (2015)	✓,✓,✓	✓,✓,✓	✓/X	✓	X	✓	✓,✓	✓,✓,✓/X	✓	✓	X,✓,✓,✓	✓,✓
Teng (2015)	✓,✓,✓	✓,✓,✓	✓/X	✓/X	X	X	✓,X	✓,✓/X,X, NA	✓/X	X	X,X,X,X	X,NA
Gillespie (2012)	✓,✓,✓	✓,✓,✓	✓	NA	X	✓	✓,✓	NA,✓,X	✓	✓	X,X,X,✓	✓,X
Huang (2011)	✓,✓/X,✓/X	✓,✓,X	✓	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,✓,X,✓	X,X
Turner (2011)	✓,✓,X	✓,✓,✓	NA	NA	NA	✓	✓,✓	✓,✓,NA	✓	✓	X,✓,X,✓	✓,✓
de Vries (2008)	✓,✓/X,✓	✓,✓,✓	✓	✓	X	✓	✓/X,✓	✓/X,✓,✓	✓	✓/X	X,X,X,X	X,X
Gift (2008)	✓,✓/X,✓	✓,✓,✓/X	✓	✓	X	✓	✓,✓	✓/X,✓,✓	✓	✓	X,✓,✓,✓	X,X
Adams (2007)	✓,✓/X,✓/X	✓,✓,✓/X	✓/X	✓	X	✓/X	✓,✓/X	✓/X,X,X	✓/X	✓	X,✓,✓,✓	X,✓
Low (2007)	✓,X,✓	✓,✓,✓	✓	✓/X	X	✓	✓,✓	✓,✓,NA	✓	✓	X,✓,X,✓	X,✓
Andersen (2006)	✓,✓/X,✓	✓,✓,✓	✓/X	✓	X	✓	✓,✓	✓/X,✓,NA	✓	✓	X,X,✓,✓	X,X

Bernstein (2006)	✓,✓/X,✓	✓,✓,✓	✓/X	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,X,✓,✓	X,NA
de Vries (2006)	✓,✓/X,✓	✓,X,✓	✓	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,X,✓,✓	X,X
Evenden (2006)	✓,X,✓	X,✓,✓	✓/X	✓	X	✓/X	✓,X	✓/X,X,NA	✓/X	✓	X,X,✓,✓	X,X
Walleser (2006)	✓,✓,✓	✓,✓,✓	✓/X	✓	✓	✓	✓,✓	✓,✓,✓	✓	✓	X,X,X,✓	X,NA
Aledort (2005)	✓,✓/X,✓	✓,✓,X	✓/X	✓	✓	✓	✓,✓	✓,✓,✓/X	✓	✓	X,X,✓,✓	X,X
Evenden (2005)	✓,X,✓	✓,✓,✓	✓/X	✓	X	✓/X	✓,✓	✓/X,X,NA	X/✓	✓	X,X,✓,✓	X,X
Gift (2005)	✓,✓/X,✓	✓,✓,✓	✓	✓	X	✓	✓/X,✓	✓,✓,NA	✓	✓	X,✓,X,✓	X,X
Hu (2004)	✓,✓/X,✓/X	✓,✓,X	✓	✓	✓	✓	✓,X	✓/X,✓,✓	✓	✓	X,✓,X,✓	X,✓
Norman (2004)	✓,✓,X	X,✓,X	X	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,X,✓,✓	X,✓
Novak (2004)	✓,✓,X	✓,✓,X	X	✓	X	✓	X,✓	✓,✓,NA	✓	✓	X,X,X,✓	X,NA
Tao (2004)	✓,✓,✓	✓,✓,✓	✓/X	✓	X	✓	✓,X	✓/X,✓,NA	✓	✓	X,X,✓,✓	X,X
van Bergen (2004)	✓,✓,✓	✓,✓,✓	✓/X	✓	X	✓	✓,✓	✓,✓,NA	✓	X	X,X,✓,✓/X	X,✓
Gift (2002)	✓,✓,✓/X	✓,✓,✓/X	✓	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,✓,X,✓	X,X
Mehta (2002)	✓,✓,✓/X	✓,✓,X	✓/X	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,✓,X,✓	✓,NA
van Valkengoed (2001)	✓,✓,✓	✓,✓,✓	✓	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,✓,✓,✓	X,NA
Postma (2000)	✓,✓/X,✓	✓,✓,✓/X	✓	✓	X	✓	✓,✓	✓,✓,NA	✓	✓	X,X,✓,✓	X,✓
Townshend (2000)	✓,✓,✓	✓,✓/X,✓	✓	✓	X	✓	✓,X	✓,✓,NA	✓	✓	X,X,✓,✓	X,X
Welte (2000)	✓,✓,✓	✓,✓,✓	✓/X	✓	X	✓	✓,✓	✓,✓,X	✓	✓	X,✓,✓,✓	X,X

✓, Done; ✓/X, To some extent completed; X, Not reported; NA, Not applicable

Appendix 4.5. Critical appraisal of trial-based studies

(Drummond and Jefferson, 1996)

Critical appraisal of trial-based studies. Complete checklist (1/3)

	Study design (includes sections 1 to 3 from in text table)							Data collection (includes sections 4 to 7 from in text table)				
Author (year)	**(1) Research question stated**	**(2) Economic importance of research question stated**	**(3) Viewpoints of analysis stated & justified**	**(4) Rationale for choosing alternative programmes compared stated**	**(5) Alternatives being compared described**	**(6) Form of economic evaluation used stated**	**(7) Choice of economic evaluation form justified in relation to the question addressed**	**(8) Sources of effectiveness estimates used stated**	**(9) Details of design & results of effectiveness study given (single study)**	**(10) Details of synthesis method/meta-analysis given (multiple studies)**	**(11) Primary outcome measures stated**	**(12) Methods to value health states & benefits are stated**
Jackson (2015)	X (aim stated)	X	✓	✓/X	✓	✓	✓/X	✓	✓	NA	✓	NA

✓, Done; ✓/X, To some extent completed; X, Not reported; NA, Not applicable

Critical appraisal of trial based studies. Complete checklist cont. (2/3)

	Data collection (includes sections 4 to 7 from in text table)									Analysis and interpretation of results (includes sections 8 to 10 from in text table)		
Author (year)	**(13) Details of the subjects from whom valuations were obtained given**	**(14) Productivity changes (if included) reported separately**	**(15) Relevance of productivity changes to RQ discussed**	**(16) Quantities of resources separate from their unit costs**	**(17) Methods for estimation of quantities & unit costs described**	**(18) Currency & price data are recorded**	**(19) Details of currency/price adjustments for inflation/currency conversion given**	**(20) Details of any model used given**	**(21) Model choice & key parameters on which it is based justified**	**(22) Time horizon of costs & benefits stated**	**(23) Discount rate stated**	**(24) Choice of rate justified**
Jackson (2015)	NA	NA (done in SA)	✓	✓	✓	✓ (UK £ 2012/2013)	NA (intervention less than 1 year)	✓	✓	NA	NA	NA

✓, Done; ✓/X, To some extent completed; X, Not reported; NA, Not applicable

Critical appraisal of trial based studies. Complete checklist cont. (3/3)

	Analysis and interpretation of results (includes sections 8 to 10 from in text table)										
Author (year)	**(25) Explanation if costs/benefits not discounted**	**(26) Details of statistical tests & confidence intervals given for stochastic data**	**(27) Sensitivity analysis approach given**	**(28) Choice of variables for sensitivity analysis justified**	**(29) Ranges over which variables are varied stated**	**(30) Relevant alternatives compared**	**(31) Incremental analysis reported**	**(32) Major outcomes presented in a disaggregated & aggregated form**	**(33) Answer to research question given**	**(34) Conclusions follow from data reported**	**(35) Conclusions are accompanied by appropriate caveats**
Jackson (2015)	NA	NA	✓	✓/X	✓	✓	NA	✓	✓	✓	✓

✓, Done; ✓/X, To some extent completed; X, Not reported; NA, Not applicable

Chapter 5 Appendices

Appendix 5.1. Ethical approval: Interviews with decision-makers and researchers

Re: "Perspectives on decision-making processes in a sexual health context: How is economic evidence understood and applied by national and local stakeholders."
Application for Ethical Review ERN_19-0714

Thank you for your application for ethical review for the above project, which was reviewed by the Science, Technology, Engineering and Mathematics Ethical Review Committee.

On behalf of the Committee, I confirm that this study now has full ethical approval.

Whilst working on this project please ensure you follow the University's community visit guidelines when appropriate https://intranet.birmingham.ac.uk/hr/documents/public/hsu/hsuguidance/20cv.pdf

I would like to remind you that any substantive changes to the nature of the study as described in the Application for Ethical Review, and/or any adverse events occurring during the study should be promptly brought to the Committee's attention by the Principal Investigator and may necessitate further ethical review.

Please also ensure that the relevant requirements within the University's Code of Practice for Research and the information and guidance provided on the University's ethics webpages (available at https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Links-and-Resources.aspx) are adhered to and referred to in any future applications for ethical review. It is now a requirement on the revised application form (https://intranet.birmingham.ac.uk/finance/accounting/Research-Support-Group/Research-Ethics/Ethical-Review-Forms.aspx) to confirm that this guidance has been consulted and is understood, and that it has been taken into account when completing your application for ethical review.

Please be aware that whilst Health and Safety (H&S) issues may be considered during the ethical review process, you are still required to follow the University's guidance on H&S and to ensure that H&S risk assessments have been carried out as appropriate. For further information about this, please contact your School H&S representative or the University's H&S Unit at healthandsafety@contacts.bham.ac.uk.

Best wishes,

Research Support Group
C Block Dome (room 132)
Aston Webb Building
University of Birmingham
Edgbaston B15 2TT

Please remember to submit a new Self-Assessment Form for each new project. Click Ethical Review Process for further details regarding the University's Ethical Review process.

Appendix 5.2. Consent form for interviews

Consent Form

UNIVERSITY OF BIRMINGHAM

Location: _____
Participant identification number:_____

Project title: Understanding the application of economic evidence and potential suggestions for improvements in sexual health decision-making.

Researcher: Sonja Bloch

	Please initial box:
1. I hereby confirm that I have read the participant information sheet, dated _____, that I have had the opportunity to as questions and had these answered to my satisfaction.	☐
2. I understand that participation is voluntary and that I am free to withdraw at any time during the research interview.	☐
3. I understand that following the research interview I will have a two-week period for reflection. Up until this time, I may contact the researcher to withdraw my interview entirely or in part, without providing any reasons.	☐
4. I consent that the interview will be audio recorded.	☐
5. I consent to my anonymised data being looked at by the research team and relevant others at the University of Birmingham. This is to ensure a fair analysis and that the data is reasonably represented.	☐
6. I understand that direct quotes from my interview may be published in any write-up of the data, and used for training purposes, but that my name or that of others will not be attributed to this and that I and others will not be identifiable from this quote.	☐
7. I understand that part of my organisation may be described and published in any write-up of the data, and used for training purposes, but that my name or that of others will not be attributed to this and that I and others will not be identifiable from this.	☐
8. Please tick this box if you would like to receive feedback about the study results. This will be in the form of a general summary and a link to any further information online.	☐
9. I consent to take part in this above study.	☐

_____	_____	_____
Name of participant	Date	Signature
_____	_____	_____
Name of researcher	Date	Signature

Contact information: Sonja Bloch; E-Mail: s.bloch Phone: 0121

Appendix 5.3. Information leaflets for decision-maker interviews

Page 1

The role of economic evidence in decision-making.

