CERVICAL CANCER SCREENING; PUBLIC HEALTH IMPLICATIONS FOR HONG KONG

by

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Abstract

This thesis examines issues related to cervical cancer epidemiology and prevention through screening, with the aim of informing policy regarding setting up an organised cervical screening programme in Hong Kong.

There are five studies described here. The first, a case control study, indicated that screening is effective in preventing invasive cervical cancer among Chinese women. In addition, the main risk factors identified in other studies, were confirmed as risk factors in this population.

Secondly, a cross-sectional study examined the pattern of cervical screening in Hong Kong. The screening system at that time achieved poor coverage, was inefficient, inequitable and potentially harmful.

Thirdly, a cross-sectional study of practitioners showed the diversity in provision of services and the lack of consensus among practitioners in the management of abnormal smears.

Fourthly, the use of an industrial quality management technique in monitoring quality, using inadequate smear rates as an indicator is assessed. It demonstrated that this is an efficient and useful method that can be applied to monitoring a screening programme.

The last study was a randomised controlled trial showing that when women are given balanced information on cervical screening, with information on both the harms and benefits, relatively fewer chose to attend.

The implications of these studies in relation to setting up a screening programme are discussed.

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List of abbreviations used in thesis

ACC	Adenocarcinoma
ASCUS	Atypical squamous cells of uncertain significance
CI	Confidence interval
CIN	Cervical intraepithelial neoplasia
CMC	Caritas Medical Centre (Hong Kong)
DH	Department of Health
FPA	Family planning association
GUM	Genitourinary medicine
HA	Hospital Authority of Hong Kong
HGSIL	High grade squamous intraepithelial lesions
HMO	Health maintenance organisation
HPV	Human papillomavirus
HRT	Hormone replacement therapy
IARC	International Agency for Research on Cancer
LEEP	laser electrosurgical excision procedure
LGSIL	Low grade squamous intraepithelial lesions
NGO	Non-governmental organisation
O&G	Obstetrics and gynaecology
OCP	Oral contraceptive pill
OR	Odds ratio
QEH	Queen Elizabeth Hospital (Hong Kong)
QMH	Queen Mary Hospital (Hong Kong)
RCT	Randomised controlled trial
SCC	Squamous cell carcinoma
SPC	Statistical process control
TQM	Total quality management

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INTRODUCTION AND OVERVIEW OF THESIS

This thesis examines issues related to cervical cancer epidemiology and prevention through screening, based on studies completed in Hong Kong and England. It consists of a series of research study reports, all on the same theme: cervical cancer screening. These include a case control study and two cross-sectional studies in Hong Kong, and another cross-sectional study and pilot randomised controlled trial in the UK. Each study examines an aspect of cervical cancer screening, focusing on informing policy in Hong Kong. Hong Kong is a special administrative region in China, with relatively high cervical cancer incidence, and no organised centralised screening programme[1]. However, the government are currently discussing setting up such a programme in the near future (planned for 2004).

When setting up any screening programme, certain principles must be considered. A comprehensive set of principles was suggested by Wilson and Jungner in the 1960's[2] and remains widely used to this day. In the UK, the National Screening Committee have adopted and added to these[3]. In brief, these relate to the condition for which screening is performed, the screening test applied, the treatment options for those with positive test results and aspects of the programme itself. In relation to the condition, this should be an important health problem, with a recognisable latent stage and the natural history of the disease should be understood. In relation to the screening test, this should be suitable and acceptable. The treatment should be based on an agreed policy, be acceptable to patients, and there needs to be adequate facilities for diagnosis and treatment. This dissertation examines most of these criteria (all except last two) in relation to cervical screening in Hong Kong, and these are discussed in the final chapter. The thesis is divided into 6 chapters as follows:

Chapter 1

This background chapter describes the epidemiology of cervical cancer world wide, and within Hong Kong. It provides a summary of the pathology, incidence and prevalence, geographical variation and secular trends in disease occurrence. The major risk factors for disease and approaches to prevention are discussed. Finally there is an overview of cervical cancer screening, outlining the evidence of effectiveness, the components required for an effective screening programme and current screening policy in Hong Kong. The contents of the chapter are based on a review of the literature and summary of routine data sources relating to cervical cancer incidence and mortality. In relation to the overall aims of the thesis, it provides information on the importance of, and natural history of cervical cancer, the availability of the screening test and evidence on the effectiveness of screening.

Chapter 2

The chapter describes a matched case control study of cervical cancer in Hong Kong. The study consisted of 98 cases (women with incident invasive cervical cancer) and 294 matched controls (matched for age, social class and district of residence). The aims of the study were to identify the major risk factors for disease among Hong Kong women and to assess the effectiveness of screening. The chapter includes a discussion of the role of case control studies in assessing the effectiveness of screening and discussion on risk factors for cervical cancer. In relation to screening policy, the contents of this chapter provide local data to contribute to the evidence on the effectiveness of screening. Identification and awareness of the major risk factors allows policy makers to institute primary preventive measures in addition to screening

(e.g. smoking control programmes). It also identifies the population at higher risk, that could be targeted for screening.

Chapter 3

This chapter forms the main bulk of the thesis, being the largest and most resource-intensive study reported in this thesis. It comprised a cross-sectional telephone survey of 1,826 women in Hong Kong, and examined the pattern of cervical cancer screening in this population. The main aim of the study was to assess the coverage of screening among women in different age groups in Hong Kong. In addition, it aimed to assess women's knowledge and attitudes towards screening, and sought factors associated with uptake and barriers to screening. The equity of screening uptake, in relation to epidemiological risk factors, and the relationship between risk perception and risk factors and screening were also examined. Finally, a model was developed to assess the effectiveness and efficiency of the current pattern of screening in terms of the number of cases of cancer potentially prevented, and the number of screening tests per case prevented respectively. The model was also used to compare the current system with the level of effectiveness and efficiency that would be expected if different policies for organised screening were applied.

In relation to screening policy, this chapter enables policy-makers to compare the status quo – ad-hoc screening – with what could be achieved if a centralised organised screening policy were introduced. It also identifies what the main barriers currently are to women attending for screening, and what incentives could encourage and increase uptake.

Chapter 4

This chapter gives a basic description of the way cervical screening is currently provided in Hong Kong. A cross-sectional study of practitioners involved in cervical screening in Hong Kong was conducted to determine the attitude of practitioners, and the way services are organised and provided. Given that Hong Kong has no centralised cervical screening programme, and there is a mixed medical economy, this chapter provides a summary of the main providers, their beliefs, and their clinical and administrative procedures for cervical screening. The chapter also cross-references with the cross-sectional study of women reported in chapter 3, comparing practitioners and women's views in relation to barriers and factors influencing screening uptake. Practitioners' reports of how services are provided were compared to the women's reported experience. In relation to policy, this chapter emphasises the potential problem of obtaining consensus and agreed policies, when there are multiple providers with no centralised programme.

Chapter 5

The focus of this chapter is the monitoring and quality control aspects of a screening programme. The chapter introduces the literature on continuous quality improvement and the use of these techniques in healthcare. In particular, the use of statistical process control (SPC) is discussed, and its application to monitoring one aspect of the cervical screening programme is demonstrated, using inadequate smear rates as an indicator of quality. This is based on a study of inadequate smear rates across general practices in Birmingham, UK. The study involved the use of control charts to identify practices with persistently high or low inadequate smear rates, and an investigation of possible procedures contributing to these. In relation to policy, the chapter emphasises

the importance of monitoring and quality control, and suggests a method that could be used for achieving this.

Chapter 6

This chapter examines some of the ethical issues related to screening, namely, of obtaining informed consent. In countries with organised screening programmes, there has been much emphasis on achieving high coverage. The benefits of screening tend to be overemphasised, without much regard to giving participants full information on all outcomes of the screening process. Therefore information on screening has usually not been fully balanced. This chapter is based on a pilot randomised controlled trial. This compared the effects of the current information sheets on cervical screening provided by the NHS, with one containing more information on benefits and harms, on women's intended screening uptake. This chapter should encourage policy-makers to consider the consequences of having a screening programme, and to balance a utilitarian approach with one where the emphasis is on individual informed choice.

Chapter 7

This final chapter provides a summary of the previous chapters, drawing out the main findings and implications in relation to developing a cervical screening programme in Hong Kong.

Aims and objectives of thesis

The aim of the thesis was to review the current state of cervical cancer screening in Hong Kong and to consider the pros and cons of introducing a centrally organised cervical screening programme, instead of the current ad hoc system.

In each chapter specific objectives for the study are described. However, for the overall thesis, the main objectives included:

- To review the epidemiology of cervical cancer in Hong Kong (chapters 1 & 2)
- To review the effectiveness of cervical cancer screening (chapters 1 & “)
- To assess the pattern of cervical cancer screening in Hong Kong (chapter 3)
- To determine the way cervical cancer screening services were organised and provided (chapter 4)
- To assess the use of statistical process control for monitoring cervical screening (chapter 5)
- To consider the information needs of women invited for cervical screening, and assess the effects of information on intended screening uptake (chapter 6)
- To use the above information in suggesting pros and cons of introducing an organised cervical screening programme in Hong Kong (chapter 7)

1 CERVICAL CANCER EPIDEMIOLOGY

1.1 Summary

Cervical cancer is an important preventable cause of morbidity and mortality among women worldwide. This chapter briefly reviews the epidemiology of cervical cancer, focusing on Hong Kong and explores the evidence on the effectiveness of cervical screening.

Epidemiology of cervical cancer

Cervical cancer is the third most common female cancer worldwide. It progresses from pre-invasive cervical intraepithelial neoplasia, through to invasive disease over a period of about 10 years. Disease incidence increases with age, reaching a peak around 60 years. Incidence varies widely in different countries, ranging from around 3 to over 40 per 100,000. The higher incidence rates are seen mainly in developing countries, particularly in Africa, and the lowest rates occur in western Europe and west Asia. Overall, there has been a declining trend in cervical cancer incidence over time in most countries. However, this trend is less obvious in some developing countries. Furthermore, some regions in developed countries have seen an increase in rates in younger women.

Risk factors

The main risk factor for cervical cancer is infection with human papilloma virus (HPV). Thus, other behaviours that increase risk of this sexually transmitted agent also increase risk of disease. In addition, use of the oral contraceptive pill and smoking have also been shown to increase risk. Cancer incidence has also been shown to be higher among women in lower socio-economic groups and in those with lower levels of education.

Screening

There is good evidence from observational studies that screening is effective in reducing incidence and mortality from cervical cancer. Countries with centrally organised screening policies with good coverage have seen significant reductions in

disease incidence since their introduction. A 3-yearly screening programme is estimated to reduce incidence by over 90%.

Cervical cancer and screening in Hong Kong

Hong Kong has a relatively high incidence rate of cervical cancer (10 to 15 per 100,000) compared with most developed countries (1 per 100,000) and over half the cases occur in women under the age of 65. There is no organised screening programme, though screening is offered on an ad hoc basis. There have been few studies of the effectiveness of the current system of screening in Hong Kong.

1.2 Introduction

Cervical cancer is an important public health problem, being the third most common female cancer (9.8% of all cancers) world-wide[4]. There are almost 400,000 new cases of cervical cancer diagnosed each year, about a third of which occur in southeast and central Asia[4], which includes the region of interest in this thesis. There is some evidence that effective prevention can be provided by organised health screening services[5] and death from the disease, particularly in younger women, should be avoidable[6]. Yet for several reasons (discussed later), this potential has not been achieved.[7] This chapter will review the basic epidemiology of cervical cancer, focusing on the descriptive epidemiology of the disease in Hong Kong, and provide an overview of risk factors and strategies for prevention.

1.3 Pathology and natural history

There are two main types of cervical cancer: squamous cell carcinoma (SCC) and adenocarcinoma (ACC). SCC is the more common type of cancer, accounting for about three quarters of all cases[8]. Long term studies suggest that invasive disease arises as a consequence of progression from mild dysplasia through severe dysplasia to carcinoma in situ[9; 10]. These precursor lesions are also known as cervical intraepithelial neoplasia (CIN), and represent various degrees of disordered cell maturation in the cervical epithelium. A definitive diagnosis of CIN can only be made by biopsy of suspicious lesions and histological examination. However, cervical cytology, first proposed by Dr. George Papanicolaou in the 1940's[11], is a screening tool for identifying abnormalities initially. There are several systems for classifying cervical cytology, all derived from the original Papanicolaou system[7]. The original

classification consisted of five classes, ranging from normal, to invasive carcinoma (Table 1). The Reagen system, later adopted by the WHO, divides abnormalities into mild, moderate and severe dysplasia, and carcinoma-in-situ (CIS)[12]. Richart introduced a classification system which used the same terminology as the histological changes, with different grades of cervical intraepithelial neoplasia (CIN I to III)[13]. More recently, the Bethesda system classifies lesions as low- or high- grade squamous intraepithelial lesions, LGSIL or HGSIL[14]. It also includes one group of lesions characterised by "atypical squamous cells of uncertain significance" (ASCUS). These cytological findings are associated with a variety of histological abnormalities on subsequent biopsy.

There is little information on the natural history of cervical cancer. Few cohort studies offer useful information because of treatment offered following diagnosis of CIN, short follow up and poor methodologies. However there are few well-conducted studies. These show that mild dysplasia (CIN I) frequently regresses to normal, as do half of those with moderate dysplasia, whereas CIN III once established, is less likely to undergo spontaneous regression[15]. Most regressions occur within 2 years of diagnosis of the dysplastic smear. One study found that about one in ten (9.9% [95% CI 8.2 – 11.6]) women with mild dysplasia on cytology, progressed to severe dysplasia or worse within 10 years, whereas almost a third (32.0% [95% CI 29.0 – 34.9]) of those with moderate dysplasia did so[10]. In another study, up to three quarters of cases of CIN I or II progressed to CIN III and 10-16% of all cases progressed to invasive cancer after 9 years follow-up[16]. As in the other study, those with more advanced lesions were more likely to progress to invasive cancer, whereas those with CIN I mainly did not. The number of cases of dysplasia diagnosed, far exceed the

number of cases of invasive cancer[17; 18]. For every case of invasive cervical cancer, there are approximately four cases of in situ carcinoma and more than 10 cases of pre-invasive dysplasia[19]. This supports the idea that not all cases progress, and suggests that the natural history of disease is not fully understood.

1.4 Presentation, clinical features and staging

The pre-cancerous lesions, CIN, are asymptomatic and usually detected through screening or a pelvic examination. Invasive disease can also be asymptomatic, but the first and most common symptom is abnormal vaginal or post-coital bleeding[20]. There may also be increased vaginal discharge. Symptoms of more advanced stages of the disease include pelvic pain resulting from tumour extending into the pelvic wall, incontinence or haematuria resulting from pressure on the bladder, or constipation from pressure on the rectum.

The most common diagnostic test for cervical cancer is cervical cytology, the same test that is used for screening. If the cytology result is abnormal, or if there are other indications, other more invasive investigations may be carried out to confirm the diagnosis. These include colposcopy, endocervical curettage and directed biopsy. For CIN, treatment is almost 100% curative and is usually carried out as an outpatient procedure[21]. The main forms of treatment for CIN include cryotherapy, laser vaporisation and laser electrosurgical excision procedure (LEEP)[21].