What do you understand as economic evidence and when do you apply it when making decisions?

We would like to invite you to participate in a research study exploring stakeholders' views on economic evidence for public health programmes.

Please take time to read this information leaflet carefully.

UNIVERSITY OF BIRMINGHAM

Who is funding this study?

This study is funded by the NHS.

Who is the research team?

This study is being conducted by Sonja Bloch who is a doctoral researcher at the University of Birmingham. Sonja Bloch and her research supervisors, Dr Louise Jackson, Prof Emma Frew and Prof Jonathan Ross, are interested in understanding and developing approaches for evaluating costs and outcomes of sexual health programmes with a particular focus on the control of sexually transmitted infections.

What is the purpose of this study?

We would like you to be part of a one-to-one interview to gain insight on your views on economic evidence and how helpful it is in a sexual health context. In addition, we are interested in your suggestions on how current economic evidence for sexual health programmes could be improved. The goal is that the information developed through this research will be useful for local decision-making and therefore, for you as a stakeholder.

Who is taking part in the study?

A variety of stakeholders will take part in this study. These include participants from different parts of the UK government and health system including at both national and local levels.
For example this includes: Public Health England, clinical commissioning groups (CCGs), and local authorities, public health providers, and clinicians.

What do you need to do during the interview?

During the interview, we will be asking you to share how you make decisions. We are interested in how you source, and what type of evidence you use to help inform decision-making processes. We would appreciate suggestions on how to improve economic evidence to make it more appropriate to your context and aims in decision-making. The interview will take around 30 minutes to one hour and a summary of the findings will be found at: www.birmingham.ac.uk.

Location
The location of the interview is flexible and is determined by your preference. In general, it should be a room where you feel comfortable and where we can have an undisturbed meeting.

We also have the opportunity to meet at the University of Birmingham.

Confidentiality
The interviews will be audio recorded and transcribed by the main researcher, Sonja Bloch. Your personal information will be treated confidentially and you will not be named in any publications that result from this work. We will make sure that you and your organisation will not be identifiable in any outputs. All data will be kept secure on University of Birmingham servers in compliance with the Data Protection Act 2018.

Thank you for taking time to read this Participant Information Sheet. If you have any further questions, please do not hesitate to contact the main researcher, Sonja Bloch.

Researcher contact details:

Sonja Bloch
s.bloch@...
Health Economics Unit, University of Birmingham, B15 2TT
Birmingham
Phone: 0121...

Supervisor:
Dr Louise Jackson
l.jackon.1@...

UNIVERSITY OF BIRMINGHAM

Appendix 5.4. Interview guide for decision-maker interviews

Interview guide

Introduction

- Introduce myself and my background
- Interview can be stopped at any point
- Withdraw from the study up to two weeks post interview;
- I would advise you not to disclose any personal information such as names during the interview;
- How much time do you have today?

(in case participant has not given consent yet via email/scanned consent form – provide the consent form or orally agree when starting the recording)

Start recording

Venue:

Interviewer:

Participant ID:

Participant role in organisation:

Date/time of interview:

Block 1: General questions and sexual health service commissioning

Introduction

Could you shortly introduce yourself, background, (what does your organisation do, and your role within the team?)

- (About role of organisation; Can you tell me a little bit about your organisation? Role of interviewee; since when are you working here? Could you describe your particular role?)

Decision-making process and what type of evidence is being used

(How involved is the participant in the decision-making process in relation to commissioning)

- How are you deciding on which services are provided?

(make this more general considering the participant's role)

- What kinds of decisions take place around budgets, priorities for spending?
- If you are allowed to disclose this, could you name an example on a recent decision?
  - How do commissioning/providing services decisions happen? (committee/team..)
  - How are decisions on commissioning/providing SHS reached?
    - What is your role within that?

- *If participant is not directly involved in decision-making processes:*
    - Who is making the decisions? (**if not answered prior)**
    - On what basis do you think are decisions made?
- *If participant is part of decision-making processes:*
    - What kind of evidence or information do you think is helpful when deciding what services are provided / making decisions? -service provision
    - (similar question) What do you think is most useful to you/the committee in making decisions – meaning if some evidence is very frequently used and/or considered of high quality?
    - Where is the information/evidence retrieved from?

Commissioning/Service provision environment

- (When talking about your role and how **decisions are made** and which **evidence** is being used: What year are you referring to?)
- Were there any recent changes in commissioning/service provision environment?
- We have discussed decision-making in commissioning (current approach) do you see any possible future changes in the process?

(Where are the authorities in their cycle of change concerning sexual health commissioning? Depends on the commissioning environment /If they ask why, changes in commissioning)

- The politics of decision-making;
    - What do you think how high priority is SH?
        - What are the aspects driving it?
    - How are decisions being made around SH?
    - How do those decisions compare to other services?
- Tendering is very complex;
    - How much is this a factor in the DMs thinking?
    - Reduction of spending incentive?
- Can you describe your total budgets?
- Which services are you responsible for providing/commissioning?
- Number of patients per year

Since my PhD is in health economics let's talk about: types of economic evaluations.
I will explain this – if you have any questions just let me know.

Block 2: Economic evaluation/ cost and benefit questions

Exploratory

- What do you understand under the term 'economic evidence'?
- How familiar do you feel with economic evidence?

Clarify economic evidence in case it is not clear: health economics is the assessment of costs and benefits/outcomes of a health programme. Costs = treatment, screening, etc.; Outcomes = less STIs, less sequelae; will later show you an applied example which may help to understand this better.

In case of a committee making decisions:

- To what extent are committee members familiar with economic evidence?
- In your opinion, is evidence generated through economic evaluations used to support you in decision-making processes?
    - To what extent?
- Do you/Does the committee during the decision-making process place more weight on costs or outcomes when considering economic evidence?
- When, if ever, in your opinion is economic evidence being used during decision-making?
- How do you use economic evidence?
    - Are you considering costs?
    - Do you (also) focus on benefits when making decisions?
    - Are costs and benefits used in tandem?
    - If yes, (costs and benefits are used in tandem) how?

Tools and guidance for resource allocation

Participant may have mentioned available tools and guidance documents before this:

You mentioned (tool/guidance name) before, so…

- What do you think about this tool?

In case of no awareness, mention some available tools:

- Have you heard of this evidence, i.e. PHE guidance and tools: fingertips tool?
- What do you think is the purpose of these tools?
    - (In theory the tools should inform de-commissioning)
- When is this tool used?

This is publicly available guidance. Now let's look at what health economists do, when they evaluate programmes for screening and testing STIs.

Economic evaluations applied for screening and testing sexually transmitted infections

Explain cost-effectiveness analysis and cost-utility analysis by presenting the information cards;

In case participant is familiar with types economic evaluations –

- Are you aware of CBA/CEA? Would you like me to provide an example showing you the difference? (share screen)
- What would you like to see as results/outcomes for you to utilise this evidence?
- Do you think anything is missing?
    - Subgroup`?
- (If QALYs are not helpful, what is helpful: Unit outcome (CCA), CBA, what about equity aspects?)

Unaware

- What do you think about the following economic evidence? (share screen)
- Were you aware of this measure?
- If yes, in which context have you seen it?
    - If yes, have you ever used it?
    - If not, would you consider using it?
    - Why are you NOT using this tool?
    - What would you like to see?

(the solution is not to develop another tool as there are many out there which are assumedly not used)

- In your opinion, how important is this measure in the decision-making process?
- In what ways could this measure be improved?
- Would it help if the information is presented differently?
    - Studies vs. factsheet/summary/newsletter/commissioning guidance NICE
    - Good information – where is the compromise on quality vs. short accessible
- Are there other criteria for decision-making you would like to see considered?
    - E.g. economic evaluation focuses on efficiency but might have other criteria such as inequalities/equity issues?

End

- Finish with thanking the participant and ask whether s/he would be interested in providing feedback on any results this interview may produce;
- Who do you think is useful for me to speak to about this? Any contacts?
- Would you like to receive a copy of any write-up this will result in?

Debrief

- Explain what happens with the results one more time as well as safe storage of data; please contact in case of any questions or withdrawal

In case there is time left

Other questions

- Talk about Covid-19 but **generic** not specific to SHS
    - Economic aspects and how this may change services – what would be helpful economic evidence?

- Are commissioners concerned about AMR?
- Are there differences for sexual health in PH vs. other PH things; SH = stigma; infections

MEMO Observations

Write memo about how you felt; any disturbances; how did the interviewee seem (tired; busy; distracted); were they in a quiet space etc.

How well do I think I did?

- Take notes on the setting of the interview: Noisy, alone in a room, lightning,...
    - Memo: how you felt the interview went (good/bad rapport) – any observations on body language, how you were sat in relation to each other
    - How did the participant feel? Knowledgeable, hesitant,…

Appendix 5.5. Framework for decision-maker interviews

Table 5.5.1. Theme 1 - Commissioning environment

Theme	Commissioning environment	Quote 1	Quote 2
Subtheme	**Commissioning changes and fragmented commissioning**	*"Yes so 2013 was the health and social care act but changes effectively happened 2015/2016. […] prior to that, there was either a block contract, where you end up with a fixed amount of money and you can do what you want within that or else you have paying by results where you are paid per patient you saw* […]", DM_SP_00 (service provider)	*"Back in 2012, where public health teams transferred to local authorities from Primary Care Trusts as they were before. So they are now CCGs. We* [local authorities] *took responsibility for commissioning a large range of sexual and reproductive health services. So genitourinary medicine, STI treatment and care, contraception, family planning, and HIV support. But as part of that transfer* […] *there are some changes we're still trying to work out now locally. This is why we don't full circle",* DM_LC_07 (local commissioner)
		"and then there's a fragmented system in the sense that different organisations are responsible for different parts of the pathways. […] *if you are a, for example, a woman and you come into a sexual health service, you're diagnosed with HIV and unplanned pregnancy and chlamydia. So now the local authority paid for all that testing and will pay for your chlamydia treatment. But they might not be paying for your termination,* […] *and they might not be providing or paying for your HIV care. So now you have to navigate pathways as an individual, which are much more complicated.* […] *patients don't see the system as multiple systems, they just see it as the NHS",* DM_NC_03 (national commissioner)	*"*[…] *you do have significant variation across the country what is also not prescribed in the context of sexual health where it is in the context of other services is the clinical stuff that are required to deliver."* […] *"It is a fragmented commissioning picture that is one of the things at the time of transitioning ... a significant domain of contention but that's the decisions aren't self-termed*[?]*",* DM_LC_01 (local commissioner)
	Contracting	*"Tariff basis is damaging [for the quality of the service] as the main focus is on return on investment (ROI)* […]", DM_SP_09 (service provider) *"So it doesn't matter to me in effect how many people come in the door if I've got a block contract because I'm not carrying the risk but the providers are carrying the risk. The provider wants less people coming in the door because then they can make more money. I want more people coming in the door because in effect the cost per case comes down*", DM_LC_01 (local commissioner)	*"the main contract actually hasn't changed. That was awarded in 2015 and that hasn't changed.* […] *So we've got another four years onto this contract through contract variations. And so there might be some slight tweaks to service design. But overall, no there wouldn't be anything major at the moment",* DM_LC_04 (local commissioner)
	Types of decisions made (service delivery, resource allocation, prioritisation, support tools)	[about politics of decision-making processes]: *"So for myself and it goes to my manager, then it goes to the management of that, then it goes into a senior leadership team for a joint decision making. Once it's gone through there, it has to go into a cabinet. So obviously local governments all have cabinets, and so it has to go through a cabinet meeting. They might then make decisions on that. And then if you get approval of that, it goes to a corporate board. And that all takes time, then it filters back down",* DM_LC_04 (local commissioner)	[who makes the decisions] *"It's very much a kind of a sit down and have a stakeholder group around that generally would have the lead. That would probably be me, that's the commissioning lead but we have a lot of people... practitioners and others sat around there as well as other commissioning bodies: CCG and NHS England to see where we can improve everything. That's where the commissioning comes in",* DM_LC_07 (local commissioner)

		[Decision to stop working with certain partner organisations to make savings] "[…] *So I mean, that that, that that's really what, you know, the way that it was viewed it was weighed up very much in terms of those that are delivering well, but we're not going to make a huge indent into the savings but it will be, it will help us to actually deliver and keep them going than those that we probably would have let go anyway",* DM_SP_05 (service provider)	*"Largely we decide based on service user consultation. Carrying out engagement work with communities. There's a lot of evidence out there, from a range of people that have done a lot of studies on this for instance on terms of what works for digital acceptance and acceptability.* […] *when we're moving into an age where we've all got a mobile phone… Swiping smart apps, all that sort of stuff so we have to reach people in different ways. So I guess from a digital point of view, we kind of know people want that and want a blended of offer* […]*",* DM_LC_07 (local commissioner)
	Technological change in service delivery (online screening of sexually transmitted infections)	*"I guess the way services are delivered followed the technology. So because you could test remotely and self sample. People thought, well, this must be cost-saving because we can just move all of that online. And then you eliminate all this very expensive staff time and overheads from your physical service that you no longer have to pay for it. If they don't return the kit, well, that's a shame and you've lost a bit of money on the kit. But actually, that's not very much money in the scheme of things. And they thought they would free up capacity within the services. I think what people are seeing is that the more ways you think to offer services, the more people started to test unless you have some kind of quota or cap or... make it that some people cannot have the test in that way",* DM_NC_03 (national commissioner)	*"And for example, with online testing is cheaper than face to face testing. I think, probably true. Although not by what extent. So it is rather assumed that the new ways of working are way cheaper but this is often not particularly well tested at how much cheaper they actually are",* DM_SP_00 (service provider) *"And then we were talking about digital telephone services. If it is a digital service and you go online, normally asking people for their postcode, and it will redirect you to your local service if it is not a service that is commissioned for your area. So the idea of open-access doesn't really apply to online services",* DM_LC_14 (local commissioner) "*I think clinicians would say we sometimes need to see people for a whole host of wider issues: violence, psychology, pleasure,... all of these other things which are also, I think, research shows that are hugely important to being empowered and preventing STIs*", DM_NC_12 (national commissioner)

Table 5.5.2. Theme 2 – Context

Theme	Context	Quote 1	Quote 2
Sub-theme	**COVID-19 pandemic**	*"on the pressures that local authorities have for their own funding, because I mean, obviously they're allocated funding. And they have to be very mindful as to where that funding is distributed. So I was concerned when COVID came into play, whether or not with all the things we were hearing from the government around obesity and the BAME* [Black, Asian and minority ethnic] *population who are more likely to be affected by COVID. Whether that will impact on any future funding allocations, and that's yet to be seen. But at the moment, we've been asked to deliver this saving, and we have been delivering it",* DM_SP_05 (service provider)	*"*[…] *So I think what it* [COVID-19] *does it shifts two things: One is that it shifts to predominantly telephone and postal provision and the most significant impact will be on those individuals that don't have access to digital... don't have smartphones etc those are the things that I think are the most challenged because they you know they cannot just walk in.* […] *On the flip side of course is that people are not hooking up quite so much and so the potential for spread is much lower.* […] *we don't have the data yet on what is happening in terms of prevalence. So what we know is that fewer people are getting tested but we don't know what this means in in terms of are they still... do they still have the disease or.... and haven't just not got tested for it yet. So we will see",* DM_LC_01 (local *commissioner*) "*They always had face to face services running throughout from* [the] *beginning of lockdown. But obviously those had to be scaled back. And the idea was that everybody went through the telephone triage*", DM_LC_14 (local commissioner)
	Political (the politics involved in SHS commissioning)	"[…] *the politics of it in that the local authorities are quarterly elected, the populus elects them* […]. *They see it as a very positive thing because they're accountable to the population. But it is negative as well because certain components of the population are more likely to vote than others and therefore they [local authorities] are quite reluctant to introduce services they might not get voted for. That political imperative is positive in some ways, because people are accountable. They have to do things that the population likes. But it is also bad because some things aren't popular but very good purpose none the less. So you're not always going to be popular in your approach* […]", DM_SP_00 (service provider)	*"I still see it [*SHS*] as being a high priority, certainly within the public health arena. And, as usual, some of your elected members and things do need to slight convincing of things, because if it doesn't affect them directly, or vast majorities of their [voters] and the communities that they've been voted in by then it is difficult to get them to understand the importance. But it is a statutory requirement of local authorities to provide that service. So it isn't going away. They have to do it, which is sometimes a little bit easier to reach because it is a statutory requirement if we're trying to talk about things that aren't statutory, then you have a bigger battle on your hands",* DM_LC_04 (local commissioner)
	General integration of sexual health services (what makes sexual health services unique, integrated services, mandated service, vulnerable groups)	"*We are starting to really move it and kind of make sure that a woman who is accessing wherever, can get whatever. Rather than it be: You can only have contraception here, sorry we can't fit you for that - which is absolutely ridiculous. But* [a council] *has done a lot as well. They went out on a quite a different looking integrated sexual health service. Where they have a SRH strip, gynae*[cological] *offer as a second lot of it, which included oversight from the main service to this gynae*[cological] *service, which could provide a service in general practice and use primary care networks and so on, which is what we're doing*", DM_LC_07 (local commissioner)	"[…] [for] *mandated services there is a national specification that kind of sets out the core minimum of what you have to do* […] *and then you have some flexibility around that but not a huge amount to be honest.* […] *the strength of the integrated approach to sexual and reproductive health is it needs to be integrated within the community, it needs to be integrated with things like children's centres* […] *and it has to have very strong links with community volunteering sexual health organisations who are supporting very high vulnerable groups, such as sex workers and homeless populations and substance misusers*", DM_LC_01 (local commissioner)

	Equity (access to services, reaching vulnerable groups)	*"[…]But it's equally the case that our colleagues who are working in varying different geographies, often will have much greater challenges to deal with. So they may be dealing with populations that are spread over much more extensive areas, or the transport and other networks that would allow people to get access to care are much more challenging and on the face of it, much less efficient* […]", DM_NC_06 (national commissioner)	*"So in order to access online health systems, you need digital literacy and a level of health literacy, or you assume that level but actually that level of health literacy is not evenly spread across the population. […] those who have poorer sexual health […] may also be those who are disadvantaged in terms of health literacy or access to health services. […] we might not be reaching the right people. We may also be widening the health divide or the digital divide, in terms of not reaching people who really do need to be reached, and they can no longer reach services in another way. Because the capacity within those other ways [face-to-face] is being reduced", DM_NC_03 (national commissioner)*
	Financial (budget flow and differences between local authorities, public health grant cuts)	*"So we [local authorities] pay for GPs to fit coils and implants, IUS/IUD and implants for contraceptive purposes. Not none-contraceptive purposes. So a woman accessing them, potentially for both heavy menstrual bleeding or needs it for some kind of other method or other clinical condition for management of that condition, gynaecological related; it technically shouldn't be paid for by the local authority", DM_LC_07 (local commissioner)* "*It is quite different from when public health sat within the NHS. It's quite different from the approach we take in public health at national level, and international level, which is not to diminish the fact that a programme should be cost-effective, of course. But the arguments that I think people have to make in local authority are ones of economic savings and budget reductions and fighting to protect their basic budgets and justify the programmes in a way that I don't think they [local authorities] previously had to. Don't get me wrong, it brings benefits. Some of the process has been more robust they've understood a lot more about the budget, but it's also not been entirely positive. And sometimes I have to talk to colleagues that I know care about health and remind them very gently, money is important of course and to have the money to be able to deliver these things, but it's not... it can't be the only factor in developing health programmes*", DM_NC_12 (national commissioner) *"If you are paying for abortions you pay a lot more attention to the provision of contraception but because the NHS pays for abortions and local government pays for contraception that disconnect in economic benefit unwinds or unruffles the potential for cost-effectiveness to drive change*", DM_LC_01	"[…] *in general what we have seen since commissioning of sexual and reproductive health has moved to local government - one it has been protected despite national government cuts to the grant. So we have had over 13% reduction in the public health grant I think it was 1st of August last year* [2019]. *The contract of sexual health services has only seen a 3% cut* […]", DM_LC_01 (local commissioner) "*the local authority commissioner is given less money year on year...* [the commissioner] *has to try and deliver services in some way, that are mandated, must be open access, have to be available to your population, with less money, and therefore has to follow..., it makes perfect sense they're following... in the direction with things that cost less*", DM_NC_03 (national commissioner) "*Yeah, they* [local authorities] *wanted people who didn't need to be in clinics, not to be there* [to generate cost-savings]", DM_NC_12 (national commissioner) *"[…] When does telephone triage become a consultation that another area could bill you for? […] If you're on the phone and building that rapport with somebody. […] So there's a whole conversation about how much would be reasonable amount to charge, which obviously shouldn't be as much as [in person]. Well some people [say] it should be as much as a face-to-face one because it is clinical time with that person that's on the phone. And there are other people saying you have not got the overheads naturally. If you have a largely telephone service, you don't need a building, you know, clinical space to do that from", DM_LC_14 (local commissioner)*
	Local differences (the local differences leading to low generalisability of evidence)	*"One of the key things to bear in mind for [this city council] is, [it] is very different to every other local authority that's out there. And it does stick out like a sore thumb […] in terms of its*	"*The London role is difficult* […]*. But most especially for the sexual reproductive health sector is that London size and its international flavour and the transitional populations through here.*

	uniqueness because of the vast size and nature of [this city council], even some people would think, who don't work in the area that [another big city] is big, but [the other big city] is split up into little [areas] and they have their own little budget", DM_LC_02 (local commissioner)	[…] *Ultimately, for sexually transmitted infection management, something of the order of perhaps 50% of STIs in England are diagnosed and managed in the capital. So the arrangements and the solutions that are found for managing London populations often are a good example or, or at least operators of scale that we can then attempt to translate them out to more diverse geographies* […]. *Some of the solutions for London can be translated elsewhere"*, DM_NC_06 (national *commissioner*)