If invasive disease is diagnosed, staging is based on various features such as tumour size, spread, and type of cells (Table 2)[21]. Prognosis varies according to stage and extent of spread. Five year survival for stage IA disease exceeds 95%, whereas for

stage IV disease it is less than 20%[21]. Treatment also varies according to stage, and includes hysterectomy, radiotherapy and chemotherapy (Table 2).

Table 1: Classification schemes for cervical cytology

<table>
<tr><th>Classification system</th><th colspan="8">Cytology classification</th></tr>
<tr><td rowspan="2">Bethesda system</td><td rowspan="3">Normal</td><td rowspan="2">Infection Reactive repair</td><td rowspan="2">ASCUS</td><td colspan="4">Squamous intraepithelial lesions (SIL)</td><td>Invasive carcinoma</td></tr>
<tr><td colspan="2">Low grade (LSIL)</td><td colspan="2">High grade (HSIL)</td><td></td></tr>
<tr><td>Richart</td><td colspan="3" rowspan="2"></td><td>Condyloma</td><td colspan="3">Cervical Intraepithelial Neoplasia (CIN)</td><td></td></tr>
<tr><td></td><td>CIN I</td><td>CIN II</td><td colspan="2">CIN III</td><td></td></tr>
<tr><td>Reagen (WHO)</td><td>Negative</td><td colspan="2">Atypia</td><td colspan="2">Mild dysplasia</td><td>Moderate dysplasia</td><td>Severe dysplasia</td><td>Carcinoma in situ (CIS)</td></tr>
<tr><td>Papanicolaou</td><td>I</td><td colspan="2">II</td><td colspan="3">III</td><td colspan="2">IV</td><td>V</td></tr>
</table>

Source: Adapted from reference [22]

Table 2: Staging system for invasive cervical cancer and recommended treatment

Stage	Treatment
Stage 0 Carcinoma in situ - abnormal cells only on surface epithelium of cervix, not yet invaded deeper tissue.	See text
Stage 1 Cancer strictly confined to the cervix. **Stage IA** Invasive cancer identified only microscopically.	Simple hysterectomy
Stage IB Clinical lesions (lesions that can be seen without a microscope) confined to cervix. **Stage II** Cancer extends beyond cervix, but not extended onto pelvic wall. **Stage IIA** Cancer spread to upper part of vagina, but no obvious parametrial involvement.	Radical hysterectomy with pelvic node dissection or external beam and intracavity radiotherapy
Stage IIB Obvious parametrial involvement. **Stage III** Extended onto the pelvic wall or to the lower third of the vagina. **Stage IIIA** No extension onto the pelvic wall, but involvement of lower third of vagina **Stage IIIB** Extension onto the pelvic wall or blocked urine flow.	Pelvic radiotherapy
Stage IV Extended beyond true pelvis or clinically involved mucosa of bladder or rectum.	Chemotherapy with or without pelvic radiotherapy

Source: reference [21]

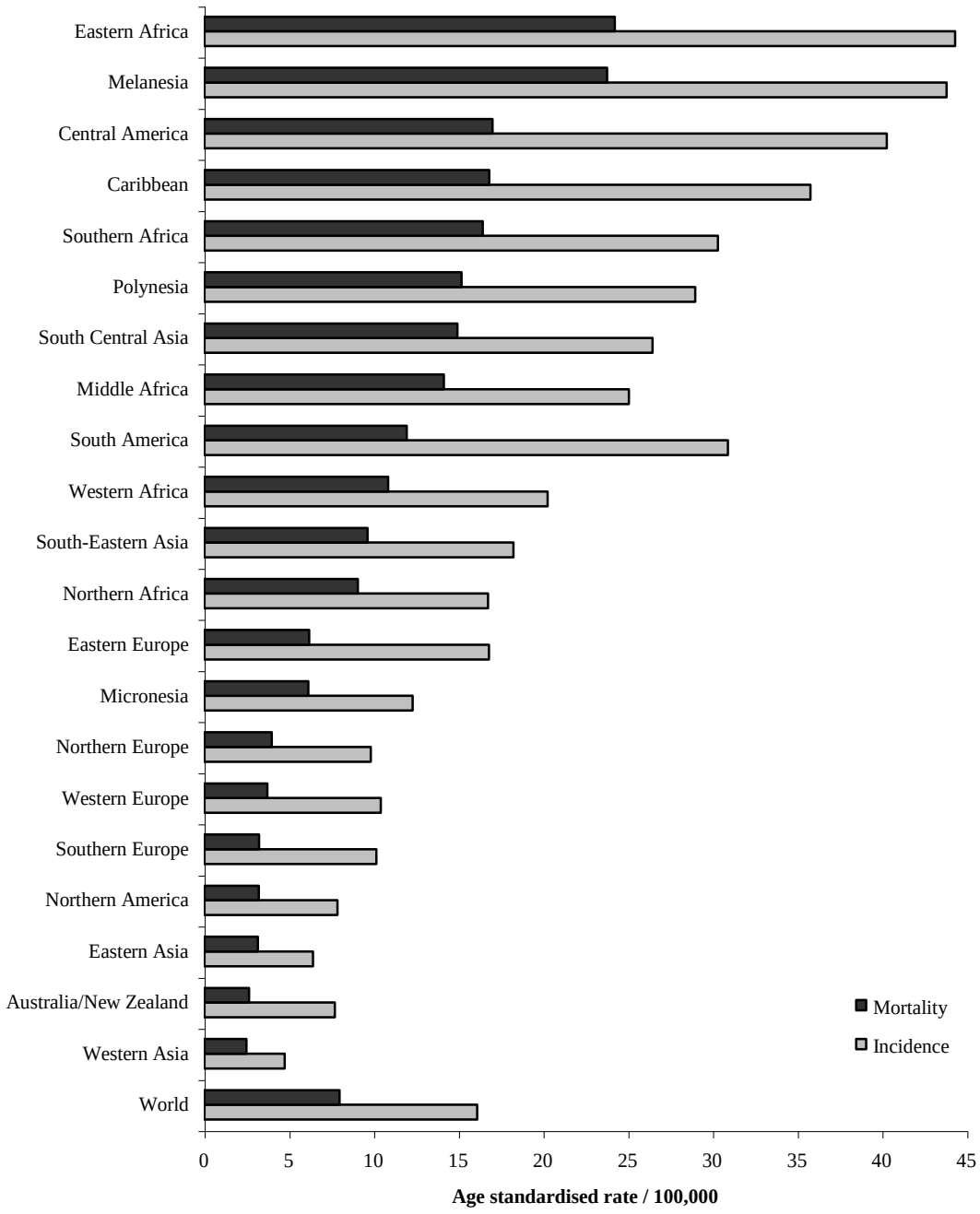
1.5 Incidence and prevalence

There is wide variation in the reported incidence and mortality from invasive cervical cancer between populations (Figure 1). Reported incidence ranges from 67/100,00 in the African population of Zimbabwe, to 3/100,000 for the non-Jewish population of Israel, during the same time period[23]. The incidence of invasive cervical cancer is highest in Central America, Sub-Saharan Africa and Melanesia[24], whilst in most developed countries, the rate is around 11 per 100,000[4]. Apart from differences in diagnostic and reporting patterns, the two major factors contributing to this variation are considered to be differences in sexual practices, and differences in access to organised cervical cancer screening programmes. There is good evidence that sexual behaviour patterns such as the age at first intercourse and the number of lifetime sexual partners of the woman and of her husband, play an important role in the aetiology of cervical cancer (see section 1.7.2 on risk factors). These practices

determine the woman's risk of acquiring sexually transmitted disease and customs vary over time and between population groups. Thus certain population sub-groups, such as nuns and groups with strict practices of abstinence and monogamy have long been noted to have very low rates of cervical cancer[25]. In contrast populations with higher rates of sexually transmitted diseases, reflecting a greater level of extra-marital sexual activity, have higher mortality from cervical cancer[26].

Figure 1: Incidence and mortality rates (per 100,000 women) of invasive cervical cancer

Adapted from Ferlay et al[24]



Standardised according to age distribution of standard world population

1.6 Trends

Comprehensive studies of international trends in the incidence of cervical cancer during the period 1973 to 1991 have shown that there has been a general decline in

incidence over time in most countries (based on 60 population based cancer registries in 25 countries) [8; 27]. Similarly, in the last few decades the overall mortality from cervical cancer has been falling in many countries[28]. This decline in both incidence and mortality, which is almost confined to developed countries, is generally attributed to the introduction of cervical cancer screening in these countries. However, changes in exposure to sexually transmitted diseases (STDs) may be another explanation. For example, in parts of China, where there has been a decline in mortality from cervical cancer over two decades, there is some evidence (based on an ecological study) that this was strongly related to a fall in risk of exposure to STDs after 1949[29].

However, if we examine trends in relation to histological type, the picture is even more complicated. For SCC, while manycountries have seen a general decline in incidence over time, there were a few exceptions, including the UK, Slovakia and Jews born in Israel. In these populations, an increase in incidence of SCC of the cervix was observed, predominantly in the younger age groups[8]. This was thought to be related to changes in sexual practice, and an increase in exposure to STDs and poor screening services[8]. In the UK, the increasing trend has started to stabilise and reverse in the last few years (see section 1.8.1 on screening for further discussion). For ACC, there has been a significant increase in the cumulative incidence in women born in the mid-1930s and in successive cohorts thereafter (age 25 – 49) in many parts of the world, including the United States (whites and Hispanic women), Australia, New Zealand, UK, Denmark, Slovenia, Slovakia and Japan (Osaka) and among Chinese women in Singapore[27]. At the same time, there has been a general decline in the incidence in women born in earlier periods. The reasons for this increase are not clear, but it may be partly attributed to an increasing prevalence of STDs, and hence human papillomavirus infection, to improvements in screening, which is less effective for

detecting ACC (see discussion on screening below – section 1.8.1) and to increasing use of the oral contraceptive pill.

1.7 Risk factors

There has been extensive epidemiological research to determine the factors underlying the aetiology of cervical cancer and CIN. Most studies do not differentiate between histological types when assessing risk factors. A geographical comparison across 60 cancer registries worldwide has shown high correlation ($r = 0.60$, $p<0.001$) between the age-adjusted incidence rates for SCC and ACC, despite large differences in overall rates in different countries[27]. This suggests similar risk factors for both pathological types, and this is confirmed in some epidemiological studies[30; 31]. However, other studies have suggested that the aetiology of ACC may differ to some extent from that of SCC[30; 32-35]. The main risk factors that have consistently been shown to be associated with invasive disease in various studies are discussed below.

The primary aetiological factor in cervical cancer and CIN, based on both epidemiological and molecular studies, is thought to be infection with human papillomavirus (HPV)[36; 37]. HPV is implicated in the aetiology of both squamous and adenocarcinoma of the cervix[38; 39]. Almost every case of invasive cervical cancer worldwide contains HPV DNA[40]. The time lag between infection and development of invasive cervical cancer is thought to be about 15 years[15]. Of over 70 types of HPV, four (particularly HPV 16, 18, 45 and 56) are associated with 75% of cancers[41]. However exposure to HPV in young sexually active women is very common and infection with oncogenic viral types (lifetime risk is around 79%)[42] exceeds the number of cases of invasive cancer. Therefore other co-factors must play a part in cervical carcinogenesis.

1.7.1 Sociodemographic factors

The incidence of cervical cancer increases with age, starting to rise in women between the age of 30 and 35 in most countries, and reaching a peak at about 50 to 60 years. Both pathological types show the same pattern of age-specific incidence[27]. The disease is more common amongst women from lower socio-economic groups[30; 34; 43-45] and low levels of education[46]. This may be partly explained by a higher rate of HPV infection in this group[47].

Initial studies suggested that unlike SCC, adenocarcinoma was more common in women of upper socio-economic groups[48]. However, later studies have not confirmed this, and have shown that AC is also associated with lower social class and with lower levels of education[30; 34; 45].

1.7.2 Reproductive and sexual risk factors

Some of the risk factors discussed below are now thought to be proxies for HPV infection, though others are likely to be co-factors in HPV progression.

The lifetime number of sexual partners

Behaviours that put women at risk for sexually transmitted diseases, also increase the risk of HPV and therefore of cervical cancer[49]. Thus, women who report three or more lifetime sexual partners have a two to three fold increased risk of developing cervical cancer compared to those with only one partner. The risk increases to nine fold for women reporting 10 or more partners. The relationship between cervical cancer and the number of sexual partners is seen for both histological types.

Use of oral contraceptives

Several studies have shown a relationship between use of the oral contraceptive pill (OCP) and both CIN and cervical cancer[50], particularly with increased duration of use (more than 5 years). Recent use of OCP (within 10 years) has shown to increase the risk of cervical cancer 2.5 fold in a large cohort study of 46,000 women followed up for 25 years[51; 52]. However, not all studies have consistent results. One case control study showed an increased risk among women taking the OCP[53] which was significant and positive for adenocarcinoma, but only weakly positive for SCC. The observed association weakened after adjusting for HPV and screening, though remained for ACC in situ. Another study showed that after adjusting for HPV, the association between OCP and cervical cancer disappeared[54]. The majority of studies suggest that the increased risk is for ACC only[35; 55]. This is suggested as an explanation for the increasing incidence in ACC among young women in many developed countries [27; 30; 56-58].

Other hormones and cervical cancer

Use of non-contraceptive hormones may also be associated with the risk of developing cervical cancer. In one case control study including 645 women aged 40-75 years, with invasive cancer in Italy, use of hormone replacement therapy (HRT) was associated with a reduced risk of cervical cancer[59]. However, a study that differentiated between the histological types of cervical cancer showed that risk was increased for adenocarcinoma, whereas there was a weak negative association with squamous carcinoma[60].

Other sexual and reproductive factors

Sexual history, including high parity, early age at first birth and at first sexual intercourse have all been shown to be related to cervical cancer. Studies that have adjusted for HPV show that some of these associations lose significance after adjustment[61], suggesting that they are confounders. The evidence on the association between ACC and reproductive risk factors, such as high parity, early age at first birth or number of abortions is conflicting[30]. Studies that have examined these associations have generally been small and not always adjusted for other confounding factors.

1.7.3 Lifestyle factors

Smoking and cervical cancer

The association between invasive and pre-invasive cervical cancer and smoking has been debated for over 20 years. A review of observational studies concluded that there was sufficient evidence to support a causal association[62]. This was based on the fact that such an association was found in almost all published studies, particularly among heavy smokers. A formal meta-analysis based on all published case-control studies in English from 1977 to 1990, estimated a weighted OR for cervical cancer of 1.4 (95% CI 1.33 – 1.51) for ever smokers compared to never smokers[63]. Generally, smoking increases the risk for cervical cancer one and half to two-fold, the risk increasing with the amount and duration of smoking[62]. Furthermore, there is evidence that smoking cessation facilitates regression of CIN, supporting a causal mechanism[64]. There are several plausible biological mechanisms to support a causal association between smoking and cervical cancer. Researchers have postulated that smoking has an immunosuppressive effect, as shown by a lower numbers of Langerhans' cells in the cervical epithelium of smokers with cervical cancer[65]. This could potentiate the effect

of HPV in cervical carcinogenesis. Furthermore, high levels of smoke derived cotinine and nicotine have been found in the cervical mucus of smokers[66-69].