Table 5.5.3. Theme 3 - Economic evidence

Theme	Economic evidence	Quote 1	Quote 2
Subthemes	**Understanding and use of economic evidence**	[Participant associated efficiency with economic evidence] *"I guess what it* [efficiency] *means at local authority level is that they've got a finite amount of money, and that amount of money is reducing* [laughs] *and therefore: What should they deliver? And who should they deliver it to? At a fundamental level. Because even with things like the national chlamydia screening program, the evidence to say that if you do this, you can have an impact on important outcomes is variable",* DM_NC_03 (national commissioner*)* [after being asked how they would define economic evidence] *I mean are you talking about return on investment? Are you talking about what happens if you stop to spend on something and the actual output from it*? […] *And we were always trying to do is understand is what the shortterm costs* [?]", DM_SP_09 (service provider) [what do you understand under the term "economic evidence?] "*I love nothing more than seeing a return on investment tool. But unfortunately, in sexual health certainly, they tend not to be particularly comprehensive*", DM_LC_13 (local commissioner) *"So the bidders* [potential service providers] *were referencing it* [tool/model] *and attaching the tool, and demonstrating how their service has been applied to that tool. So given the value of this contract, that is a minimum, I would expect, on any bid that comes through*", DM_LC_02B	*"So, for me economic evidence, would be looking at the scales of economy, I guess as well in terms of population profiles. Which population, what are the kind of... mapping out of the population profiles looking at these demographics, the age profile, the gender, the number of under 18 pregnancies, the number of high-risk* [groups], *the number of STI occurrences. And actually mapping that against what the economic contribution that is actually given to those areas. And I guess doing benchmarking to see whether or not that makes any difference in terms of the health outcomes",* DM_SP_05 (service provider) [what kind of evidence do you need?] *So, the question I think we have is, is, it is an economic question in terms of return on investment. Because one of the things that we monitor is. How many tests did you conduct, What was the reactive rate? Were these known positives before?* […] *What is the cost-effectiveness of sending out voluntary sector staff wearing t shirts into a crowded market for a crowded bar and talking to a self selecting group of people who are maybe not demographically targeted. But are they the 2000 people living with HIV. We don't know it. How effective is that use of their time, money, skills, and hours. And that is a question that we need to answer"*, DM_LC_10 (local commissioner) "*Economic evidence, ehm... I guess evidence of effectiveness and that we are going to see better healthcare outcomes and spend our money in the right places.* […] *Economic evidence that something works. The LARC one is a classic, the one pound and 11 pound return against it. I think that sort of economic evidence. So the investment makes sense*", DM_LC_07 (local commissioner)
	Data/evidence for SHS (what data is considered)	*"So a way that we might support them* [local authorities] *with that is to take the surveillance data, any audit data, any local service data around how they're delivering and who they're delivering that to in terms of testing, turnaround times for results, turnaround times for treatment, what proportion they treated, partner notification outcomes, retesting outcomes... And to synthesise that data for them and present it to them in a way that helps them to identify where they should focus efforts to get better outcomes for their population* […]*",* DM_NC_03 (national commissioner) *"*[…] f*undamental question mark about what is the cost benefit of treating*	*"I think that we are still in the foetus of generating and analysing and appropriately assessing on the correct scales the economic decisions that are there",* DM_NC_06 (national commissioner) "*PHE recently did an ROI tool, a return on investment tool for young people .*[….] *And so there's a lot of different resources that you pour through. And many of them will be in the challenge we always find around health economics and whatever and you will know is that actually, there's not much evidence really. It's, it's not looked at in that way, partly because something as complicated as sexual health is hard to*

		sexually transmitted diseases versus what we more often see which is cost-effectiveness analysis of different modalities of the same service but with a different method", DM_LC_01 (local commissioner)	*evaluate from an economic perspective*", DM_LC_11 (local commissioner) [referring to studies using pelvic inflammatory disease probability] "*And often people are referencing other modelling studies and you keep going back and actually these estimates are, some of them are 40 years old*", DM_NC_03 (national commissioner)
	Evaluating SHS' impact (Finger tips/ benchmarking, ROI)	*"So it is of course different between local authorities. For ours, we have 125 key indicator delivery, which we* [provider] *deliver each month to them* [local authority]. *So they have a lot of data they want to look at to see how we're doing. And some of them are useful and others have less use of probably less useful to them, but yes, absolutely the congress manages the contract pretty tightly. They want detailed meetings with the manager of the trust, to make sure that the important thing what they want",* DM_SP_00 (service provider)	*"We have quarterly performance monitoring meetings, where we will form and set the contract against set objectives and outcomes that they will have had in their contract and then... but apart from that there, no there wasn't a formal sort of evaluation at the end of the contract, no",* DM_LC_02 (local commissioner) *"There are national documents to support us around which outcomes we should ask for from a new service.* […] *I know that it'll be better for us now because we don't get some of those national integrative framework indicators. And then the PHOF indicators give us an overall look, which is* [fine]. *But we don't get some of those ones we should get: Partner notification and things like that are quite complex"*, DM_LC_07 (local commissioner)
		"I guess the other one which has been brilliant in the last few years is the pathway analytics modelling tool […]*. it gives you a chance to look at what you're spending in terms of your case mix. But again it doesn't get us that further and tell you why you invest in there, or whether you should invest there, and whether it's a wasted spent and actually you should put it somewhere else because your longer term outcomes are going to be better. How much should you spend on prevention and where should it be? Those sorts of things. That gives you an idea what you should be spending clinically really. So the whole model... We can always receive better information",* DM_LC_07 (local commissioner)	*"And how do we compare nationally? So obviously we'd use Public Health here the fingertips* [tool]. *So obviously we can compare ourselves against other local authorities within our region, but also then within the country. So that helps us give a bit of a benchmark as to where we are and what we need to work on",* DM_LC_04 (local commissioner) *"Bayer did a return on investment tool a couple of years ago, which they made available to local authorities, which came as a table that indicated cost avoidance in housing, education, welfare payments*", DM_LC_13 (local commissioner)
	Outcome measures	*"I mean ultimately we are probably more interested in prevention* [people not contracting a STI in the first place] *because it stops the costs of people coming in the door",* DM_LC_01 (local commissioner) *"I would lean more towards thinking about how health outcomes, mainly the PHOF outcomes, I would say would be the immediate ones that would spring to mind in terms of reduction of new STIs, STI prevalence in the area, increased LARC* [long acting reversable contraception] *uptake, are the things that we know are going to make the biggest impacts, and particularly obviously late diagnosis of HIV is a massive piece of* [this city] *at the moment around fast track city's agenda. And meeting Triple 90 targets* [HIV	*"It* [what data, i.e. raw numbers/ QALYs is used] *varies* [long pause]… *I think it depends slightly on the audience. I've not had conversations about QALYs with local authority commissioners. I think my experience is that they're more interested in return either return on investments, which is challenging within sexual and reproductive health, for a number of reasons, not the least of which the return on the investment is not seen by the person who invests in it. [laughs] And you're nodding your head, you understand that, you know, the local authority pays for the chlamydia test and treatment, but they don't* […]*",* DM_NC_03 (national commissioner) *"*[…] *But then also, I think, knowing about, who are these people who are testing, are they the right people to be*

		targets], *and having people diagnosed earlier, to not only give them much better, better life chances and better outcomes longer term"*, DM_LC_07 (local commissioner) *"And now the question as well councils will have no money.* […] *So first and foremost, it becomes an economic question. Not about what is optimal spending to achieve your outcomes, but it becomes an economic question of what is available* [to fund the service]*",* DM_LC_10 (local commissioner*)* [what has more weight costs or outcomes?] *"A good way of looking at it is when I first started to look at commissioning. Prior to local authorities, you know, there was traditionally a kind of 80% on quality, of how we order contract, 20% on cost. When I went to local authorities, I was shocked to find that it was like, I had to fight to get 50-50 for both of them* [quality and cost], *and they wanted to do 100% on cost*", DM_NC_12 (national commissioner) "*I think it* [QALYs] *is helpful. I am possibly thinking that might be more applicable to some other public health disciplines, particularly weight, obesity... those sorts of things... Smoking and so on.* […] *I don't know if there is a preference* [CBA vs. CEA example]*. I think they are all useful. They are all good tools. Costs received back against an intervention massively useful. I think that's always useful to commissioners to see that, to know that actually longer term, they are spending this now but they will see this return",* DM_LC_07 (local commissioner)	*testing, is it the people who are just low risk, or is it truly the people you should be testing? I think you need to look at the positivity rates again. And think is this really a key population what is the repeat testing like, should people to be able to retest? Can you use modelling to see which individuals are the people who could test more than ones and the frequency of that? I think that's also a really important question to be raised",* DM_NC_03 (national commissioner) "[…] *there are limited resources. It does mean that it is under expense under some things that are nice to do. But what the risk of reducing budgets is, those things that can go, the things that have [?] outcomes can go. Because you're gonna deal with the [?] review and the primary fund [?].So actually if somebody turns up with syphilis for example and needs treatment. You're gonna send the money on that rather than on the long-term outcome stuff that is very difficult to measure. You can't. You will only see benefits, 2 years, 5 years later",* DM_SP_09 (service provider)
	Presentation of evidence	*"So that would be still quite interesting in a sexual health capacity to say, this is how much of the test costs; This is how much a consultant would cost; or this is how much a nurse would cost.* […] *For every person that is not treated for an STI, it costs us 12,000 pounds in GP time* […] And *offset that against … our test costs £8.50, So it would be interesting to have it detailed in a table format that you could use the data against your local data. I wouldn't expect it all to be laid out before me but it would be interesting to have all the costs broken down. Not so much average costs because every area is slightly different. But then to be able to use that national average costing to put against local data would be interesting",* DM_LC_04 (local commissioner) *"So if you then think about not just the cost of the kit and processing, but the cost of time and resource and energy.[…] we need to almost try and cost more of the pathway. […] when*	*"Yes, so decision-makers are used to seeing guidance, statements saying 'do this' with a reference saying why that is the case. And I think maybe here having to fit these into a statement of practical application, would be useful. Saying that maximising partner notification is the most effective way of delivering a screening programme, where possible and referencing it. So they can end trying to accept that in the contract to providers saying you know we want you to maximise partner notification",* DM_SP_00 (service provider) *"I love graphs and figures. Definitely.* […] *I think it's so useful as a way of getting a lot of information across",* DM_LC_14 (local commissioner) "*I think having a summary, perhaps with a diagram of in the way that you just demonstrated of key outcomes. And then if people do want to see more in depth, having that that link. But I have to be honest, with us, it would be very*

we're looking at, climate change and those kinds of things. […] you can then see that actually doing everything online isn't cost neutral as a wider economic cost [perspective]. […] *just in a comparative perspective. So that you could actually then look at that as an overall piece*", DM_LC_11 (local commissioner)

much a question of time. We probably wouldn't have a great deal of time to read this unless we're actually making these decisions. So that would be very useful coming up to the whole re-tendering of sexual health. But, knowledge is a great thing and if we can be pointed in the direction of health economics in terms of what would be really useful for us, with decision making, and just understanding more in depth about the impact of our service through health economics rather than the savings that we have to make and the normal governance and operational work that we have to do, I think that'd be really useful", DM_SP_05 (service provider)

Chapter 6 Appendices

Appendix 6.1. Information leaflet for researcher interviews

Page 1

The role of economic evidence in decision-making.