Some researchers have suggested, however, that the observed association between smoking and cervical cancer may be due to residual confounding, particularly due to HPV infection[70]. Indeed, one case control study showed that the association between smoking and cervical cancer was weakened after adjusting for infection with HPV[43]. Another showed that the association between smoking and cervical cancer disappeared after adjustment for age and social class[71]. More recent studies however, have found that even after adjusting for HPV and other factors, smoking remains a significant risk factor for squamous carcinoma of the cervix[54; 72]. Smoking has also been shown to be an independent risk factor for high grade CIN, after adjusting for HPV[73].

Smoking is generally more strongly associated with squamous cell carcinomas than with adenocarcinomas for numerous cancer sites[74]. Most studies have found no association between smoking and ACC[30; 32; 34; 45; 75; 76].

With SCC, many of the aetiological studies have included women with carcinoma-in-situ as the only or predominant group, rather than those with invasive cancer. One study that compared risk ratios for the two groups, found that the association with smoking was slightly stronger for invasive SCC (OR for current smoking = 3.0) compared with carcinoma in situ (OR = 2.6)[72].

Some studies suggest that smoking is a risk factor for cervical cancer only in younger women[42; 77]. A study of women in Utah, found that the risk estimate for cervical cancer among young smokers was greater than among older smokers (OR 6.81 for women under 30, compared with 2.30 for those over 40)[77]. Similarly a Swedish study

showed higher risk estimates for women under the age of 45 years (OR 2.61 compared with 0.81 for older women)[42]. A possible hypothesis for this difference in age-related risk is that smoking has an anti-estrogenic effect[42; 78]. However, two other case control studies undertaken in Italy and the UK, to examine risk factors for cervical cancer in young women under the age of 40 and 45, showed that smoking was not related to disease in this age group[79; 80]. A possible explanation for the lack of association in this younger age group is that smoking may act at the start of the process of carcinogenesis and therefore require a longer time to have a measurable impact on cervical cancer risk. This is supported by the finding of increased risk with increasing pack years of exposure[72]. Another view is that smoking facilitates HPV effects, particularly for less aggressive viral strains. Cervical cancer in young women is more likely to be due to more aggressive viral strains, and therefore the effect of smoking would be negligible argues against increased risk in young women.

Although there is much evidence on the association between smoking and increased risk of cervical cancer, little has been published on the association between passive smoking and disease. A case control study exploring the relationship between passive smoking and CIN, found no effect[81]. This study, based on 103 cases and 268 controls in the US, showed a strong relationship between active smoking and high grade CIN, but no relationship between exposure to passive smoke and disease among smokers and non-smokers. However, 70% of the cases in the study were active smokers, leaving relatively few never smokers. Another study in the US, based on 212 cases (30% of whom smoked) and 330 controls, did show an increased risk with increased exposure to passive smoking[77]. This was a well-conducted case control study, but limited to white women, predominantly with CIS and some with invasive squamous cell carcinoma of the cervix. The study showed a significant dose-dependent

relationship between exposure to passive smoking and disease, which diminished, but persisted after adjusting for age, education, number of sexual partners and church attendance. The strength of this study was its' fairly robust exposure assessment, but it was limited in its study population.

Nutritional status

Studies about nutritional factors and both cervical cancer and CIN are conflicting. Some have shown that micronutrients such as folic acid, vitamins A, E, C and β-carotene confer a protective effect[82-86], while other studies have not[54; 87-89]. Other factors that have been suggested as risk factors include coffee drinking and a high intake of dairy products[54].

Weight gain

Unlike SCC, adenocarcinoma is associated with weight gain in early adult life, a risk factor for endometrial carcinoma[30]. However, it differs from endometrial carcinoma, in that OCP use is protective in the latter, but increases risk in the former.

1.7.4 Summary

Many sociodemographic, sexual and lifestyle factors have been implicated as potential risk factors for cervical cancer. However, much of the evidence is conflicting. In general, there is consistent association between low socio-economic status and increasing number of sexual partners, and increasing risk of cervical cancer. There is also a consistent and strong association between smoking and SCC and use of the OCP and ACC. However some of the risk factors (e.g. low socio-economic status or smoking) may be at least partly acting as proxies for HPV infection.

1.8 Prevention

Primary prevention of CIN and therefore cervical cancer could theoretically be achieved, primarily through interventions to prevent or treat HPV infection. However, HPV infection is asymptomatic, and easily transmitted and therefore usually not detected. Furthermore, there are currently no treatments to eliminate the infection once it is established. Some researchers are working on developing vaccines against HPV, which may be a primary preventive strategy in future[20; 90]. However, even when a vaccine is developed, issues such as safety, effectiveness and programme implications would have to be clarified. These approaches to primary prevention are therefore not feasible in the foreseeable future. Nevertheless, several features of cervical cancer make it an ideal target for a screening programme. It has a long pre-invasive phase that may extend 10-15 years[91]. A safe, widely acceptable and inexpensive test, the Papanicolaou (Pap) smear, is available to detect early stage disease and effective treatment of early stage lesions can be accomplished with minimally invasive techniques[91]. When setting up any screening programme, the importance of considering both the scientific validity and overall benefits, and establishing cost-effective, ethical and equitable policies for population screening are increasingly recognised. Although insufficient evidence is available to support the provision of most screening procedures at a population level, cervical screening is one which has been shown to be highly effective and is well established in many countries[91].

1.8.1 Screening for cervical cancer

Cervical cancer screening programmes usually screen using the Pap smear. This involves scraping cells from the cervix, fixing and staining them on a glass slide and having them evaluated by a trained cytologist. Other screening methods are possible,

but are either less effective (e.g. visual inspection with or without acetic acid[92]), or not yet evaluated. There has been growing interest in the use of HPV testing as a primary screening tool. However, a comprehensive review of the evidence by the Health Technology Assessment Committee of the UK DoH, suggests that further research is needed before this can be implemented[93]. HPV testing has been shown to be more sensitive than cytology screening, but it has low specificity, particularly in younger women.

Evidence on screening for cervical cancer

Although there have been no randomised controlled trials to determine the efficacy of the Pap smear as a screening test, there is much evidence of its value. This comes mainly form historic studies describing the effects of the introduction of well organised screening programs[94-97], and case control studies. These clearly show that organised screening results in a reduction in both the incidence and mortality from invasive cervical cancer. Some of the Nordic countries (Finland, Iceland and Sweden) have had nation-wide "population based organised" screening programmes since the 1960s. In these countries, the protective effect of two or more smears is clearly demonstrated[98] and deaths from cervical cancer have reduced by 80%[91]. There is a strong correlation between increasing intensity of screening and reduction in the risk of cervical cancer[99-101], lending support to a causal effect.

Screening interval

The extent of risk reduction is partly dependent on the screening interval. Data from large screening programs in European and North American centres has been analysed by a working group of the International Agency for Research on Cancer (IARC) and used to quantify the reduction in the probability of developing cervical cancer with

varying screening intervals[102] (Table 3). These results agree very closely with estimated reductions in incidence from mathematical models[103]. The information is also adopted by other agencies, including the World Health Organisation Western Pacific Regional Office[104], as a basis for some of their recommendations. The relative protection against cervical carcinoma in women with two or more previously negative smears have been estimated to be 15.3 after 0-11 months and 6.6 after 60-71 months when compared to women never screened. Protection was no longer apparent after six years however.

Table 3: Percent reduction in cumulative rate of invasive cervical cancer in women screened from age 35 to 64 at different frequencies

Interval between screenings (Years)	Reduction in cumulative incidence (%)	Number of tests
1	93.5	30
2	92.5	15
3	90.8	10
5	83.6	6
10	64.1	3

Assuming the woman has had at least one previous screen
Source: reference[102]

The table shows that screening in intervals of one to three years amongst women of 35-64 years accomplishes about the same effect. Furthermore, even screening once every 10 years reduces the incidence of invasive cancer by almost two thirds. An analysis of the benefits of screening in the elderly, assuming there was no harm associated, found that 80% of the benefit for cervical cancer screening is achieved before the age of 65[105]. By the age of 75, non-attendance for screening will result in a

maximum of 3 days of life lost, whilst by the age of 80, a maximum of 1.5 days would be lost.

There is much debate about the optimum screening interval, but several cohort[102; 106; 107] and case control studies [108-110]suggest that intervals of one, two or three years offer similar levels of protection. Different countries have different screening policies, with organised programmes offering screening intervals of between 1 and 5 years. Annual screening is recommended as the optimum screening interval by some expert bodies[111]. Nevertheless, evaluation of a programme with 5 year screening interval showed that this was appropriate and effective in reducing the risk of invasive cancer[112].

Screening coverage

There is some evidence that an organised programme with a wide coverage and range of ages is a more important determinant of risk reduction than a high frequency of screening[5]. At a population level, targeting women who have never had a Pap smear will have a much larger impact on reducing disease incidence and mortality, than screening more frequently those who have already been screened. There is evidence that older women and those with low socio-economic status, who have a higher than average risk for cervical cancer, are less likely to take up preventive health services[113; 114]. This has several important implications. Increasing coverage by targeting will tend to attract these women more, and can therefore contribute to a reduction in health inequalities[115]. Furthermore, if most women attending screening are those at low risk, a higher proportion of false positive cases will arise, resulting in additional medical work, unnecessary anxiety and possibly iatrogenic disease. This also wastes scarce resources and reduces the cost-effectiveness of screening[116; 117].

Elements of an effective screening programme

In practice, despite the success of some screening programmes, others, such as the early ones in the United Kingdom and Norway, have not been successful[118]. The main reasons cited for such failures are poor programme co-ordination and non-implementation of policy. In the United Kingdom resources were concentrated on more frequent screening of younger women, rather than trying to achieve regular coverage for the entire population[119]. In Norway, only a small proportion of the population were covered by an organised programme, and this is believed to account for their poor success.

The essential elements of an effective cervical cancer screening programme, including organisation, accountability and commitment, are well documented[120] and cases of invasive cervical cancer arising as a result of administrative and procedural failures cannot be justified in any developed country. In addition, the success of screening is dependent on other factors, including the provision of adequate resources and the adoption of quality control measures. Ensuring that smears are promptly examined and the results fed back accurately requires considerable resources, both in terms of laboratories and manpower. Amongst screening smears, over 90% of samples are expected to be normal, and a proportion of positive cases are likely to be missed. In order to minimise such false negative results independent re-screening and quality assessment must be an integral part of the programme[119]. Once abnormalities are detected, agreed guidelines for follow-up and clear lines of responsibility are essential. Several studies have highlighted incomplete follow-up as a problem, which is responsible for a proportion of cases of invasive cervical cancer[121]. Incomplete follow-up following screening has been reported in up to 40% of cases[122]. In one

study omission by clinicians and administrative errors accounted for over 90% of cases of documented incomplete follow-up, and only a small proportion of cases were attributable to the patients themselves[123].

Although financial and technical considerations are important, the main difference between effective programmes and those which fail, is in their level of organisation and management[118]. The recognition by the World Health Organisation that poor management and the implementation of inappropriate policies are responsible for the failure of some screening programmes, prompted the Western Pacific Regional Office to adopt managerial guidelines[124]. The purpose of these is to assist in the planning, development, management and monitoring of programmes for the early detection of cervical cancer.

An organised screening programme is more likely to include women at high risk compared to one where screening is opportunistic[125]. There is a strong correlation between the organisation of screening programmes and changes in disease incidence [100; 101].

Screening and adenocarcinoma

The aim of cervical screening is to prevent SCC, the more common histological type of cancer, rather than ACC. Evidence suggests that cervical smears are not sensitive for detecting ACC[126]. An evaluation of the screening programme in Iceland showed that the sensitivity of cervical smears for identifying pre-invasive SCC following a 3-year interval was 81%, but only 42% for ACC[127]. Another case control study of ACC, based on screening in the 1970's and 1980's suggested that screening was ineffective in preventing cases[128]. This may also partly explain the increasing trend in ACC seen

in many countries where screening is established, whilst the incidence of SCC has reduced.

1.8.2 Summary

There is consistent evidence from observational studies across different countries on the effectiveness of cervical smear screening in reducing incidence and mortality from cervical cancer. However, there is no evidence from randomised controlled trials, and few studies have taken place in non-westernised countries. Effectiveness is increased with reducing screening interval, with over 90% risk reduction for 3-yearly intervals. However, at the population level, incrasing coverage of screening increases programme effectiveness most. Other outcomes of participation in cervical screening programmes (including potential harm) and considerations for setting up a screening programme are discussed in chapters 6 and 7.

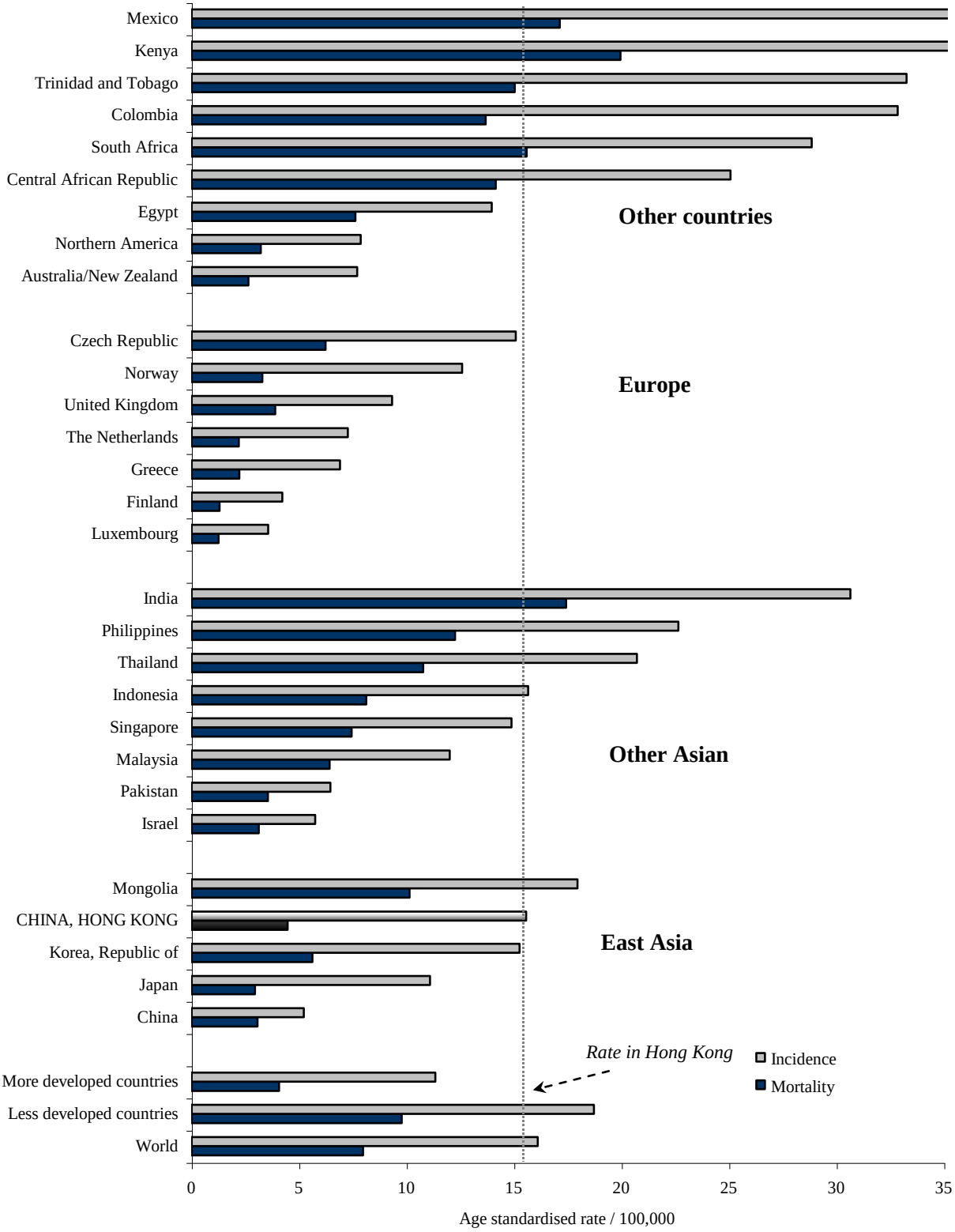
1.9 Descriptive epidemiology of cervical cancer in Hong Kong

Hong Kong has had a population based cancer registry for the last 30 years. The registry is a member of the International Association of Cancer Registries (IACR), which means that it conforms to accepted standards for data collection and quality[129]. Each year the registry publishes information on cancer incidence in Hong Kong, by age and sex, though the publications are based on data that is approximately 5 years old. In addition, the Hong Kong Department of Health (DH) publishes data on mortality from cancers, in their annual report each year. These reports have been published since 1989, and provide age and sex specific data for the current year. Therefore there is good, reliable information on cervical cancer incidence and mortality for at least 24 and 15 years respectively.

Cervical cancer is an important public health problem in Hong Kong. Compared to other developed countries, Hong Kong has a moderately high mortality rate for cervical cancer[130], and is cited as a "high risk" area for this by the International Agency for Cancer Research[131] (Figure 2). In contrast, Hong Kong women are at lower risk of other common cancers, such as those of the breast and lung, compared to their counterparts in most of the Western countries[1]. Mortality from cervical cancer increases with increasing age, though age-specific mortality rates have reduced over the last 15 years, and peak mortality has increased from around 55 in the early 1980's to over 70 years in late 1990's (Figure 3). Cervical cancer is the fourth most common cancer in Honk Kong. [132], in contrast to being ranked eighth in the UK in 1988[5]. There are about 450 to 500 new cases of invasive cervical cancer in Hong Kong each year, of which two thirds occur in women in the age group (15 to 64 years) where it could be considered "avoidable"[6]. Out of 159 deaths from the disease in 1999[133], over half occurred in this age group.

There has been little change in the overall rate of cervical cancer mortality in Hong Kong from the period 1982 – 1997 (Figure 4). This is mainly because rates in the older age group, with the highest mortality rate, have remained fairly steady, though there is a slight decreasing trend in recent years. In the 40 – 59 year age group, there has been a relatively sharp decline in mortality rate, particularly in the mid-1980's, which then levelled out. In the youngest age group (20-39 years), there are very few deaths in any one year to make meaningful interpretation of the trend. By calculating a 5-year rolling average in the mortality rate, there was a pattern of slow decline in mortality rate in the late 1980's, though there appears to be an upward trend in more recent years (Figure 5).

Figure 2: Age standardised incidence and mortality rates for cervical cancer in selected countries, 2001



Standardised according to age distribution of standard world population
(*Adapted from Ferlay et al{Ferlay, Bray F, et al. 2001 337 /id}*)

Figure 3: Age-specific mortality rates for cervical cancer over three time periods in Hong Kong (*Source: Hong Kong DH data)*

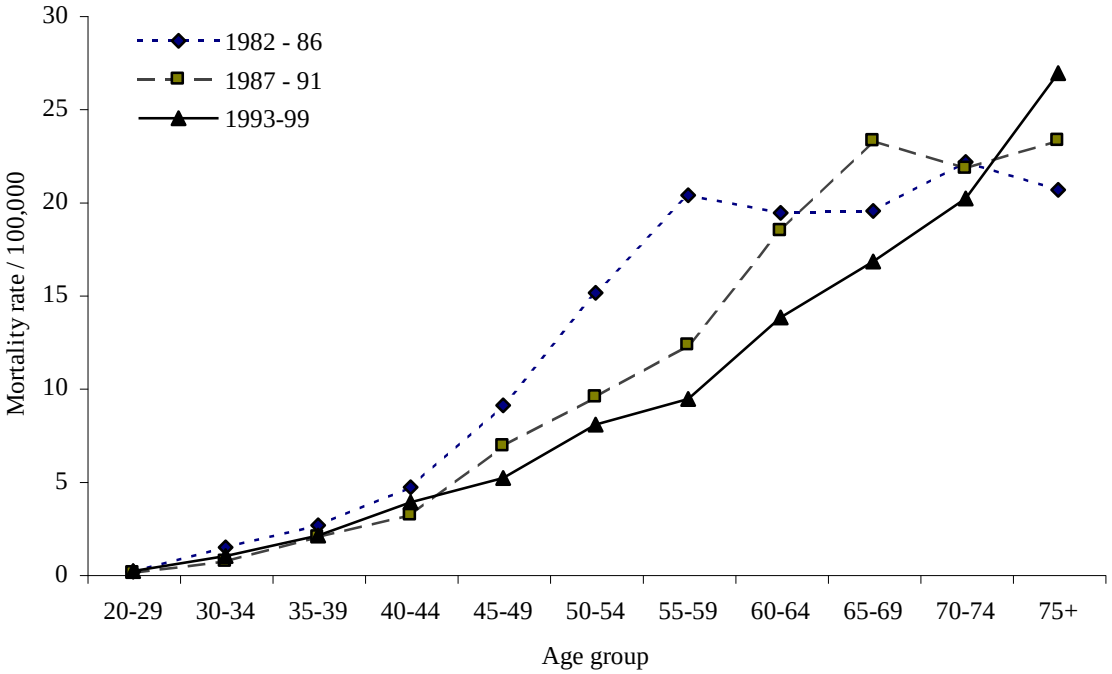
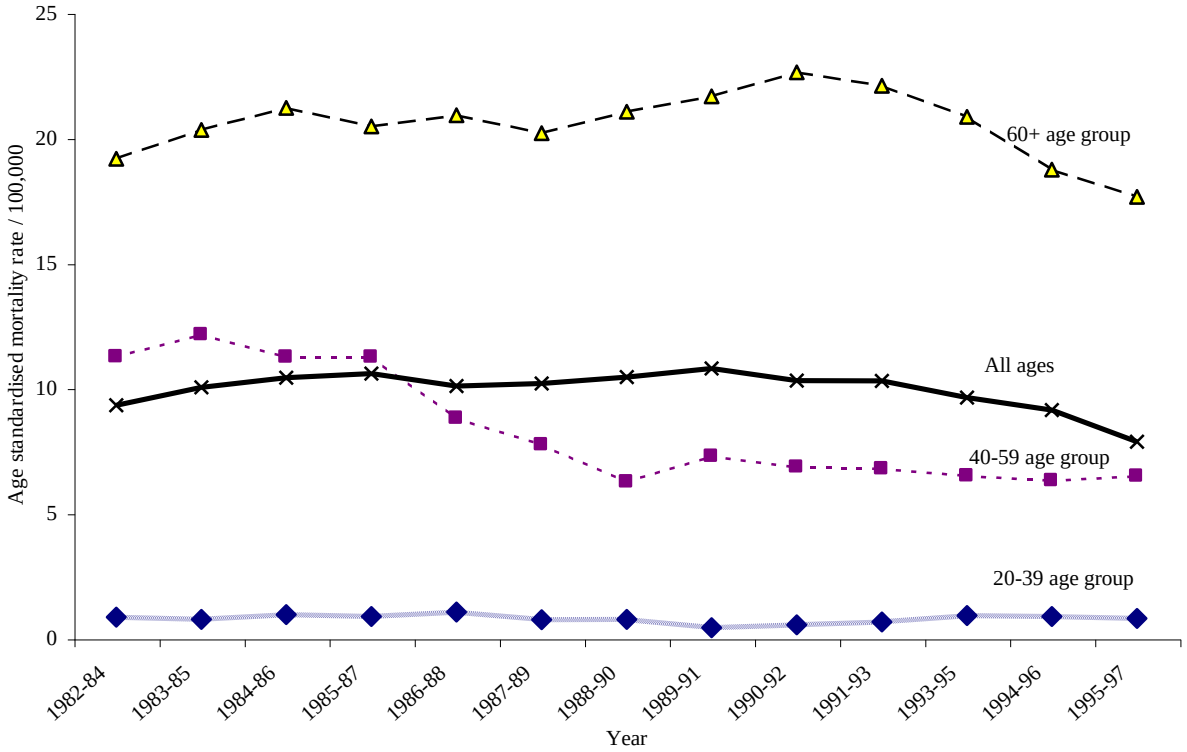
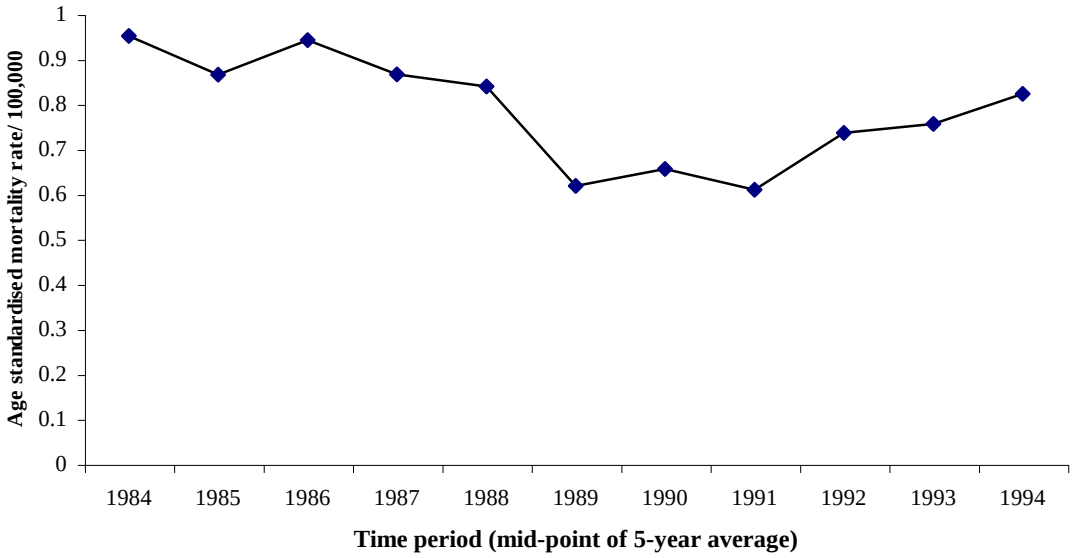


Figure 4: Trend in age-standardised mortality rates (3-year rolling average) for invasive cervical cancer by age group (1982 - 1997), in Hong Kong *(Source: Hong Kong DH data)*



Rates standardised to world standard population of women

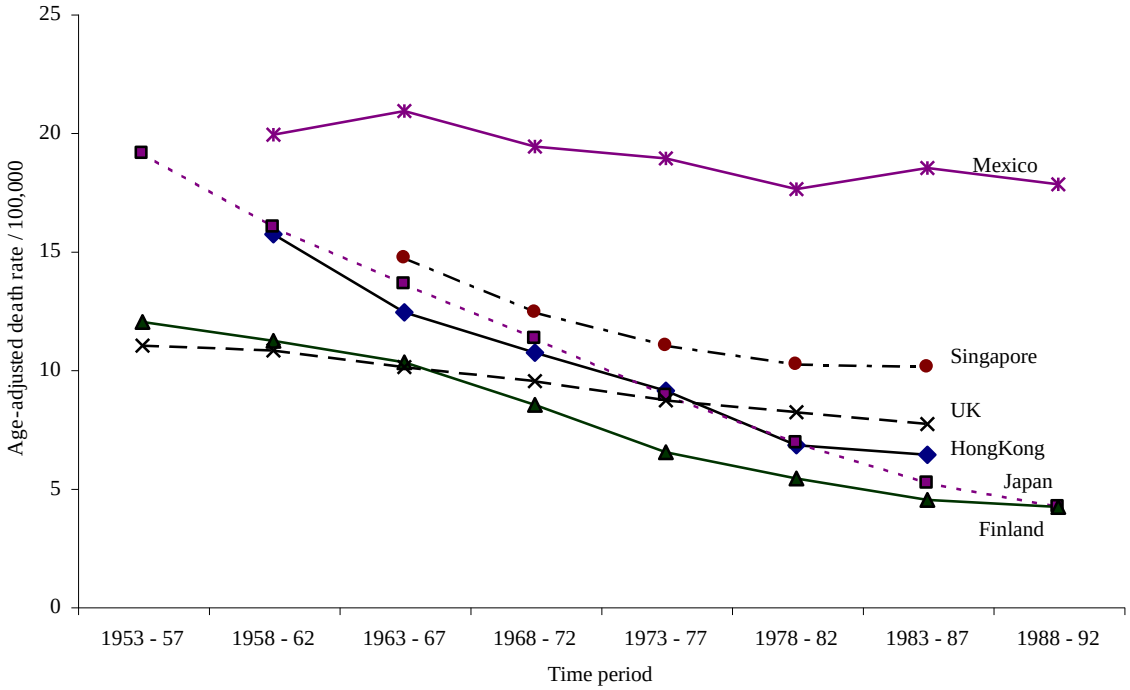
Figure 5: Trend in age-standardised mortality rates (5-year rolling average) for invasive cervical cancer for 20-39 year age group, in Hong Kong (*Source: Hong Kong DH data)*



The International Union Against Cancer (UICC) published a review of trends in cervical cancer mortality in 33 countries, over a 40-year period, based on WHO data (Figure 6). The mortality rates for the later years quoted in this study are slightly lower than those published in Hong Kong, and data prior to the 1980's is likely to be of poor quality. Therefore the graph should be interpreted with caution. Nevertheless, it suggests that the rate of decline in mortality in Hong Kong is similar to that seen in many developed countries, and steeper than that seen in developing countries such as Mexico.

Incidence rates for cervical cancer also increase with increasing age, reaching a peak at around 60 to 65 years, and moderately declining thereafter (Figure 7). There has been a general decline in incidence rates over the last 24 years (Figure 7 and Figure 8). The decreasing tendency is apparent in all age groups to a similar extent.