What is your research experience with decision-making and economics and what would you recommend when conducting new research in this area?

We would like to invite you to participate in a research study exploring academics' views on economic evidence for public health programmes.

Please take time to read this information leaflet carefully.

UNIVERSITY OF BIRMINGHAM

Who is funding this study?

This study is funded by the NHS.

Who is the research team?

This study is being conducted by Sonja Bloch who is a doctoral researcher at the University of Birmingham. Sonja Bloch and her research supervisors, Dr Louise Jackson, Prof Emma Frew and Prof Jonathan Ross, are interested in understanding and developing approaches for evaluating costs and outcomes of sexual health programmes with a particular focus on the control of sexually transmitted infections.

What is the purpose of this study?

We would like you to be part of a one-to-one interview to gain insight on your views on your experience working with public health decision-makers and economics. In addition, we are interested in your suggestions on how current economic evaluation tools could incorporate aspects of equity or context. The goal is that the information developed through this research will be useful for local decision-making.

Page 2

Who is taking part in the study?

A variety of academics will take part in this study. These include participants from different parts of the UK Universities.

What do you need to do during the interview?

During the interview, we will be asking you to share your experience researching economics and health decision-making processes. We are interested in the challenges associated with developing information for decision-makers and what to do to overcome these. We would appreciate suggestions on how to incorporate equity aspects in an economic evaluation for a public health programme. The interview will take around 30 minutes to one hour and a summary of the findings will be found at: www.birmingham.ac.uk.

Location

The location of the interview is flexible and is determined by your preference. In general, it should be a room where you feel comfortable and where we can have an undisturbed meeting via video or audio call. Possible channels could be Zoom, Skype, Skype for Business or any other software you may prefer.

Confidentiality

The interviews will be audio recorded and transcribed by the main researcher, Sonja Bloch. Your personal information will be treated confidentially and you will not be named in any publications that result from this work. We will make sure that you and your organisation will not be identifiable in any outputs. All data will be kept secure on University of Birmingham servers in compliance with the Data Protection Act 2018.

Thank you for taking time to read this Participant Information Sheet. If you have any further questions, please do not hesitate to contact the main researcher, Sonja Bloch.

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Appendix 6.2. Interview guide for researcher interviews

Interview guide

Before recoding

- Welcome, thank you for participating and for sending the consent form; Louise sends her apologies
- Introduce myself and my background – who am I and what I am doing?
    - 2nd year PhD student in HE
    - Topic: Identifying and developing approaches to understand the costs and outcomes of control programmes for sexually transmitted infections to inform local decision-making
- Inform participant that the interview can be stopped at any point as well as s/he may withdraw from the study up to two weeks post interview;
- I would advise you not to disclose any personal information such as names during the interview;

(in case participant has not given consent yet via email/scanned consent form – provide the consent form or orally agree when starting the recording)

- How much time do you have today? ~40 mins would be great

Start recording

Venue:

Interviewer:

Participant ID:

Participant role in organisation:

Date/time of interview:

Part A: Introduction

- Could you introduce yourself and your background?
- What does your organisation do?
- What is your role within the team?
- Do you have experience with decision-makers in health care?
    - What kind of decision-makers do you/were you working with?
    - How long have you been working in this context?
        - What motivated you to work within this context?
    - How did you connect with decision-makers?
        - Is this an ongoing relationship or has it evolved over time?
    - Have you been working with one or a team of DMs?

Part B: Interview experience with public health decision-makers

You have been involved in developing models for infectious diseases (economics of infectious diseases):

- How did you get involved in this?
- Challenges/opportunities of designing infectious disease models – especially for STIs
    - Understanding/use by decision-makers?
    - If this makes sense to ask: How realistic do you think are the different recommendations to be included in an economic evaluation?
- Advantages / disadvantages of economic models for STIs

- TEASE OUT: Would you say that your work has had an impact on the local authority level/informing public health policy?

- Can equity, context be incorporated somehow?
- Tease out: Current economic evaluations do not resonate well to local decision-makers' needs;
    - How to improve these (how?)
- What has changed methodologically since you have been involved in this work?
    - How have you changed since you have been working in this field your work?

Part C: Challenges associated with developing information for decision-makers and what to do to overcome these

- When developing [economic] evidence aiming to support DMs, what kind of challenges do you associate with this?
    - Who are these DMs exactly? LA, Dir. PH, Provider?
    - What do you do to overcome these?
- Especially local DMs – what do you think would be helpful for them? How much are they engaged with the available evidence?
- What are the opportunities you see in this process (developing economic evidence)? (e.g. collaborate with DMs)
- How can you achieve higher accessibility of the evidence?
- Do you have recommendations on how to balance the academic knowledge and applicability of evidence in reality?

Part D: Expertise on incorporating aspects of equity in an economic evaluation for a sexual health programme (or public health in general).

My work is on SH and SH control programmes. I am wondering how I can put some of your recommendations into practice. (it doesn't matter that you do not know much about SH but I still would appreciate your expertise)

- If you were to conduct an economic evaluation now, what would you recommend? (practically and methodologically) (considering low resources, i.e. time)
- Based on your experience working with DMakers what would you recommend?
- What about the COVID-19 pandemic? Can you incorporate this somehow in an economic evaluation?
- If there is time: talk about work with WHO

End

- Is there anything else you would like to add which could contribute to this research?
- Do you have any questions?
- Finish with thanking the participant and ask whether s/he would be interested in providing feedback on any results this interview may produce;
- Who do you think is useful for me to speak to about this? Any contacts?
- Would you like to receive a copy of any write-up this will result in?
- information about study website (?)

Debrief

- Explain what happens with the results one more time as well as safe storage of data; please contact in case of any questions or withdrawal

Observations:

Write memo about how you felt; any disturbances; how did the interviewee seem (tired; busy; distracted); were they in a quiet space etc.

Appendix 6.3. Framework for researcher interviews

Table 6.3.1. Theme 1 – Context

Theme	Context	Quote 1	Quote 2
Subtheme	**Financial: Budgets; Cost (savings); budget flow; fragmentation**	*"These decision-makers are also incentivised by… My understanding is that they're incentivised by making cost-savings in the short term. And until that incentive is removed…. I mean, we all understand that we have to work in budgets. But I think the whole structure of those budgets and the time horizon associated with the budgets and the incentives for decision-makers to be successful in their roles personally, needs to be disentangled", RS_09*	*"So the local authority decision-makers, not knowing what was going to happen wanted to know whether it was worth actually funding the smoking cessation interventions, given that most of the benefits actually are generated in the NHS context not the local authority context", RS_10* *"Saying it's [the intervention] cost effective, but it'll cost you a lot of money in the short term and you'll get money back in the future is rubbish, because you may not get the money back", RS_01 (refers to the fragmentation of services)*
		"there's also this anticipation in public health that public health and prevention are going to save money. And we do not, we almost want our programmes to prove that they are going to save money, and we don't say that for a surgery, do we, or a cancer drug. We don't say 'Oh this cancer drug is going to save money'. It's not fair. It's not a fair hurdle", RS_04 *"And I feel that there's a, there's a real bias, because there's only really a public health that I see that I can see as much clinical medicine and therapeutics, but you do see in public health for some reason, this need to evidence cost-savings, rather than rather than having a focus on cost effectiveness", RS_09* *"I also would like to add that, then public health also always push it to say that it has to be cost-saving. And obviously it's much more accepted to spend budgets on, I don't know cancer treatment or. So, yeah, different clinical trials showing cost effectiveness it's not, it's okay but it doesn't need to be cost-saving. So, yeah, there's lots of pressure on the public health budget for sure", RS_11*	*"But what we haven't yet addressed I guess some of the key concerns that I've heard from some local authority people is that sometimes it's the costs that are the biggest issue. That the costs don't reflect what they're paying and also don't reflect what difference it makes to their budget. Because they're quite concerned with what difference it makes to their budget. Versus being driven, very largely by NHS costs. […] Well this is just from a couple of people who didn't like the SPOT tool, [they] were saying that they didn't like the fact that when you bring all the healthcare costs in together, that kind of obscures for them what it means for the council, for example", RS_08* *"I wonder whether the fundamental problem is the non harmonisation of budgets […] Now local authorities they don't pay for health interventions from a NHS budget. They pay from their own budgets and that's been heavily slashed in the last 10-15 years. So, really they are saying 'should we close a library or should we not fund this [health] intervention.' And so really I think part of… it feels like part of the job is actually working out what is the opportunity cost at a local level and the opportunity cost of health care spending is probably much higher", RS_11*
	National vs. local decision-making costs and time horizons	*"[…] much of the evidence that we have available to [local authorities] has been generated at national level. And that's not particularly helpful to local decision-makers", RS_00* *"NICE always wants sort of national costs to be used. Whereas actually if you're really wanting a local group to use the results of your economic evaluation, then it makes more sense to use local costs for example. So I think of that question about who is it.* *[…]* *"the sorts of decisions that they were [local level] making were not the sorts of decisions that economists typically look at in economic evaluation. So in economic*	*"the role of your local county council in thinking about what needs to be spent within that particular local authority. So the local authority advantage in terms of the prevalence of particular disease or incidence of particular disease area. And we, as a national context, something likely very important to investing might not be that important in that particular localizer into something else. And therefore, it is important to understand that variation in context", RS_10* *"So much less sculpt to make decisions, much fewer resources to make them, much fewer people [in a local context compared to national decision-making]," RS_01*

		evaluation and sort of NICE decision-making […], it's always about 'Shall we do this intervention or shall we do that intervention?'. But what [a researcher] found at the local level was that the decisions weren't: 'Are we going to do this intervention at all'; 'We're going to do that intervention'. They [local level decisions] were: 'Are we going to buy this piece of kit, or we're going to invest in another nurse or the doctor?'", RS_07	*[…]"So NICE has people [health economists] inside, the Department of Health has people inside and they're trusted and they do a lot of work and then redo it and dadada. Whereas almost no local authority or CCG has except by accident that people with knowledge of research skills, let alone health economics research skills or the relevant set of skills", RS_01* *"And one of the things that became very clear with NICE, was it's not just about cost effectiveness, it's also about budget impact. And it's about practicalities on the ground. Will this cost you money, save you money, and over what timeframe? Saying it's cost effective, but it'll cost you a lot of money in the short term and you'll get money back in the future is rubbish, because you may not get the money back", RS_01*
	Thresholds	*"[…] 'what is the value of keeping a library open or fixing potholes in the roads' or whatever it is. But then you might find that actually the threshold at a local level might be much lower than the threshold for the NHS. And I think that's important for two reasons. One is actually then you can give useful information to local authorities. You can say, well, this intervention might be cost-effective for NHS to fund but probably not for you since your threshold is lower. I think that's also an important piece of information for the public and for decision-makers to say 'actually our current national budget allocation is saying that we fund hospital care at this threshold; we fund public health at a local level at this threshold. Which means we value a life three times higher if they go to a hospital compared to if they don't receive this intervention. – I mean three is arbitrary, picked of the top of my head – but if that's the value you put on this, then that's fine but if that's not your value doesn't this say that there's a misallocation of funding somewhere. I think that's an important point to make as well", RS_11*	*"we have a problem where we have thresholds for things like quality adjusted life years, we don't have currently available thresholds for lots of other outcomes. And so what I'm seeing in the research that we're doing what we're using, are we using things like the capability instrument. I can see, and we've used this as well as talking about how much it costs to achieve capability. So, rather than using the threshold of a QALY, cost per QALY, we can see how much it will cost to move from a certain capability level to either full capability or capability level which would be deemed to be acceptable. I guess you can use that same approach with other measures", RS_09*
	COVID-19 influence	*"I'm quite interested in now is the, is something called precautionary principle, which has become very relevant with COVID because it's this idea that we have been very focused on cost effectiveness but now if you think COVID. The chancellor just said we'll spend, everything that is required. So the boundary went out the window. And that's an uncomfortable place for health economists", RS_04*	*"I think is interesting with COVID and public health. They were apparent, it was immediate, it became an emergency decision-making situation. We don't tend to have that in public health that often. So we talk about obesity and alcohol and smoking cessation. And we put in place long-term strategies. But COVID has forced an emergency public health decision-making. […] But actually from an economists perspective, you […] could argue that actually the same should be treated obesity and alcohol and drug misuse,… They should all be treated in the same way. They should be emergencies as well. It's just that you don't see the [consequences] are not immediate like with COVID. So I think there'd be lots of interesting discussions to be had that will play out over the coming years around how decisions are made, whether it's crisis decision-making or some sort of lower level type decision-making," RS_09*