Figure 6: Trends in age adjusted mortality rates for cervical cancer in selected countries, 1953 – 1992



Rates are standardised to world standard population[134]

Figure 7: Age specific incidence rates for cervical cancer, over three time periods in Hong Kong *(Source: HK cancer registry data)*

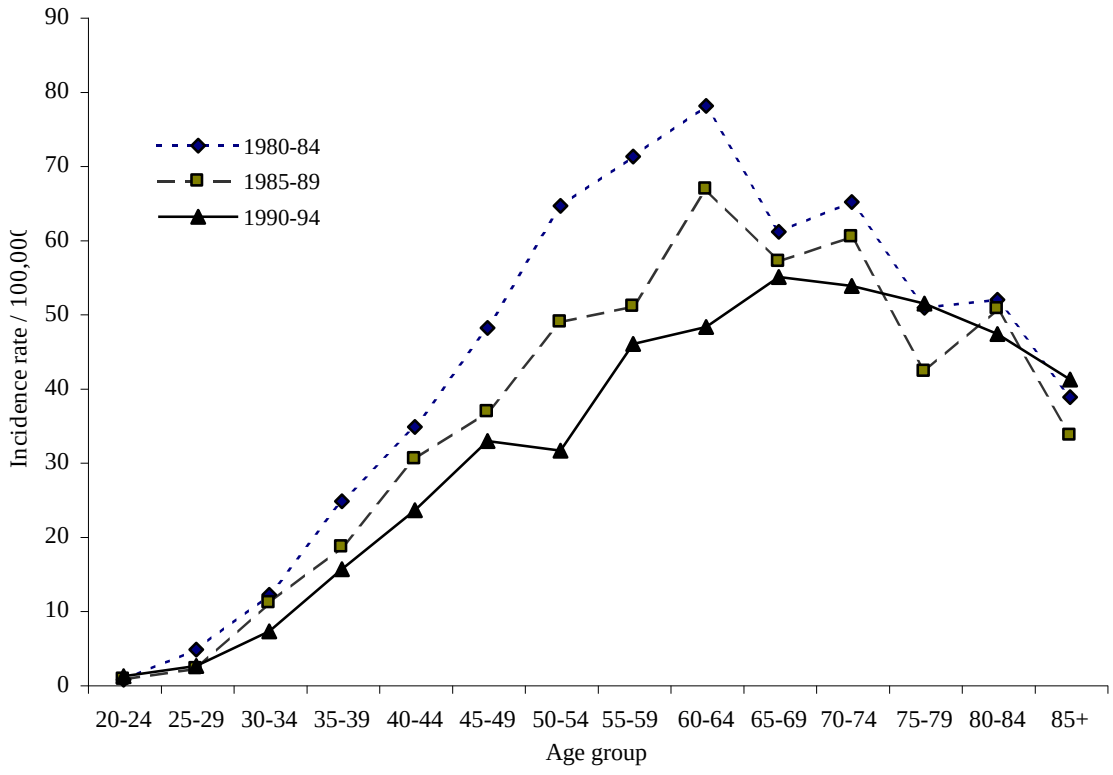
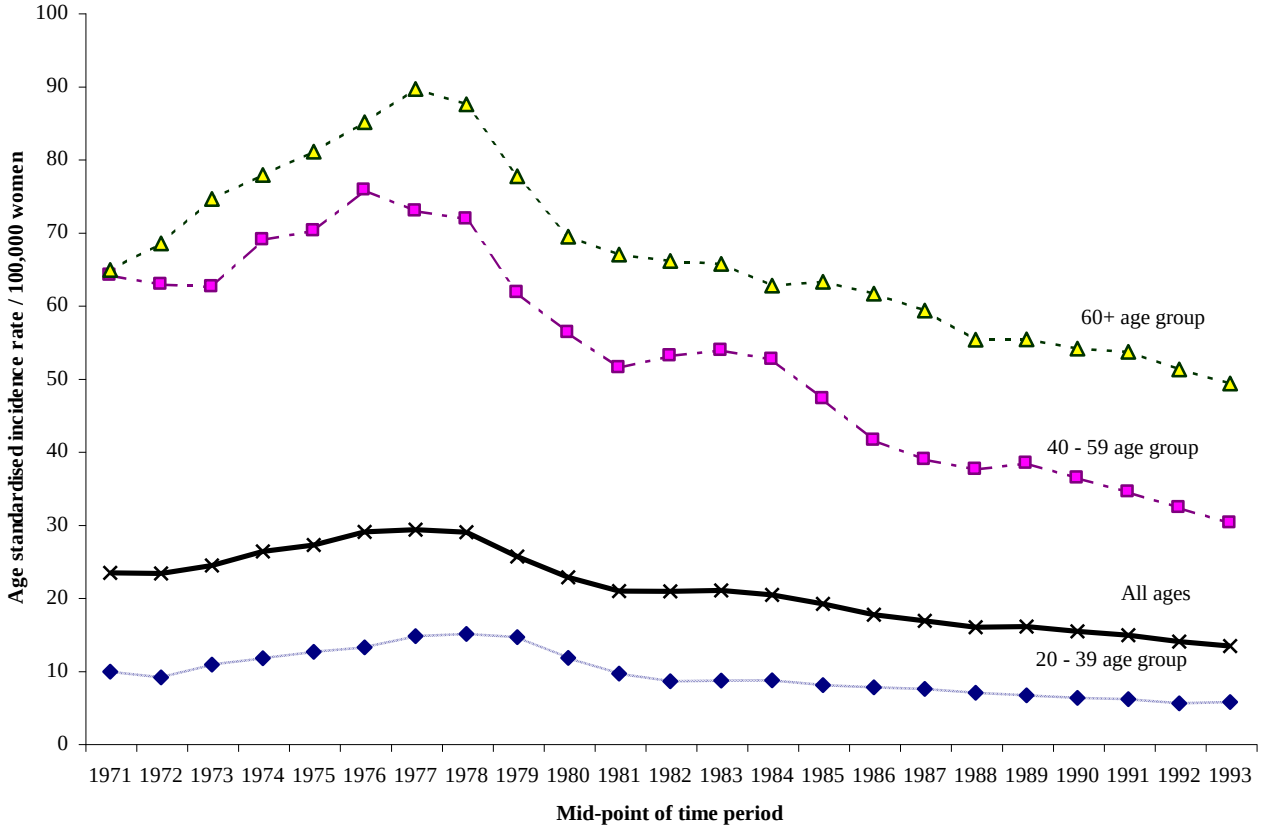


Figure 8: Trend in age-standardised incidence rates (3-year rolling average) for invasive cervical cancer by age group (1970 - 1994) in Hong Kong *(Source: HK cancer registry data)*



Rates standardised to world standard population of women

1.10 Cervical screening in Hong Kong

This issue is topical and of increasing public interest in Hong Kong, as reflected by an article in both the Chinese and English daily press[1]. At present there is no centrally organised, systematic population-based cervical screening programme in Hong Kong. Most screening activity is either opportunistic or offered as a part of a general "well woman" check up by various health care providers, each with their own agenda. It is estimated that about two thirds of Pap smears are carried out by the Family Planning Association (FPA) and the Department of Health, whilst the rest are done mainly in the private sector (personal communication: Director of FPA). The two main

providers have no locally developed policy on screening. There were also no guidelines from the major local medical organisations such as the Hong Kong Medical Association and the Hong Kong College of Obstetrics and Gynaecology (HKCOG) prior to this study. Subsequently, in 1999, the HKCOG has developed guidelines on the management of an abnormal cervical smear. In these guidelines, they recommend targeting screening at women with greatest risk, including those who have never been screened, or women not screened within 3 years.

Health surveys by the Family Planning Association of Hong Kong in 1992, found that the one year coverage of screening amongst women under the age of 60 is around 30%[135; 136]. One found that amongst women aged 15 to 60 years, 32% had a vaginal check up over a 12-month period[135]. The more detailed study showed that amongst married women of childbearing age (15 to 49 years), 30.2% had a Pap smear every year, whilst a further 27.7% have had a smear at some time in the past. The highest coverage was amongst the 30-49 year olds, whilst women over the age of 50, who are at highest risk of invasive tumours, had the lowest coverage (20%)[136].

Although these surveys contained some useful information, they had several limitations and there are still many unanswered questions. Neither study determined what proportion of cervical smears were done for routine screening, or for some other reason, such as investigation of menstrual symptoms. There is insufficient information on the frequency of screening or the equity of the present system in terms of access. The limited age range of the study populations means we do not know the coverage of screening amongst older women. In addition, there is no information on whether routine screening would be acceptable to women in Hong Kong, what factors affect the uptake and what barriers there are to screening. More research is needed to assess the technical and quality control aspects of screening. There is no local information on

the acceptability of the present arrangements for screening. Most important in terms of minimising the population impact of the disease, is the need to consider the most effective means of achieving high coverage of the population at risk. This is a major challenge because of the heterogeneous nature of Hong Kong's mixed medical economy.

This thesis attempts to address some of these issues, based mainly on two studies conducted in Hong Kong during 1997 to 1998.

2 CASE-CONTROL STUDY OF CERVICAL CANCER IN HONG KONG

2.1 Summary

The aims of this case control study were to assess the effectiveness of screening and to determine the main risk factors for the disease in Hong Kong.

Methods

Cases included all women with newly diagnosed invasive cervical cancer presenting to three hospitals in Hong Kong over the two-year period 1997-98. For each case, three matched controls were selected, from among responders to a random population survey on cervical screening. Controls were matched for age, social class and area of residence. All participants were interviewed and information was collected on sociodemographic factors, screening history and behavioural risk factors for cervical cancer. Cases and controls were compared in relation to screening history and risk factors for disease. Separate analysis was done for squamous and adenocarcinomas of the cervix.

Results

98 out of a possible 122 possible cases (80.3%) were interviewed, and 294 controls were selected (response rate 62.5% for controls). Over 70% of cases had squamous cell carcinoma, and most of the rest had adenocarcinoma. Cases were significantly less likely to have had a screening test in the last 3 years (unadjusted odds ratio for invasive cancer among unscreened population, 2.46 [95%CI 1.36 – 4.44]). Non-participation in screening particularly increased the risk of squamous carcinoma (OR

3.8; 1.8 – 8.3) rather than adenocarcinoma (OR 1.2; 0.4 – 3.4). After adjusting for other factors using conditional logistic regression, other characteristics associated with squamous carcinoma included increasing number of lifetime sexual partners (OR 2.3; 1.0 – 5.5 for two or more compared with one partner), having ever smoked (OR 3.7; 1.6 – 8.6) and exposure to passive smoke (OR 2.9; 1.2 – 7.2 for exposure to two or more smokers compared with none). For adenocarcinoma, the most important risk factor was use of the oral contraceptive pill (OR 18.1; 1.7 – 188.7) and having ever smoked (OR 6.4; 1.1 – 38.2).

Conclusions

Case control studies are useful for examining screening effectiveness and risk factors for relatively rare diseases. The level of effectiveness for screening estimated from this study is similar to that found in other case control studies. Therefore a screening programme in Hong Kong is likely to be as effective as in other populations. The main risk factors identified in other studies were also important in this population. The findings suggest that separate risk factors play a part for different histological types. The study also supports the hypothesis that passive smoking contributes to the aetiology of squamous cell carcinoma of the cervix.

2.2 Introduction

Case control studies offer an efficient method for evaluating the association between an exposure and disease, particularly where the disease has a long latency period and is rare[137]. They are also useful for examining multiple etiologic factors, and they are often used for exploring risk factors for disease. Increasingly, case control studies have also been used for evaluating the effectiveness of screening. This chapter focuses on a case control study that aimed to evaluate cervical cancer screening in Hong Kong and determine the main risk factors for cervical cancer in that region.

2.2.1 Use of case control studies in evaluating the effectiveness of screening

The gold standard method for assessing the effectiveness of any health care intervention is the randomised controlled trial (RCT). However, RCTs have practical difficulties that limit their use in certain circumstances. Where an intervention is already commonplace, such as in the case of cervical screening, and where the existing evidence suggest the intervention is beneficial there is an ethical dilemma in denying a control group the intervention. RCTs also require a large sample size and are generally a more expensive study design. Therefore observational studies are sometimes necessary to evaluate the effectiveness of preventive interventions. Case control studies have been used for assessing the effectiveness of screening since the 1940s[138].

There has been much published on the principles behind using case control studies to evaluate screening efficacy[139-143], but their appropriateness has been questioned[144]. There are two main arguments against their use. The first relates to the influence of

confounding factors, particularly as those who attend for screening may be at lower risk of disease, irrespective of screening. The second concern is that subjects with true positive screening results who are treated and do not subsequently develop the outcome that screening was intended to prevent, are excluded from the control population. However, these concerns do not invalidate the use of case control studies for assessing screening efficacy, rather they highlight the importance of attention to study design and the selection of cases and controls[145; 146]. The main issues that need to be considered in conducting such studies [137; 147] include:

1) *Definition of cases and controls*[147]. Cases should be subjects with the stage of disease which screening aims to prevent. They should also be incident rather than prevalent cases[137]. For cervical cancer, the aim is to detect pre-invasive lesions and prevent invasive disease and death. Therefore appropriate cases would be women with newly diagnosed invasive cervical cancer. Controls should ideally be selected from the general population, and be representative of the population who would have been selected as cases had they developed disease.

2) *Handling of cases detected by screening*[147]. If these cases are excluded, the benefits of screening are likely to be overestimated, whereas their inclusion, would tend to underestimate benefit. This is particularly a problem where there is no established screening programme, and coverage is low.

3) *Differentiating between "symptomatic" and "screening" smears*[147]. Inclusion of symptomatic smears will underestimate benefit. Therefore studies should try to identify and exclude smears taken because of symptoms. Another way of

handling this is to exclude smears taken within six or 12 months of the date of diagnosis of the case.

4) *Selection bias*. In situations where women at higher risk of cervical cancer are also those who are less likely to attend for screening, the case-control study would overestimate benefit[144; 147]. Some studies have tried to account for this by adjusting for risk factors, but residual confounding is still a possibility that must be considered.

There have been few studies to compare the results of RCTs with those obtained from case control studies. However, Demissie et al did undertake such a comparison, in relation to screening mammography[138]. They found that the direction of effect was the same with both study designs. However, the case control studies consistently showed significantly more protective effect than RCTs. Selection bias in the uptake of screening may have been one explanation for this difference, though the authors did not find convincing evidence to support this. Another explanation is that case control studies may be assessing the efficacy of intervention, whereas RCTs assess programme effectiveness. If RCTs are analysed in relation to actual screening practice, rather than based on intention to treat, the risk estimate is lowered to a similar level to that found in case control studies, providing some support to this hypothesis[148].

For cervical cancer, case control methods have been used frequently for evaluation of screening[109; 110; 149-156]. Table 4 summarises the main characteristics of these studies. The table is ordered according to the number of cases included in the study.

Most published studies have found screening to be protective, with a relative risk for ever versus never screening generally ranging from around 0.37 to 0.25[147]. The main

exceptions are a case control study from Taiwan[154], which showed no difference in screening practice among cases and controls, and a study from Italy[153], with an odds ratio of 0.1. The former study was based on a very small number of cases, and the authors attributed the findings partly to poor screening coverage and poor laboratory quality. In the latter study the percentage of women (cases and controls) who had screening was also generally very low, compared with other studies, suggesting that factors other than screening were contributing to the observed difference. Another study with null findings was a relatively recent study in Sweden, in a region with an organised screening programme[157]. In this study, history of ever screening was similar in cases and controls, though significantly more cases had some form of abnormality recorded previously. Uptake rates were over 80% among all women (cases and controls) in the age group targeted for screening (20 to 59 years). This suggests that other factors, such as follow-up and treatment of abnormalities were likely to be responsible for the difference observed in this population.

Presentation of cervical cancer

The vast majority of cervical cancers are squamous cell carcinomas[8; 158]. Before the general use of cytological screening, 75-90% of women with invasive cervical cancer presented with abnormal vaginal bleeding at a later stage of disease[158]. In countries where screening is widespread, the pattern has changed so that more women are diagnosed on the basis of abnormal pap smears, before the onset of symptoms.

Table 4: Features of case control studies to evaluate cervical screening (adapted from Moss[147])

Study	Diagnosis of cases	Matching and source of controls	Total cases (% screened)	Total controls (% screened)	OR (ever vs. never)	Other notes
Herrero[152] Latin America	1990	Hospital and community	759 (50)	1,430 (71)	0.33	Not modified by risk factor adjustment
Hernandez[159] Mexico	1990 - 92	Age, district	233 CIS (38.6) 397 invasive (28.2)	1005 (76.1)	0.68 (CIS) 0.38 (invasive)	OR adjusted for age, age at first coitus, parity, number of sex partners and socio-economic group
La Vecchia[153] Milan	1981 – 3	Age	145 with CIN 191 with invasive (31)	145 age-matched 191 hospital control (64)	0.26	After adjusting for SE status & sexual habits, RR for screening intervals: < 3 years = 0.10, 3 – 5 years = 0.18 > 5 years = 0.36
Clarke[151] Toronto	1973 – 6	Age, neighbourhood, type of dwelling	212 (32)	1,060 (56)	0.37	Stratification by age, income, education, marital history, smoking and employment not affect result
Aristozabel[150] Cali	1971 – 81	Age, neighbourhood, health centre attendance	204 (4)	408 (31)	0.1	
Raymond[160] Geneva	1970 – 6	Age, nationality, civil status	186 (18)	186 (38)	0.31	Information only from abstract. Article not in English
Celentano[161] Maryland	1982 – 84	Age, race, neighbourhood	153	392	0.29	Adjustments for education, ever treated for a sexually transmitted disease, smoking, age at first sexual intercourse, number of pregnancies & lifetime contraceptive use

Andersson-Ellstrom[157] Sweden	1990 – 97	Age (first woman after case on population register)	112 (61) All ages 69 (82.6) Age 20 - 59	112 (65) All ages 69 (88.4) Age 20– 59	0.83	No significant difference in screening history between cases and controls. However, cases had significantly more atypia on smears.
Sato[109] Japan	1984 – 90	Age, area	109 (55)	218 (85.5)	0.16	Only significant for squamous cell carcinoma
Chaplain[162] France	1987 – 97	Age, date of last screening, residence	104 (41.4)	208 (67.8)	0.32	Cases had CIS
Shy[110] Washington	1978 – 83	Geographical area	92 (*)	178 (*)	0.26	Not modified by risk factor adjustment
Lai[154] Taiwan	1979 – 84	No information on matching in abstract	56 (*)	Number of controls not given in abstract	No effect	Information based on abstract only (rest of article not in English)
Oleson[156] Denmark	1983	Age, area	45 (*)	67 (*)	0.25	
Van der Graffe[155] Netherlands	1979 – 85 (cases < 70 years)	Age, district	36 (47)	120 (68)	0.32	Adjust for age at first coitus → RR = 0.22 Smear within 2 – 5 years → RR = 0.18 Smear > 5 years previously → RR = 0.38

*Data on proportions screened not provided

2.2.2 Use of case control studies in determining risk factors

Case control studies are useful and efficient for indicating disease aetiology. Several case control studies have examined risk factors for cervical cancer. Some factors have consistently been demonstrated to increase risk, though their relative importance may vary. Others are still controversial. Differentiating between epidemiological risk factors in different age groups can help us to better understand the mechanisms in cervical carcinogenesis. In general young women share the same risk factors for cervical cancer as older women. However, some studies suggest that smoking and use of the OCP have different effects in different age groups[42; 77; 79; 80]. The main risk factors were discussed in detail in chapter 1.

There has been one other published case control study of cervical cancer in Hong Kong, focusing on reproductive and sexual risk factors [163]. This hospital based study included 68 cases, of whom 20 had invasive disease and the others cervical dysplasia. The study showed that cases and their spouses had significantly more sexual partners than controls, and that they tended to have been younger at first sexual intercourse. However, this study did not examine other risk factors nor screening practice among cases and controls.

2.2.3 Unanswered questions

There have been no studies to confirm the protective effect of screening amongst the Hong Kong population. The extent to which the classical risk factors for cervical cancer in other populations contribute to disease in this population is also not known. Also, given the paucity of studies examining the relationship between cervical cancer and passive smoking exposure, this study provided the opportunity for further examining this risk factor.

2.3 Aims and objectives:

The primary aim of this study were to assess the effectiveness of the current system of screening in Hong Kong, in preventing invasive cervical cancer and to investigate the importance of previously identified risk factors for cervical cancer, in Hong Kong.

Research questions:

1. What is the level of screening activity amongst women with cervical cancer?
2. How does this compare with screening activity among women in the general population?
3. To what extent do the classic risk factors for cervical cancer explain disease among women in Hong Kong?
4. Is passive smoking associated with an increased risk of cervical cancer?

2.4 Subjects and methods:

This case-control study was based on Hong Kong Chinese women recruited over a two-year period (1997 – 1998), to examine the effectiveness of cervical screening, and the main risk factors for disease in this population.

2.4.1 Selection of cases

Given that the objective of cervical screening is to reduce the number of invasive cases of cervical cancer rather than reducing mortality, we defined cases as Hong Kong Chinese women with incident diagnoses of invasive disease. Women with newly diagnosed invasive cervical cancer who presented to Queen Mary Hospital (QMH), Queen Elizabeth Hospital (QEH) or Caritas Medical Centre (CMC) from the beginning of January 1997 to the end of December 1998 were included in the study. Recruitment started in QMH, and all women presenting here during this period were included. In QEH, women with newly diagnosed disease who had radiotherapy were included, and recruitment started from mid-June 1998. In CMC, all new cases diagnosed since March 1998 were included. The recruitment period was based on the time at which approval for the study was obtained from the respective hospitals' ethics committees.

Informal discussion with the gynaecologists, suggested that almost every woman with cervical cancer would be referred to a hospital initially. Therefore, by targeting hospitals, we were unlikely to miss incident cases, unless the case was so advanced that they were directly referred to a hospice. QMH is the main oncology centre in Hong Kong, and women are referred here from all parts of the region. QEH is predominantly a tertiary referral centre, so is likely to have a higher proportion of more advanced cases. CMC is a relatively small hospital, with referrals from primary

care only. Limitation of resources did not allow us to include other hospitals in the study, but those included are major providers for Hong Kong and Kowloon.

At the end of the study, a search of hospital records was made to identify any cases that may have been missed during the study period. For these cases, as much information as possible was obtained from the case records.

2.4.2 Selection of controls

Controls were randomly selected from among women interviewed for a different study to assess the pattern of cervical cancer screening in Hong Kong. This study is described in detail in chapter 3, but briefly, it was a population survey of 1,700 women conducted by telephone. Participants for the study were predominantly selected through random digit dialling, though some were recruited through convenience sampling in order to obtain equal numbers of women in three broad age bands (20-39, 40-59 and 60 or over). The study included one women from each household contacted, who was 20 years old or more and who had not had a hysterectomy.

For each case in the current study, all participants from the telephone survey who matched in terms of age (+/- 2 years), social class (based on own or husband's occupation) and geographical district of residence were identified. From amongst these, three controls were randomly selected per case. The controls would have been expected to be referred to the same hospital as the case, had they been cases.

2.4.3 Study instrument and measurement

The same research assistant, using a structured questionnaire (Appendix 1) interviewed all cases face-to-face. These were all conducted in Cantonese in the

respective hospitals, usually in the clinics. The interview questionnaire had four main parts:

A) Background information on patient's socio-demographic details

B) Screening history, including when and the reason for testing and regularity of previous tests

C) Personal history to assess other risk factors (smoking history, number of years of education, number of years of oral contraceptive use, age of first sexual contact and the number of lifetime sexual partners)

D) Patient's understanding of problem and satisfaction with care (not presented in this thesis)

The questions for sections A to C were adapted from two other questionnaires used for similar studies elsewhere[164; 165], with permission of the authors. In addition, for each patient, information was collected from the hospital records on the date of diagnosis, histopathology of the tumour, stage of disease at diagnosis and treatment received.

The questionnaire used for controls was similar to that used for cases, except that other questions were used instead of section "D"(Appendix 1). For both questionnaires, we asked specifically about the reason for any Pap smear done, and when this was taken. Any smear test associated with prior symptoms was classed as a "diagnostic test", whereas those initiated by the patient, or where there were no previous symptoms were classed as screening tests. Women who had a screening test were asked when they had their last test, and whether they attended for screening regularly. Those who said they did attend regularly were classed as "regular attendees".

2.4.4 Sample size estimation

There is no reliable estimate of the extent of screening for cervical cancer in Hong Kong, but two studies from the Hong Kong Family Planning Association estimate a coverage of 30% amongst selected groups of women[135; 136]. In order to detect a relative risk of at least 2 for invasive cancer without screening, with 95% confidence and with a power of 80%, we needed at least 75 cases, using 3 controls per case (based on tables for calculation of sample size in unmatched case-control studies)[166].

2.4.5 Data management and analysis

The same research assistant, who also supervised data entry and the interviewers undertaking telephone surveys, collected all data for the cases. Analysis was done predominantly using SPSS, except for conditional logistic regression analysis, which was done using STATA. Cases and controls were compared regarding their cervical screening histories. The odds ratio for invasive cervical cancer in women who have been screened in the past 5 years compared to women with no prior screening was obtained. Logistic regression was also used to take account of possible confounding factors during analysis, and to identify any other factors associated with invasive cervical cancer.

2.5 Results

All cases that the study team were informed about agreed to be interviewed. In addition, 24 cases were identified that presented to the hospitals included in the study within the study period, but failed to be interviewed because the study team were not informed about them (Table 5). Therefore overall 80.3% of potential cases were included in the study. The response rate for the survey from which controls were drawn was 62.5%. A total of 98 cases and 294 controls were included in the matched study. Where available, information regarding their age, method of presentation, screening history, stage of presentation and treatment were obtained from the relevant hospital notes. Analysis was repeated whenever possible, to include these women.

Table 5: Characteristics of cases (including cases not interviewed)

	Cases interviewed (%)	**Cases not interviewed (%)**	**All cases (%)**
Hospital	n=98	n=74	n=122
Caritas Medical Centre (CMC)	6 (6.1)	6 (25.0)	12 (9.8)
Queen Elizabeth Hospital (QEH)	28 (28.6)	0	28 (22.9)
Queen Mary Hospital (QMH)	64 (65.3)	18 (75.0)	82 (67.2)
Stage of disease			
I	52 (53.1)	13 (54.1)	65 (53.7)
II	27 (27.6)	3 (12.5)	30 (24.8)
III & IV	18 (18.4)	8 (33.3)	26 (21.5)
Not known	1 (1.0)	-	1 (0.8)
Histology			
Squamous cell carcinoma	69 (70.4)	18 (75.0)	87 (20.9)
Adenosquamous	6 (6.1)	1 (4.2)	7 (1.7)
Adenocarcinoma and other	22 (22.4)	5 (20.8)	27 (6.5)
Not known	1 (1.0)	-	1 (0.8)
Treatment received			
Radiotherapy	53 (54.1)	13 (54.2)	66 (54.1)
Hysterectomy	36 (36.7)	7 (29.2)	43 (35.2)
Radiotherapy and surgery	8 (8.2)	0	8 (6.6)
Other	1 (1.0)	4 (16.7)	5 (4.1)
Not known	1 (1.0)	-	1 (0.8)
Screening history			
Ever screened	38 (38.8)	3 (12.5)	42 (34.4)
Never screened	60 (61.2)	9 (37.5)	48 (39.3)
Not known	-	12 (50.0)	12 (9.8)

Information on screening was only available for half of the cases that were not interviewed. These cases tended not to have had screening in the past, to have presented with more advanced disease and consequently fewer had hysterectomy as the only form of treatment (Table 5).

The median age for all participants (cases and controls) was 52 years (mean 53.6), with a range from 27 to 75 years. Although the cases were recruited from only three hospitals, they came from all districts in Hong Kong. Cases and controls were similar in terms of age, social class and district of residence (Table 6). The mean age for controls was 53.5, and for cases 53.7 (or 53.8 if we include those not interviewed). However, cases were more likely than controls to be single, divorced or separated, and generally tended to have had less education.

Table 6: Comparison of baseline characteristics in cases and controls

	Number (%)	
	Controls (n=294)	**Cases (n=98)**
Social class		
I	72 (24.5)	24 (24.5)
II	97 (33.0)	32 (32.7)
III	86 (29.3)	29 (29.6)
IV	39 (13.3)	13 (13.3)
District		
Wan Chai, Eastern & Mid West	58 (19.7)	19 (19.4)
Southern	48 (16.3)	16 1(6.3)
Kung Tong, Won Tai Sin, Kowloon City, Sham Shui Po & Yau Tsim Mong	108 (36.7)	36 (36.7)
Kwai Tsing & Tsuen Wan	17 (5.8)	6 (6.1)
Tuen Mun & Yuen Long	18 (6.1)	6 (6.1)
Sha Tin, Tai Po & Northern	45 (15.3)	15 (15.3)
Age group		
20 – 39	37 (12.6)	12 (12.2)
40 – 59	147 (50.0)	51 (52.0)
60 +	110 (37.4)	35 (35.7)
Marital status		
Single	1 (0.3)	1 (1.0)
Married / cohabiting	240 (81.6)	72 (73.4)
Divorced / separated	9 (3.0)	9 (9.2)
Widowed	44 (15.0)	16 (16.3)
Educational level		
Non/ primary	138 (46.9)	56 (57.1)
Secondary	131 (44.6)	37 (37.8)
Matriculation and above	25 (8.5)	5 (5.1)

2.5.1 Knowledge and practice of cervical screening

Overall, 67.9% (266/392) of women in the study had ever heard of a cervical smear, and 43.3% (175/404) had ever had a screening test. Information on screening history was available for 404 women, including all but 12 of those who were not interviewed.

Comparison of cases and controls is described in more detail in later sections, but overall, a higher proportion of controls compared with cases had heard of a cervical

smear (before diagnosis of cancer for cases), had ever had a screening test and were regular attendees for screening (Table 7). Apart from having heard of the test, none of the differences were statistically significant.

Table 7: Comparison of cases and controls in terms of screening knowledge and practice

	Cases (n=98)	**Controls (n=294)**	**Matched OR for control compared with case (95% CI)**
Heard of cervical smear	59 (60.2)	207 (70.4)	1.77 (1.03 – 3.05)
Ever had screening smear	38 (38.8)	122 (41.5)	1.18 (0.69 – 1.99)
Regular screening	20 (20.4)	69 (23.4)	1.26 (0.72 - 2.22)

Among those who regularly attend for screening (n=89), over three quarters attended at least once per year, and the longest screening interval was 2-3 years. Women in the control group tended to have more frequent screening (Table 8) compared with cases (χ^2 for trend = 13.65, p=0.009).

Table 8: Frequency of regular screening among cases and controls

	First smear	**≥Once a year**	**Every 2 years**	**Every 3 years**	**No regular smear**
Controls (n=294)	11 (3.7)	57 (19.4)	6 (2.0)	6 (2.0)	214 (72.8)
Cases (n=98)		11 (11.2)	3 (3.1)	6 (6.1)	78 (79.6)

2.5.2 Comparison of risk factors between cases and controls

Cases and controls were compared in relation to the prevalence of established risk factors. The comparison took account of matching, using conditional logistic regression, but no adjustments were made at this stage for other factors.

Generally we found a greater prevalence of known risk factors among cases compared with controls (Table 9). Cases were significantly more likely to have had a greater number of sexual partners in their lifetime, to have ever smoked and to have used the

oral contraceptive pill (and for longer). Women in the control group tended to have been older at first sexual intercourse compared with cases. Since the cases and controls were matched on social class, the difference in educational level between groups will have been masked to some extent. Nevertheless, there was a tendency for cases to have had less education compared with controls.