Table 6.3.2. Theme 2 – Decision-making process

Theme	Decision-making processes	Quote 1	Quote 2
Subtheme	**Decision-makers - Who they are; complexity**	*"So that tends to be at the national level so it's working with people in Department of Health for NHS England around things they're interested in conducting research associated with that. As part of that we've also linked in with the government, sort of the directors of public health", RS_05*	*"Everybody's got an opinion about education, and everyone's got an opinion about STIs and why they pass" "And what's worse now is that every local council have got an opinion on it and that matters", RS_03*
	Objectives of decision-makers	*"[…] what is the decision-making goal or maximum demand. […] But actually, decision-makers don't have one goal of efficiency and, and if you sat down and asked them what their goals are often they are. They can range from adhering to go central government goals or target, public acceptability, reducing no improving the health of the worst off - so equity goals. So I think it's unrealistic to think that we're really on the ground and bothered […] There's a disconnect [regarding objectives] from the Treasury - to NICE - to local decision making. There's a bit of a disconnect. But I think the more work that gets done, the better. Just generally the more studies that are published the better", RS_04*	*"what exactly they are trying to optimise even if they don't immediately think solving an optimisation problem. What are they trying to optimise and if it isn't quality is because they're not sort of like NICE with a certain explicit remit to maximise QALYs under a fixed budget, what is it that you're trying to do is it, is it really. We hope not. But is it really a sort of long term budget minimisation problem like they're trying to invest in the interventions that will save money in the long term. Is it that they're trying to reduce certain indicators in the population that may be a high profile like, I don't know whatever they might be like the number of people with positive tests of chlamydia", RS_11* *"We're trying to work with NICE because when we've spoken to people at local level about whether they make use of say the NICE public health guidelines, they are feeling like it doesn't really provide anything useful for them at local level", RS_08*
		" [responds whether there were requests to include inequality aspects] Not that much actually, which is surprising because you would think that this is an important aspect. I do see the question being asked more in the last few years. Well, as also analysts including myself starting to be actually more conscious about, well, even if this is not part of the ask maybe we should do an analysis by [subgroup?]. So she could tell us I think anyway because if it's going to be informed like for instance, the current covid pandemic. I mean it's so socially, economically determined that it feels like an important aspect to look at. And so, maybe this is information that we should provide decision-makers anyway even if they don't ask for it, but in the past, not as much as you might expect. It's usually been, about the average cost effectiveness of the intervention. I think partly because I've been in vaccinations. The UK does have very high vaccine coverage. So most people do get vaccinated, regardless of whether they're rich or poor or ethnic group or so forth but I think […] it is an important question", RS_11 *"you need some ex ante belief that there is a differential impact across the distribution based on whatever your*	*"Well it is defining what is the equity objective that's the biggest challenge. So decision-makers are often reluctant to define it. They talk about equity fairness and what exactly do you mean by that? Which social groups or which groups do you want to reduce inequality between? Do you want to reduce inequality between? And is it lifetime health that you care about, or current severity of illness. And decision-makers get very confused about these things. They talk about severity of illness. So there's a lot of confusion and debate. And it's quite difficult to pin the decision-maker down so precisely what they mean by fairness. So that's the biggest challenge. […] And then I mean, there are intellectual ethical challenges about how you weight things, how you do the trade offs, but we have we have various frameworks for doing that. So I think it's more it's that discussion with a decision-maker. And that is getting hold of data to measure equity properly", RS_06* *"[…] in the NHS we talk about health gain maximisation that is what underlies NICE. Whatever they say, it is about QALY maximisation with some adjustments for equity, which are operationalised through a higher*

		inequality characteristic is. The typical one we always use is socio-economic. That tends to be the one which we are most interested in. And if you do believe there is a case, that we are going to see differential effects it is worth examining that to see. […] *We should start including distributional cost-effectiveness analyses where possible. But a note for that is, that in itself is not [?] a cost-effectiveness analysis and therefore before diverting resources to do these more complex evaluations, you need to have a decent view that you think it is a... there is an inequality impact that we are interested in", RS_05*	*threshold for cancer drugs, and a higher pay threshold for end of life drugs", RS_04*
	Priorities	*"what the outcomes are that matter and finding how far they diverge between the different stakeholders. And also thinking about patient reported ones because I think, as I was saying I think we infectious diseases generally and certainly STIs we're quite weak at that. And that is actually quite a powerful perspective to get in people's commissioners perspective,* *So it might be that speed of treatments beyond a certain threshold doesn't really matter very much. But if the patients really care about that, then you might want to commission that in, because it's part of their experience so kind of, yeah, those would be my general suggestions", RS_03*	*"I've been quite interested in doing some work to show if you've got to kind of cut things, how do you prioritise in a way that doesn't exacerbate health inequalities. Like, I guess it's all a bit dismal in terms of it's quite negative, but trying to prioritise. And that links to some work in terms of the impact of COVID and lockdowns and stuff. How should you prioritise what you do in that emergency situation in a way that doesn't disadvantage, those groups that are already disadvantaged", RS_08*
	(De)commissioning process	*"[…] if you reduce the funding for something, it involves some kind of decommissioning", RS_02* *"she's [researcher] interested in digitally providing sexual health services, and the potential for decommissioning old style face to face, face to face services and replacing them with digital. But if you were to do all those replace face to face models of service models, you couldn't do it over the night. There'd have to be a period where you are transitioning from one to the other. And there's very, it's it sounds like a prosaic and simple thing, but there's no there's no support for service planners and decision-makers in how to implement the processes. And what you tend to find is the new way is introduced, the old one is never removed. So all you've done is double the resource that you're expanding on in the service area. So, all of that sort is still relatively, still poorly understood." RS_02*	*"[…] decommissioning, the term as I use it refers to deliberate processes of trying to, to remove replace or, or reduce services", RS_01*
	Nature of sexual health services; complexity	*"So GU [genitourinary] clinics have historically been quite separate from general practice. That is changing quite a lot. But they've been quite separate partly because they were there's this huge priority on them being confidential and nobody knows you've gone there and all that sort of stuff. But also and then in the days of AIDS, early days of AIDS, there was a lot of … you can't make people tell their GP and all this kind of stuff. There's been quite a lot of cultural pushes to make GU medicine quite a lot more separated than it might be. Not sharing*	*[Response to that responsibilities lie with the local health authority to commission SHS]* *"so that's a huge change. I think the people, the public health teams, you know, the oldest study suggested that it took them a while to adapt to this completely different environment", RS_02*

information, all this kind. I mean the culture has changed", RS_03

"one of the arguments of that paper might be: The more people that you reach, then the better your disease control will be. So how do you have outcome measures that allow you to measure those sorts of things. Given that, given that you're basically having to think about what happens to somebody who isn't your patient, and they might be someone who has a lot of sexual partners and they might be somebody who hasn't said.... So it's really it's quite a complex area", RS_03

"And so it's kind of just getting some getting some clarity on what the big wins are and then making sure people really get that and have non patronising informative information", RS_03

Table 6.3.3. Theme 3 – Economic evidence

Theme	Economic evidence	Quote 1	Quote 2
Subtheme	**The development process**	*"somebody [from a local authority] was brave enough to tell us that whatever we have presented, they respected the credibility of the data, the underlying assumptions of the model, but they were not useful to them at all. And that was kind of an eye opener to us because you are sitting in an ivory tower of academia and then create all these kind of models and think okay this is how it should be. But apparently that wasn't the case at the time. So we asked ourselves then you know what, where should we actually go with all this and we started engaging with most stakeholders more often", RS_10.*	*"I think the time available is always a challenge and resources as well", RS_11* *"Nobody's going to wait for the researcher, unless it's a vaccine for COVID", RS_01* *"the whole point is to try and provide information to help inform decisions. So as part of that, if you're going to provide information to help inform decisions you kind of need to speak to the people that you're hoping will use the results so that you can check whether what you're doing is useful, whether it's understandable, whether there's improvements you could make or things like that and also because in terms of the choice of topics. Often we would say that they're the best people to ask if there's some kind of freedom in terms of what we choose to investigate. It's not a doesn't matter what we think is the most interesting topic it matters what they think is the most. The topic where they need some information and support", RS_08*
		"I think we [health economists] shouldn't be there to impose value judgements on decision-makers. We should be trying to be transparent what our methods are doing and highlight how value judgements feed into any of our evaluations and highlight the because that'd allow them to be tested and edited accordingly", RS_05	*"[…] we're [refers to a clinical lead person] going to free up all this money, and we're also going to improve everything for everyone and, and all the evidence supports it. And what they [decision-makers] mean by evidence is that, this is what everyone else does. It's not really evidence, and I think academics. One of the roles for academics is to bring a little, a little bit of challenge and a little bit of rigor into some of the projected benefits for decommissioning and for commissioning for that matter", RS_02*
	Problems with current economic evaluations	*"one of the stakeholders clearly said to me that he understood most of the economic evidence generated at the time, or in the literature, was basically informing the national context, for example whether [? some programme] should be funded or not. But if you look at the commissioning context, and you've got the fixed budget. And then there are more than one ways to do the same thing. So you're actually looking at the portfolio of interventions and what you're looking for is a mix of interventions delivered together. And whether they are going to be cost effective or not", RS_10*	*"The problem with economic evaluation generally is, there are a lot of value judgements which feed into it anyway, which aren't necessarily value judgements the decision-maker would agree with or hold", RS_05* *"If you want to do a distributional cost-effectiveness analysis you are going to have to incorporate a preference on the inequality inversion parameter which is key. And that's not particularly transparent. And it's not clear whose views should matter on that", RS_05*
	Accessing evidence and data	*"You may have some people on the committee that did a week's training, maybe health economics, and that was about it. So in terms of accessibility. They struggle to understand it and they didn't know where to go to find it", RS_02*	*"One of the biggest barriers that we have to them using anything like that was that the information wasn't instantly accessible", RS_07*

		"then the next challenge is data. Getting good quality data split by these, whatever sub-groups. Yeah, so those are the biggest challenges", RS_06 *"what you see with routine data are that it often focuses on primarily authentication only. So we have a lot of public health interventions are delivered in schools and other settings in the NHS, you're missing a lot of impact of the primary care and Community Care level that would not be picked up by the data collection sector here. So I think they're missing out, they're missing a lot of information, and routine data to be used more often in research, then they need to have some data capture to capture these primary care, community care and sort of lower level resources. They do tend these claiming these, these routine data sources do tend to focus on the key cost drivers of cost location missions, missions. And I think that for a lot of population health interventions that might not be that relevant", RS_09*	*"I think the problem is getting the right information, to get the right data to be able to do that so in terms of local authorities or councils. One issue that we've found is that there's not really much information on what they're actually currently doing what they're actually currently spending on that's easily accessible. So kind of characterising, what is common practice. And what does that cost is, is tricky. And so that's one. So getting hold of information is problematic", RS_08*
	Outcomes	*"We have to understand the wider values. So if better sexual health gives women, young women a particular more confidence, more ability to study or to lowering anxiety or depression. We may not pick any of that up in our rather narrow evaluations which are more alongside an RCT design", RS_04* *"they were interested in all the other gains [besides productivity gains] as well, for example, how much money they would save from creating the latter [smoking cessation programme]", RS_10*	*"[…] decision-makers out there in the system make the decisions. If they're successful in getting it implemented, they move on to the next cycle of decisions and implementation. And so on this part, there's very little by way of evaluation of longer term outcomes. So not just sort of health and well-being but also equity and yeah, etc. So I think that's an area where researchers can make a real contribution in supporting evaluation and building up an evidence base over time", RS_02* *"People don't necessarily think the QALY is [ideal?] or it is not something they are interested in. They might have preferences for other outcomes. They might look solely on one particular health outcome. They might... be most interested in impact on their budgets", RS_05*
		"I think I used to have quite a hard rule that the economic evaluation decision around maximising health with health being measured by QALYs. […] It has benefits and it is clear and transparent and it's easily reproducible and allows for some consistency across evaluations. It has the cost but we're posting quite strong normative views there, which aren't necessarily accepted and all correct", RS_05 *"one other big thing is we need to better in reflecting what are the key issues and consequences for decision-making [?]. Something like a QALY might not always be that helpful in public health", RS_05*	*"And actually argue back to my academic colleagues that this pursuit to just this sort of focus on a QALY as being the outcome that local decision-makers are interested in is just so... it's just not reflective of the real world at all. Although I think to some extent that is changing a little bit and I think more academic health economists are agreeing with that.* *[…] this is cost effective, because the cost per QALY is like £10,000 per QALY. What does that even mean? You know, in terms of a decision, what they want to know is what's the budget impact, how are the cost distributed? What's the different outcomes? And how are those distributed across different subgroups in the population? And what's this going to be like in year one? And then, you know, year five, year ten?", RS_00*

	Opportunity cost	*"I am very keen on ensuring that benefits and opportunity costs are measured with a symmetrical fashion. I don't always think they have been. That's one of the big issues with a lot sort of the theories we use is to... people ignore what the opportunity costs are. And my unit here is trying to effectively measure what the opportunity costs are. So that we can make efficient decisions in what we are comparing like with like", RS_05* *"So one of my main critiques of CBA and social return on investment and other things, is effectively the assumption that a pound spent on something is only worth a pound elsewhere. So, as soon as we reached zero, we get the zero return on any of the other things. Where what we really need to know is what would have been generated if that pound was spent elsewhere, using the same metrics that we're using now. So, if we fund the sexual health programme, it means we're not going to fund the smoking cessation programme. What do the pounds spent on smoking cessation generate? […] We're not fairly comparing the benefits of a new treatment with the true opportunity costs. […] we're probably getting one pound equals one pound, and I don't think that's ever really true. Most of the evidence seems to suggest for public health spend more and NHS expenditure generates three pounds of value, or maybe even four pounds of value for every pound spent. So you've got an inherent inconsistency you assume, that there isn't", RS_05*	*"the trouble is NICE tends to only weights the benefits to two people that receive the drug in question and what they ignore is the health opportunity cost. So, probably end of life people, some of that have opportunity cost. And so we should apply the weight even-handedly to both sides of the equation. So that's what hasn't been done properly in the past. And we're trying to persuade people to pay attention to the opportunity cost side of the economic valuation as well as the benefits side. Because, in my view, a lot of equity weighting work... It's part of this this idea of a value framework. People talk about value and the only ever apply that value to the benefits side to the patients who are getting the treatment. They don't think about dis-values or people who you do take money away from", RS_06*

Table 6.3.4. Theme 4 – Recommendations for conducting economic evaluations

Theme	Recom-mendations	Quote 1	Quote 2
Subtheme	**Before starting an economic evaluation**	*"What's the point of the economic evaluation and who's it for. So first thing I would do is think about who is going to use this, the results of this economic evaluation and what are they going to use them for", RS_07*	*"It is sometimes the best thing that a health economist does is get people to start asking certain questions. Not necessarily providing any answers but just making sure that people are asking the questions they're kind of articulating what their values are or what their aims are. That can be, that can be a first step, an important stepping stone", RS_02*
	Methodological recommendations	*" […] to do this subgroup analysis and see whether any particular subgroup where the intervention is likely to be more or less cost effective", RS_10* *"I think we should be much more... within UK rules, but we should care not just about improving population health but we need to care about our distribution of health. And therefore we should be. We should start including distributional cost-effectiveness analyses where possible. But a note for that is, that in itself is not [?] a cost-effectiveness analysis and therefore before diverting resources to do these more complex evaluations, you need to have a decent view that you think there is an inequality impact which we are interested in," RS_05*	*"So I would definitely be conducting an economic evaluation and working with my behavioural psychology colleagues to understand the best the barriers and facilitators to use of the intervention, because economists can ignore this stream that you need to build the behavioural side effects", RS_09*
	Collaborating with decision-makers	*"[…] so it's important that you know you're starting with those new stakeholders on board and start kind of building trust relationship and mutual respect", RS_10*	*"It's about the right information at the right time. And the right information may vary according, well will vary, I guess, according to the to the question at the time, but there will be some key aspects of it. For instance, that under our lessons, there are lessons about what the right information looks like, I think, to be drawn from NICE and similar bodies", RS_01*
	Presenting evidence	*"for example we think that increasing the reach of partner notification makes a bigger difference than the speed. That is a fairly simple story", RS_03* *"So one of the things we actually did was to present the data in terms of very short term returns, medium term returns and the long term ones. That way, what happens is that we are able to show that some of the investment they're [local authority] trying to make actually doesn't make any money in the next two years, but from five years, actually they start making money. And if you take a lifetime perspective, it is highly highly cost effective. And that actually gave them some confidence that even if they know that there's no return in the next three years but it is going to be cost effective from fifth year onwards", RS_10*	*"So we produced three accessible reports with photographs. They were desktop published so they had graphic design through them. The point is a lot of decision-makers don't read academic papers. And so those reports... I mean you might argue they are not peer reviewed, they don't have an impact factor, but they are very accessible to local decision-makers", RS_04* *"So I guess, try to present as much information as possible to the decision-maker at ones, which is transparent to them. […?] Show them based on a set of things, how you make a decision. Show them at which point, sort of threshold analysis, at which point decisions would switch. Highlight any potential inconsistencies in their views that are there already. But yeah trying to be as explicit and transparent as possible", RS_05*

Chapter 7 Appendices

Appendix 7.1. Patient volume data

Pathway / month-year	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Average
Total no. incoming calls	6,064	8,163	9,350	12,119	12,268	10,677	8,304	9,201	9,278	9,391	**9,481.5**
General enquiries/ signposting	3,994	4,264	6,221	8,069	8,349	7,296	5,276	6,669	7,052	6,725	**6,391.5**
Phone consultations	2,070	3,899	3,129	4,050	3,919	3,381	3,028	2,532	2,226	2,666	**3,090**
Face-to-face consultations (walk-ins)	1,148	1,502	1,359	2,011	1,983	1,782	1,716	1,399	1,141	1,245	**1,528.6**
Triaged from phone to F2F	367	619	673	1,024	1,030	968	1,039	836	690	866	**811.2**
No. of STI tests issued	4,406	5,742	5,434	937	746	741	639	4,846	3,745	4,615	**4,798***
No. of STI tests returned	2,971	3,802	3,122	884	649	472	514	1,584	2,598	2,161	**2,706***
No. positive from returned STI tests	337	392	324	80	54	51	61	165	249	153	**270***
% STI kits positive	11.34%	10.32%	10.37%	9.10%	8.37%	10.80%	11.90%	10.43%	9.57%	7.09%	**10%***
Proportion returned	67%	66%	57%	94%	87%	64%	80%	33%	69%	47%	**57%***

*Only June 2020 to August 2020 and January 2021 to March 2021 considered.

Data received from Umbrella Sexual Health Services Birmingham.

No, Number, STI, Sexually transmitted infection

Appendix 7.2. Return rates of STI self-sampling kits April 2018- March 2020

STI Kits 2018/2019	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Total
No. STI kits issued	3,645	3,428	3,371	4,134	3,585	3,775	4,478	4,328	4,224	5,197	3,957	4,502	**48,624**
No. STI kits returned	2,056	2,173	2,112	2,289	2,245	2,148	2,438	2,462	2,159	3,069	2,735	2,623	**28,509**
% STI Kits Returned	**56.41%**	**63.39%**	**62.65%**	**55.37%**	**62.62%**	**56.90%**	**54.44%**	**56.89%**	**51.11%**	**59.05%**	**69.12%**	**58.26%**	**58.63%**
STI Kits 2019/2020	**Apr-19**	**May-19**	**Jun-19**	**Jul-19**	**Aug-19**	**Sep-19**	**Oct-19**	**Nov-19**	**Dec-19**	**Jan-20**	**Feb-20**	**Mar-20**	**Total**
No. STI kits issued	3,784	4,876	3,756	5,729	4,018	4,058	5,220	5,322	4,142	5,608	5,332	4,450	**56,295**
No. STI kits returned	2,220	2,956	2,566	2,923	2,397	2,737	2,751	1,572	2,678	3,371	3,173	2,937	**32,281**
% STI Kits Returned	**58.67%**	**60.62%**	**68.32%**	**51.02%**	**59.66%**	**67.45%**	**52.70%**	**29.54%**	**64.65%**	**60.11%**	**59.51%**	**66.00%**	**57.34%**

Data received from Umbrella Sexual Health Services Birmingham.

No, Number; STI, Sexually transmitted infection

Appendix 7.3. Detailed calculations for net monetary benefit and incremental net monetary benefit

Net monetary benefit (see Table 7.11 in text)

Calculations were done in TreeAge and then re-done manually, which resulted in minor differences due to rounding (TreeAge Software Inc., 2021; Klarenbach et al., 2011).