Risk factors were then examined separately by histological type of cervical cancer. Adenosquamous carcinomas were included together with adenocarcinoma (n= 27) and SCC was grouped separately (n = 69). The unadjusted matched odds ratio for cervical cancer was obtained for each risk factor (Table 10). The same risk factors as the combined analysis remained significant for SCC. However, the odds ratios for the sexual and smoking risk factors were higher and for use of the OCP lower than for the combined results. In contrast, most of the odds ratios for ACC reduced and were no longer significant. However, the odds ratio for use of OCP was much higher for ACC than for SCC and this remained statistically significant as a risk factor.

Table 9: Prevalence of risk factors for cervical cancer among cases and controls and matched odds ratio (OR) for being a 'case' for each risk factor

Risk factor	Number interviewed (%)		Matched OR (95% CI)*	p-value (based on χ^2)
	Controls n=294	Cases n=98		
Number of sexual partners				
One	238 (89.1)	75 (76.5)	1.00	0.002
Two or more	29 (10.9)	23 (23.5)	2.65 (1.42 – 4.95)	
Not known	27	-		
Age at first sexual intercourse				
19 or more years	170 (90.9)	79 (82.3)	1.00	0.040
≤18 years	17 (9.1)	17 (17.7)	2.27 (1.06 – 4.87)	
Not known	107	2		
Smoking history				
Never smoked	262 (89.1)	69 (70.4)	1.00	
Ever smoked	32 (10.9)	29 (29.6)	3.51 (1.94 – 6.36)	<0.001
Ex-smoker	13 (4.4)	15 (15.3)	4.72 (2.06 – 10.84)	<0.001
Current smoker	19 (6.5)	14 (14.3)	2.84 (1.35 – 5.87)	0.006
Not known	-	-		
0 – 5 pack-years	277 (94.2)	83 (84.7)	1.00	
5.1 – 15 pack-years	6 (2.0)	4 (4.1)	2.22 (0.58 – 8.49)	0.245
15.1 – 30 pack-years	6 (2.0)	3 (3.1)	1.61 (0.40 – 6.50)	0.502
30.1 or more pack-years	5 (1.7)	8 (8.2)	4.80 (1.57 – 14.67)	0.006
Per increasing pack-year of smoking			1.03 (1.01 – 1.05)	0.008
Use of oral contraceptive pill				
Never or up to 5 years	261 (89.4)	74 (76.3)	1.00	
More than 5 years	31 (10.6)	23 (23.7)	2.65 (1.42 – 4.96)	0.002
Not known	2	1		
Educational level				
None / primary	138 (46.9)	56 (57.1)	1.00	
Secondary or above	131 (44.6)	37 (37.8)	1.83 (1.03 – 3.26)	0.040
Matriculation	25 (8.5)	5 (5.1)	3.21 (0.99 – 10.51)	0.053
Not known	-	-		
Marital status				
Married/ cohabiting	240 (81.6)	72 (73.5)	1.00	
Single/ widowed/ separated	54 (18.4)	26 (26.5)	1.86 (1.00 – 3.46)	0.051
Not known	-	-		

** Odds ratios are unadjusted*

Table 10:Risk factors for cervical cancer by histological type

	Matched OR for cases vs. controls (95% CI)			
Risk factor	**SCC**	**p**	**ACC (inc. Adenosquamous)**	**p**
Number of sexual partners				
One	1.00	0.001	1.00	0.45
Two or more	3.34 (1.62 – 6.86)		1.60 (0.47 – 5.47)	
Age at first sexual intercourse				
19 or more years	1.00	0.04	1.00	0.51
≤18 years	2.73 (1.07 – 6.97)		1.56 (0.41 – 5.97)	
Smoking history				
Never smoked	1.00		1.00	
Ever smoked	4.41 (2.15 – 9.04)	<0.001	2.81 (0.68 – 11.67)	0.14
Ex-smoker	6.29 (2.21 – 17.79)	0.001	1.85 (0.38 – 9.01)	0.15
Current smoker	3.54 (1.50 – 8.34)	0.004	2.84 (1.35 – 5.87)	0.04
0 – 5 pack-years	1.00		Numbers in categories too small to make meaningful comparison	
5.1 – 15 pack-years	1.19 (0.12 – 11.83)	0.88		
15.1 – 30 pack-years	2.29 (0.50 – 10.43)	0.28		
30.1 or more pack-years	10.50 (2.18 – 50.56)	0.003		
Per increasing pack-year of smoking	1.04 (1.01 – 1.07)	0.004	1.00 (0.95 – 1.05)	0.95
Use of oral contraceptive pill				
Never or up to 5 years	1.00		1.00	
More than 5 years	2.13 (1.02 – 4.44)	0.04	5.62 (1.46 – 21.46)	0.01
Educational level				
None / primary	1.00		1.00	
Secondary or above	2.15 (1.06 – 4.38)	0.03	1.42 (0.52 – 3.85)	0.49
Matriculation	3.64 (0.91 – 14.62)	0.07	2.80 (0.27 – 28.78)	0.39
Marital status				
Married/ cohabiting	1.00		1.00	
Single/ widowed/ separated	1.92 (0.92 – 4.05)	0.08	1.96 (0.59 – 6.44)	0.27

** Odds ratios are unadjusted*

Information on passive smoking exposure was obtained in relation to the place of exposure (home or at work), and the extent of exposure (number of people smoking at home or workplace). Cases were more likely to have been exposed to passive smoke, particularly at home. When we examined only women who were never smokers (n=331), the relationship remained with cases being more likely to have had any exposure (Table 11). Furthermore, for home exposure, there was a dose response relationship, with cases reporting a greater number of people smoking at home. The number of women reporting two or more smokers at work was relatively small, resulting in wide intervals for the risk estimates.

When passive smoking exposure was examined according to histological type, the odds ratios were increased and significant only for SCC (Table 12).

Table 11: Exposure to passive smoking among cases and controls and matched OR for being a 'case', with a given level of exposure

Passive smoking exposure	**Number (%)**		**Matched OR (cases vs. controls)**	**p**
	Controls (n=294)	**Cases (n=98)**		
Smokers and non-smokers				
Exposure at home				
No exposure (or live alone)	203 (69.0)	53 (54.1)	1.00	
Exposed to 1 smoker	68 (23.1)	32 (32.7)	1.91 (1.11 – 3.27)	0.02
Exposed to 2 or more smokers	23 (7.8)	13 (13.3)	2.42 (1.09 – 5.37)	0.03
Exposure at work				
No exposure (or not work)	248 (91.2)	86 (87.8)	1.00	
Exposed to 1 smoker	8 (2.9)	6 (6.1)	2.10 (0.72 – 6.14)	0.17
Exposed to 2 or more smokers	16 (5.9)	6 (6.1)	1.14 (0.41 – 3.07)	0.80
Not known	22	-		
Exposure from all sources				0.006
No exposure	187 (63.8)	48 (49.0)	1.00	
Exposed to 1 smoker	66 (22.5)	30 (30.6)	2.23 (1.25 – 3.99)	0.007
Exposed to 2 or more smokers	40 (13.7)	20 (20.4)	2.51 (1.24 – 5.11)	0.010
Not known	1	-		
Never smokers only	**(n=262)**	**(n=69)**		
Exposure at home				
No exposure (or live alone)	186 (71.0)	38 (55.1)	1.00	
Exposed to 1 smoker	58 (22.1)	23 (33.3)	2.24 (1.18 – 4.29)	0.014
Exposed to 2 or more smokers	18 (6.9)	8 (11.6)	2.31 (0.79 – 6.71)	0.124
Exposure at work				
No exposure (or not work)	222 (91.0)	58 (84.1)	1.00	
Exposed to 1 smoker	7 (2.9)	6 (8.7)	5.61 (1.39 – 22.61)	0.015
Exposed to 2 or more smokers	15 (6.1)	5 (7.2)	1.21 (0.40 – 3.67)	0.734
Not known	18	-		
Exposure from all sources				0.006
No exposure	171 (65.5)	33 (47.8)	1.00	
Exposed to 1 smoker	55 (21.1)	21 (30.4)	2.57 (1.25 – 5.28)	0.010
Exposed to 2 or more smokers	35 (13.4)	15 (21.7)	2.75 (1.18 – 6.38)	0.019
Not known	1	-		

Table 12: Effect of passive smoking exposure on risk of cervical cancer, by histology

	Matched OR for cases vs. controls (95% CI)			
Risk factor	**SCC**	**p**	**ACC (inc. Adenosquamous)**	**p**
Smokers and non-smokers:				
No exposure	1.00		1.00	
Exposed to 1 smoker	2.47 (1.27 – 4.79)	0.01	1.50 (0.46 – 4.94)	0.50
Exposed to 2 or more smokers	3.35 (1.48 – 7.59)	<0.01	0.87 (0.19 – 4.04)	0.86
Never smokers only:				
No exposure	1.00		1.00	
Exposed to 1 smoker	3.01(1.36 – 6.68)	0.01	1.03 (0.20 – 5.36)	0.97
Exposed to 2 or more smokers	4.50 (1.64 – 12.34)	<0.01	0.48 (0.07 – 3.15)	0.45

The relationship between active smoking and invasive cervical cancer was examined in more detail, by age group. Generally, ever smoking was a more important risk factor for women aged 40 – 59 years, than for younger or older women (Table 13). The OR for increasing pack years of smoking was highest for the youngest age group, but only statistically significant for the 40 – 59 age group.

Table 13: Odds ratios and (95% confidence intervals) of invasive cancer for smoking risk factors, by age group, using conditional logistic regression

Age group	**Odds ratio (95% CI) compared with never smokers**	
	Ever smoking	**Per increasing pack-year**
<40	2.08 (0.48 – 8.41), p = 0.34	1.41 (0.81 – 2.44), p = 0.22
40 – 59	6.55 (2.33 – 18.45), p < 0.001	1.05 (1.01 – 1.08), p = 0.02
60 +	2.32 (0.96 – 5.62), p = 0.06	1.18 (0.99 – 1.04), p = 0.24

2.5.3 Effectiveness of screening:

Case presentation:

The majority of cases had squamous cell carcinoma (n=87, 71.9%), followed by adenocarcinoma (n=24, 19.8%) whilst the rest had adenosquamous (n=7, 5.8%) or other histology (n=3, 2.5%). The histology was not recorded or not known for the remaining woman. At presentation, stage I disease was most common (n= 63, 52%), but 31 (25.6%) had stage II disease, 23 (19.0%) stage III and the rest higher stage disease.

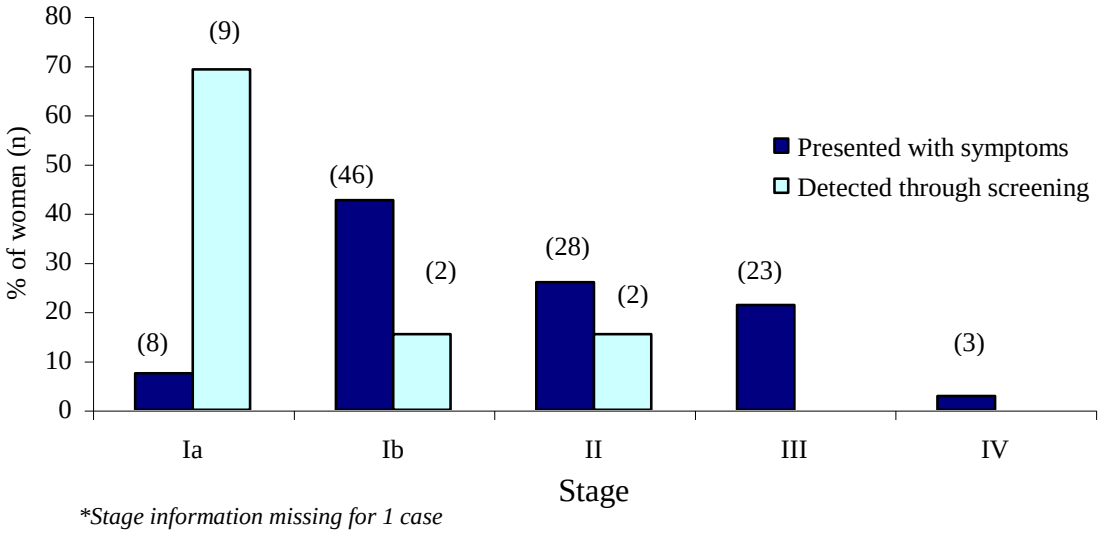
The majority cases, presented with abnormal bleeding, and relatively few (10.7%) were detected through screening (Table 14).

Table 14: Presenting symptoms for women with invasive cervical cancer

Presenting symptom	**Number (%) presenting**		
	Cases interviewed	**Cases not interviewed**	**TOTAL**
Abnormal vaginal bleeding	77 (78.6)	21 (87.5)	98 (80.3)
Abnormal Pap smear	10 (10.2)	3 (12.5)	13 (10.7)
Vaginal discharge	7 (7.1)	-	7 (5.7)
Pain	2 (2.0)	-	2 (1.6)
Other symptoms	2 (2.0)	-	2 (1.6)

As expected, women who presented following screening were more likely to present with early stage disease, compared with women presenting with symptoms (Figure 9).

Figure 9: Stage of disease at presentation, according to whether case was symptomatic or detected through screening



**Stage information missing for 1 case*

Screening histories among cases:

Information on screening history was available from 110 cases. Just over one third (42/110 = 38.2%) of these women had ever had a screening smear in the past. These were cervical smears that were unrelated to any gynaecological symptoms. Of these, 20 women (50% of those ever screened) had a cervical smear within the last 3 years, and 29 (72.5%) within the last 5 years (Table 15). There were 20 women (50% of those ever screened) who were regular attendees for screening. A total of 6 of these women (6/20 = 30%) presented with invasive cancer of stage II or above, despite reporting a negative smear within the previous 5 years. Of these, 2 presented during their routine screen, whilst the remainder were interval cancers.

Table 15: Stage of disease at presentation, according to screening practice

Time since last screening smear	**Stage of cancer at presentation**		
	Ia	**Ib**	**II or more**
Within 3 years (n=20)	6 (30.0)	10 (50.0)	4 (20.0)
3 – 5 years (n=9)	2 (22.2)	5 (55.6)	2 (22.2)
>5 years (n=11)	2 (18.2)	6 (54.5)	3 (27.3)
Never been screened (n=69)	6 (8.7)	22 (31.9)	41 (59.4)

**Stage information missing for 1 case*

Screening practice among controls and comparison with cases:

Among controls, 45.6% (134/294) had ever had a screening test, including 105 (35.7%) in the last 3 years, and 113 (38.4%) in the last 5 years. There were 69 (51.4% of those ever screened) regular attendees. Generally, among controls that had ever been screened, the age at which they had their first smear was younger (mean age 28.6), compared with cases (mean age 34.1), though the difference was not statistically significant (p = 0.21). When comparing time since last screening smear test, controls were significantly more likely to have had a test within the previous three years (Table 16). The risk of having invasive cervical cancer (being a case) was greatest for those not screened within 1 year of interview (OR 26.2), but screening remained protective even if we included screening within the last 10 years (though not statistically significant).