Net monetary benefit = (benefit x threshold) – cost

A £500 willingness to pay threshold was assumed.

Net monetary benefit per patient screened

Face-to-face pathway: (0.99 x 500) – 69 = 426

OPSS pathway: (0.56 x 500) – 10 = 270

Phone pathway: (0.66 x 500) – 34 = 296

Net monetary benefit per infection detected

Face-to-face pathway: (0.14 x 500) – 69 = 1

OPSS pathway: (0.04 x 500) – 10 = 10

Phone pathway: (0.07 x 500) – 34 = 1

Incremental net monetary benefit (see Table 7.12 in text)

Calculations were done manually and were based on the York Health Economics Consortium (York Health Economics Consortium, 2016).

Incremental net monetary benefit = (∆benefit x threshold) – ∆cost

A £500 willingness to pay threshold was assumed.

Incremental net monetary benefit per patient screened

Face-to-face pathway: Baseline

OPSS pathway: (-0.43 x 500) – (-59) = -156

Phone pathway: (-0.33 x 500) – (-35) = -130

Incremental net monetary benefit per infection detected

Face-to-face pathway: Baseline

OPSS pathway: (-0.1 x 500) – (-59) = 9

Phone pathway: (-0.07 x 500) – (-59) = 24

Appendix 7.4. Deterministic sensitivity analyses of cost parameters

Cost parameter	Results univariate worst case			Results univariate best case		
	Pathway costs	NMB per patient screened	NMB per infection detected	Pathway costs	NMB per patient screened	NMB per infection detected
Self-sampling kit	F2F 69 OPSS 12* Phone 35*	F2F 426.05 OPSS 269.87* Phone 294.53*	F2F -0.98 OPSS 5.91* Phone -0.53*	-	F2F 426.05 OPSS 272.46* Phone 296.12*	F2F -0.98 OPSS 8.50* Phone 1.07*
Treatment with doxycycline	F2F 70* OPSS 10 Phone 34	F2F 424.75* OPSS 271.90* Phone 295.33*	F2F -2.28* OPSS 7.95* Phone 0.28*	-	F2F 426.13* OPSS 272.26* Phone 296.03*	F2F -0.90* OPSS 8.30* Phone 0.97*
Health advisor triage	-	--	-	-	--	-
Clinic attendance	F2F 80* OPSS 10 Phone 38*	F2F 414.58* OPSS 271.88* Phone 291.56*	F2F -12.44* OPSS 7.93* Phone -3.50*	F2F 48* OPSS 9* Phone 26*	F2F 446.99* OPSS 272.89* Phone 304.08*	F2F 19.97* OPSS 8.94* Phone 9.02*
Health advisor follow-up	-	-	-	-	-	-
Health advisor phone consultation	-	F2F 425.90* OPSS 272.18* Phone 295.35*	F2F -1.13* OPSS 8.22* Phone 0.30*	F2F 69 OPSS 10 Phone 33*	F2F 426.19* OPSS 272.29* Phone 296.57*	F2F -0.84* OPSS 8.34* Phone 1.51*
Clinician phone consultation[1]	F2F 69 OPSS 10 Phone 36*	F2F 425.56* OPSS 272.05* Phone 293.96*	F2F -1.46* OPSS 8.09* Phone -1.10*	F2F 69 OPSS 10 Phone 35*	F2F 425.80* OPSS 272.14* Phone 294.96*	F2F -1.22* OPSS 8.19* Phone -0.10*

All costs in £.

Willingness to pay threshold was £500.

- No change compared to base case.

*Change compared to base case.

[1]Health advisor phone consultation was replaced by clinician.

F2F, Face-to-face; NMB, Net monetary benefit; OPSS, Online postal self-sampling

Appendix 7.5. Deterministic sensitivity analysis of proportions

Pathway	Parameter	Distribution, value, and probability	Results		
			Pathway costs	NMB per patient screened[6]	NMB per infection detected[6]
OPSS	Return of self-sampling kit[1]	Beta (3838, 4798) 0.8	F2F 69 OPSS 12* Phone 36*	F2F 426.05 OPSS 387.82* Phone 363.40*	F2F -0.98 OPSS 13.44* Phone 4.01*
		Beta (960, 4798) 0.2	F2F 69 OPSS 6* Phone 31**	F2F 426.05 OPSS 93.97* Phone 192.02*	F2F -0.98 OPSS 0.33* Phone -3.82*
	Chlamydia positivity rate[2]	Beta (924, 9238) 0.1	-	F2F 426.05 OPSS 295.87* Phone 272.09*	F2F -0.98 OPSS 16.98* Phone 4.54*
	Patient booked for F2F appointment[3]	Beta (2548, 8493) 0.3	F2F 69 OPSS 14* Phone 35*	F2F 426.05 OPSS 268.10* Phone 294.24*	F2F -0.98 OPSS 4.15* Phone -0.81*
Face-to-face	Sample taken[4]	Beta (5202, 10403) 0.5	F2F 35* OPSS 10 Phone 28*	F2F 214.70* OPSS 272.24 Phone 225.28*	F2F -0.99* OPSS 8.28 Phone -3.99*
	Chlamydia positivity rate[4]	Beta (924, 9238) 0.1	-	F2F 426.00* OPSS 272.24 Phone 305.08*	F2F 5.02* OPSS 8.28 Phone 3.95*
Phone call	Patient was triaged to order OPSS after phone call	Beta (2000, 9482) 0.21	F2F 69 OPSS 10 Phone 46*	F2F 426.05 OPSS 272.24 Phone 341.26*	F2F -0.98 OPSS 8.28 Phone 0.83*
		Beta (4741, 9482) 0.5	F2F 69 OPSS 10 Phone 30*	F2F 426.05 OPSS 272.24 Phone 291.67*	F2F -0.98 OPSS 8.28 Phone 2.20*
Phone consultation	Phone consultation[5]	Beta (6180, 9482) 0.65	F2F 69 OPSS 10 Phone 37*	F2F 426.05 OPSS 272.24 Phone 289.40**	F2F -0.98 OPSS 8.28 Phone -1.61*
	Referral to F2F service[5]	Beta (1545, 3090) 0.5	F2F 69 OPSS 10 Phone 37*	F2F 426.05 OPSS 272.24 Phone 310.05**	F2F -0.98 OPSS 8.28 Phone 1.08*
	Advised to order self-sampling kit	Beta (618, 3090) 0.2	F2F 69 OPSS 10 Phone 32*	F2F 426.05 OPSS 272.24 Phone 272.08**	F2F -0.98 OPSS 8.28 Phone 0.83*
General	Willingness to pay threshold	1,000[7]		F2F 921.05 OPSS 554.23 Phone 625.70	F2F 67.00 OPSS 26.32 Phone 35.59
		5,000	-	F2F 4,881.06 OPSS 2,810.17 Phone 3,263.40	F2F 610.80 OPSS 170.63 Phone 312.83

All costs in £.

- No change compared to base case.

*Change compared to base case.

[1]Changed this value in the following pathways SSK, CSSK, PCSSK.

[2]Changed the chlamydia positivity rate for the OPSS pathway and after phone call triage (SSK/CSSK).

[3]Changed the value for F2F appointment booked in the OPSS pathway and phone call triage to order SSK (SSK/CSSK).

[4]Sample taken after walk-in was changed for the CF2F and WAC pathways.

[5]Involved reducing the probability of service users being referred to OPSS after the phone consultation.

[6]Willingness to pay threshold was £500.

[7]No distribution for willingness to pay threshold.

CSSK, Call to be triaged to order a self-sampling kit; CF2F, Call to be triaged to a face-to-face appointment; F2F, Face-to-face; NMB, Net-monetary benefit; OPSS, Online postal self-sampling; PCSSK, Called reception + phone consultation followed by triage to order a self-sampling kit; SSK, Self-sampling kit; WAC, Walk into clinic / face-to-face appointment

Appendix 7.6. Deterministic sensitivity analysis for willingness to pay threshold

WTP threshold (£)	**500 (base case)**		**1,000**		**5,000**	
Pathway / NMB per outcome considered	**NMB per patient screened**	**NMB per infection detected**	**NMB per patient screened**	**NMB per infection detected**	**NMB per patient screened**	**NMB per infection detected**
Face-to-face	426.05†	-0.98	921.05†	67.00	4,881.06†	610.80†
OPSS	272.24	8.28*	554.23	26.32	2,810.17	170.63
Phone	295.99	0.93	625.70	35.59	3,263.40	312.83

All costs in £.

†Indicates highest NMB.

NMB = WTP*Effectiveness - Cost

NMB, Net-monetary benefit OPSS, Online postal self-sampling; WTP, Willingness to pay

Appendix 7.7. Multivariate sensitivity analysis of proportions: Increased face-to-face services

Pathway	Parameter	Sensitivity analysis distribution, value, and probability	Results		
			Pathway costs	NMB per patient screened[2]	NMB per infection detected[2]
OPSS	Patient booked for F2F appointment due to other risk factors[1]	Beta (2548, 8493) 0.3	F2F 69 OPSS 14* Phone 48*	F2F 426.05 OPSS 268.10* Phone 318.49*	F2F -0.98 OPSS 4.15* Phone -2.74
Phone call	Patient was triaged to order self-sampling kit after phone call	Beta (2000, 9482) 0.21			
Phone consultation	Referral to F2F service after phone consultation	Beta (1545, 3090) 0.5 Changed proportion which ordered SSK after phone consultation to 30% to allow for this calculation: Beta (3090, 1000) 0.324			
	Advised to order a self-sampling kit	Beta (618, 3090) 0.2			

All costs in £.

[1]Change the value for F2F appointment booked in the OPSS pathway and phone call triage to order SSK (SSK/CSSK).

[2]Willingness to pay threshold was £500.

*Change compared to base case.

CSSK, Call to be triaged to order a self-sampling kit; F2F, Face-to-face; NMB, Net-monetary benefit; OPSS, Online postal self-sampling; SSK, Self-sampling kit

Appendix 7.8. Multivariate sensitivity analysis of proportions: Higher risk population

Pathway	Parameter	Sensitivity analysis distribution, value, and probability	Results		
			Pathway costs	NMB per patient screened[2]	NMB per infection detected[2]
F2F[1]	Chlamydia positivity in F2F pathway	Beta (952, 9516) 0.1	F2F 69 OPSS 10 Phone 34	F2F 426.00* OPSS 272.24 Phone 296.00*	F2F 5.02* OPSS 8.28 Phone 2.92
OPSS[1]	Chlamydia positivity in OPSS pathway[1]	Beta (924, 9238) 0.1	F2F 69 OPSS 10 Phone 34	F2F 426.05 OPSS 272.09* Phone 295.87*	F2F -1.37* OPSS 16.98* Phone 5.12*

All costs in £.

[1]Changed this value in all respective pathways (phone call/phone consultation triage for self-sampling / face-to-face triage respectively)

[2]Willingness to pay threshold was £500.

*Change compared to base case.

- No change compared to base case.

F2F, Face-to-face; NMB, Net-monetary benefit; OPSS, Online postal self-sampling