Table 16: Risk of invasive cervical cancer according to time since last screening test

Time since last screening test	Number (%) cases screened (n=110)	Number (%) controls screened (n=294)	Matched OR (Unadjusted) Invasive cancer in non-screened vs screened population (95% CI)	Significance (p-value) for χ^2 test
< 1 year	1 (0.9)	63 (21.4)	26.25 (3.60 – 191.52)	<0.001
<2 years	12 (10.9)	92 (31.3)	3.90 (1.97 – 7.74)	<0.001
<3 years	21 (19.1)	105 (35.7)	2.46 (1.36 – 4.44)	0.003
<4 years	29 (26.4)	108 (36.7)	1.58 (0.91 – 2.74)	0.104
<5 years	30 (27.3)	113 (38.4)	1.61 (0.93 – 2.77)	0.086
<10 years	34 (30.9)	122 (41.5)	1.63 (0.94 - 2.84)	0.080
Ever screened	41(37.3)	134 (45.6)	1.42 (0.84 – 2.38)	0.190

Each row represents a separate bivariate comparison of all cases and controls

The relationship between screening history and risk of invasive cervical cancer was further examined by histological type. When only SCC was considered, screening appeared significantly protective at all screening intervals (Table 17). The protective effect was greater the more recently the last screening test took place. However, for

ACC, there was no apparent protective effect after 3 years, and only screening in the last one year significantly reduced risk.

Table 17: Risk of invasive cancer in relation to time since last screen and histology

	Matched Odds Ratio (Unadjusted) Invasive cancer in non-screened compared with screened population (95% CI)			
Time since last screening test	**SCC**	**p**	**ACC**	**p**
< 1 year	$1.36x10^{15}$ (0 to infinity)	1.00	7.90 (1.0 – 61.5)	0.05
<2 years	5.58 (2.27 – 13.69)	<0.01	2.34 (0.78 – 7.04)	0.13
<3 years	3.84 (1.78 – 8.28)	<0.01	1.23 (0.44 – 3.45)	0.70
<4 years	2.24 (1.13 – 4.46)	0.02	0.87 (0.32 – 2.40)	0.80
<5 years	2.40 (1.22 – 4.72)	0.01	0.77 (0.28 – 2.10)	0.61
<10 years	2.31 (1.18 – 4.54)	0.01	0.87 (0.31 – 2.43)	0.79
Ever screened	2.03 (1.08 – 3.83)	0.03	1.54 (0.58 – 4.11)	0.39

When screening effectiveness was examined separately for different age groups, the benefit appeared to be greatest among middle-aged women, although a higher proportion of controls compared with cases had attended for screening in all groups (Table 18).

Table 18: Effectiveness of screening within last 3 years by age group

Age group	**Number (%) screened among cases**	**Number (%) screened among controls**	**Matched OR (95% CI) for invasive cancer among controls compared with cases**	**p-value**
20 – 40 (n= 72)	8 (47.1)	31 (59.6)	1.00 (0.32 – 3.10)	1.00
41 – 60 (n= 211)	10 (17.9)	61 (41.2)	3.89 (1.64 – 9.22)	<0.01
61+ (n=137)	3 (8.0)	13 (13.8)	1.56 (0.42 – 5.84)	0.51

2.5.3 Factors associated with invasive cervical cancer (adjusted models):

Conditional logistic regression was used to assess which factors were associated with invasive cervical cancer (being a "case"). Using the case/control variable as the outcome measure and the "enter method" for logistic regression, the influence of screening, number of sexual partners, use of the oral contraceptive pill, smoking and exposure to passive smoking were examined, as risk factors for developing invasive disease. After adjustment for the other factors, having had no screening test within 3 years of interview was associated with a significantly greater risk of developing invasive cancer (Table 19). The other factors in the model also remained important predictors of being a "case". Thus, having been a smoker, exposure to passive smoking and use of the pill for over 5 years were associated with increased risk.

Table 19: Conditional logistic regression model for factors associated with invasive cervical cancer

Variables included in model (reference category)	**OR (95% CI)**	**Significance (p-value)**
Cervical smear within last 3 years (screened)		
- Not screened	2.22 (1.14 - 4.32)	0.02
Number of lifetime sexual partners (one)		
- Two or more	2.43 (1.12 - 5.26)	0.02
Use of oral contraceptive pill (never used or < 5years)		
- 5 years or more	2.16 (1.03 - 4.53)	0.04
Smoking status (never smoker)		
- Ever smoked	3.61 (1.76 - 7.41)	<0.001
Exposure to passive smoking (not exposed)		
- Exposed to one person	1.99 (1.03 - 3.81)	0.04
- Exposed to two or more persons	2.46 (1.10 - 5.47)	0.03

The analysis was repeated to compare risk factors for different histological types. Cases were restricted to either those with squamous cell carcinoma (n=87), or those with adeno- and adenosquamous carcinoma (n=31), and for each case, the matched controls were included in the analyses. For ACC, the only significant risk factors in

the adjusted model were use of the oral contraceptive pill and history of smoking (Table 20), whereas the other factors were not associated with increased risk. On the other hand, after adjusting for other factors, use of the pill was not significantly related to squamous cell carcinoma, whereas increasing number of sexual partners, smoking, exposure to passive smoking, and no previous screening were all associated with increased risk (Table 20).

Table 20: Conditional logistic regression models exploring risk factors associated with cervical carcinoma, by histology

Variables included in model (reference category)	**Squamous cell carcinoma (n=252)**		**Adenocarcinoma (n=80)**	
	OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**
Pap smear within last 3 years (screened)				
- Not screened	3.84 (1.54 – 9.56)	<0.01	1.26 (0.35 – 4.54)	0.72
Number of lifetime sexual partners (one)				
- Two or more	2.35 (1.01 – 5.47)	0.05	2.45 (0.31 – 19.65)	0.40
Use of oral contraceptive pill (never used or < 5years)				
- 5 years or more	1.28 (0.52 – 3.15)	0.59	18.08 (1.74–188.68)	0.01
Smoking status (never smoker)				
- Ever smoked	3.72 (1.61 – 8.63)	<0.01	6.37 (1.06 – 38.17)	0.04
Exposure to passive smoking (not exposed)				
- Exposed to one person	2.50 (1.15 – 5.45)	0.02	0.61 (0.13 – 2.87)	0.53
- Exposed to two or more persons	2.91 (1.16 – 7.25)	0.02	2.43 (0.32 – 18.59)	0.39

In the adjusted model for SCC, the OR for screening remained the same as in the unadjusted analysis, however, all other odds ratios reduced to a small extent. For ACC, almost all odds ratios increased, but particularly for use of the OCP and for smoking, which both remained statistically significant in the adjusted model.

2.6 Discussion

Among participants in this study, screening coverage was generally low, with 39.4% of women having ever had a Pap smear for screening, and less than a quarter of women being regular attendees for screening. Generally, cases (women with invasive cervical cancer) were less likely to have ever had screening, particularly in more recent years. Just over 1 in 10 cases were detected through screening. Screening in the last three years was significantly protective against SCC. Risk factors for disease in this study were long-term use of the oral contraceptive pill (for adenocarcinoma) and increasing number of lifetime sexual partners, smoking and exposure to passive smoking (for squamous cell carcinoma).

2.5.4 Strengths and weaknesses of study

This was the first case-control study to assess the effectiveness of cervical cancer in Hong Kong.

Role of bias

We clearly differentiated women who had attended for a cervical smear as a diagnostic test, from those who attended for screening. This is important in order to minimise bias in estimating the effect size[167]. We assessed screening history by self-report, though some studies suggest people over-report screening[168; 169]. This would be important if there is a difference in recall between cases and controls, and it is possible that cases would have better recall of their last screening test. If this were the case, we may have overestimated the effect of screening.

The selection of cases in this study was limited, as we were only able to recruit from 3 hospitals, one of which was a tertiary referral centre. As most cases are referred to

hospital at diagnosis, however, we are likely to have identified a range of cases, with various stages of disease at presentation. The comparison of cases interviewed with those that we missed, suggests that the former tended to be those with less advanced disease, who were more likely to have attended for screening. This would mean that we might be underestimating the effect of screening, as a higher proportion of screened cases were interviewed.

We selected controls from a random population sample rather than from the hospital, as they are more likely to be comparable to cases. However, almost all eligible cases were interviewed (>80%), whereas there was a moderate response rate to the population survey (62.5%). The controls may therefore be less representative of the general population. There is some suggestion that study responders tend to have higher screening rates[170], be from a higher socio-economic group and be more likely to engage in a healthier lifestyle. Although in this study we matched for social class, the differential response rate between cases and controls is likely to bias the estimate of screening benefit to be greater than actual. We may also have overestimated the effect of behavioural risk factors.

Role of confounding

Although randomised controlled trials (RCT) are the gold standard method for evaluating the effectiveness of screening, case control studies provide an efficient alternative. It is likely, however, that the case-control study overestimates the protective effect of screening[138]. The validity of case control studies in this respect is strengthened when adjustments are made for other risk factors for the disease under study[171]. We made adjustments for established risk factors, both by matching and in the analysis stage. Nevertheless, residual confounding is still possible.

2.5.5 Effectiveness of screening in preventing cervical cancer

Several studies have shown that screening is protective for cervical cancer (Table 4). The most recent case control study in a French region with no organised screening programme, found that controls had a higher rate of screening within 3-years, compared with cases (OR 3.09)[162]. Similar findings were reported in Mexico, where the risk of cancer was lower among those who had ever had screening (OR 0.4) [159]. Other studies have shown risk reduction from periodic screening, ranging from 0.16 for 3-yearly screening in Japan[109] to 0.37 for 5-yearly screening in the UK[151]. The level of protection from 3-yearly screening demonstrated in this study (adjusted OR 0.37) is in keeping with these.

We did not find a significantly protective effect of screening for adenocarcinoma, though the number of cases with this histology was small. Nevertheless even the point estimate of benefit was lower than that for SCC, again in keeping with studies elsewhere[109; 126; 172].

2.5.6 Risk factors for cervical cancer

Our findings were compatible with other studies in identifying the major risk factors for cervical cancer; namely increasing number of sexual partners, smoking and use of the oral contraceptive pill. HPV infection is a major risk factor, for which we were unable to adjust. Nevertheless, even after adjusting for HPV infection, smoking and use of the oral contraceptive pill have been shown to increase the risk of cervical carcinoma in situ in other studies[42]. A case control study in Sweden also showed that the relationship between smoking and increased risk of cervical cancer remained after adjusting for HPV infection, though the relationship with oral contraceptive pill use disappeared[54]. Conversely another case control study showed that among women

positive for HPV, use of the pill was a significant risk factor for cancer[43]. Most of these previous studies did not differentiate between ACC and SCC.

Another case control study in Thailand showed that lower education, increasing numbers of sexual partners, interval since last screening test and smoking were all associated with invasive cancer, after adjusting for HPV[38]. We found a trend for higher risk among those with less education, though this was not significant. However, any effect of education is likely to have been diminished in this study, given that we had matched with respect to social class.

Initiation of an active sex life at an early age has been shown to increase risk in other studies[173]. We also found increasing risk with earlier age of starting sexual intercourse (under 19 years).

Use of the oral contraceptive pill has particularly been shown to increase the risk of adenocarcinoma[35; 50; 53] though it is weakly associated with an increased risk of squamous cell carcinoma in some studies. In this study, despite the small proportion of cases with adenocarcinoma, the use of the pill was significantly associated with risk in this group, whereas the risk of squamous carcinoma was not significantly increased. Conversely, the other risk factors were mainly significantly associated with squamous carcinoma of the cervix. Similar findings have been shown in other studies[32].

In addition to smoking being confirmed as a risk factor for cervical cancer in this study, we found that passive smoking was also an important risk factor, particularly among women who had never smoked. There have been few studies on this issue, and although a US study has shown passive smoking to be an important risk factor[77], another study found no effect[81].

2.6 Conclusion and implications

The study suggested that cervical screening does offer protection against invasive cervical cancer, particularly SCC, among Hong Kong Chinese women. However, even among controls, screening coverage was low. This study therefore provides a strong case for introducing an organised cervical screening programme in Hong Kong. On the other hand, 30% of cases with more advanced disease reported that they had regularly attended for screening in the past, this implies a high false negative rate. This suggests an important role for monitoring, and for quality control measures among institutions currently offering screening to be reviewed.

It was also confirmed that increasing number of sexual partners, active and passive smoking and long term use of the oral contraceptive pill increase the risk of invasive cervical cancer. These are important if a targeted screening programme is planned, rather than one that targets all women. In addition, these are important messages for health promotion.

Finally, the finding of a significant increase in risk of cervical cancer with exposure to passive smoking among non-smoking women has important public health implications. The evidence on passive smoking as a risk factor has not been clear in the past, and this study provides more evidence to support this as a risk factor. Although smoking rates among women in Hong Kong may be lower than that among men[122; 174], non-smokers may be exposed to passive smoke at home. This has important implications for health protection, and strengthens the argument for promoting non-smoking in public indoor places.

3 A CROSS-SECTIONAL STUDY OF THE PATTERN OF CERVICAL CANCER SCREENING IN HONG KONG

3.1 Summary

This cross-sectional study was undertaken to assess the pattern of cervical cancer screening in Hong Kong. In particular, the objectives included assessing the age-specific coverage for screening, factors associated with screening uptake and barriers to attendance and the relationship between risk, risk perception and screening attendance. In addition, the results of the study were used to assess the effectiveness and efficiency of the current system of cervical screening in Hong Kong. The current system was compared with what could be achieved through an organised programme.

Methods

This was a cross-sectional study, interviewing a random selection of Chinese women in Hong Kong. The main outcome measure was coverage and frequency of Pap smear screening and the sample size was selected to allow coverage to be estimated in three main age bands (20 – 39, 40 – 59 and 60 and over). In addition information was obtained on socio-demographic and health behavioural characteristics, as well as perceived risk. The relationship between these and screening behaviour was examined. The coverage and screening frequency obtained was used to estimate the effectiveness (number of cases of invasive cervical cancer potentially prevented) and efficiency (tests per case prevented) of the current screening system. Potential effectiveness and efficiency of various organised programmes with different screening intervals and coverage were also estimated.

Results

A total of 1,826 women participated in the study (response rate 62.5%). Ever screening coverage was 43.2% (95% CI 40.8 – 45.5) with regular attendance in 25.2% (95% CI, 23.1 – 27.2). Coverage was lowest in the oldest age group (47.3%, 54.7% and 20.6% for the 20-39, 40-59 and 60+ age groups respectively). Among those who reported attending for screening regularly, most attended annually or more frequently.

Women who attended for screening tended to be in the higher socio-economic groups, to be married and to have better knowledge about cervical screening. They also tended to engage in other health protective behaviours, such as not smoking, attending for mammograms and for regular dental checkups.

There was no relationship between overall epidemiological risk (based on a risk score) and attendance for screening, however attendees tended to have higher perceived risk and to express more worry about cervical cancer.

The main barrier identified for non-attendance was not knowing what cervical screening was, and not wanting to attend (80% of non-attendees). Inconvenience and resource implications were also reasons given by about 15%, whilst a small proportion attributed their non-attendance to fear, anxiety, pain and finding the procedure humiliating.

We estimated that the current system prevents about 40% of potential new cases of invasive cancer, with 2,192 tests per case prevented. In comparison we expect an organised programme with 5-yearly screening to achieve 80% coverage and to almost halve the number of incident cases with 70% fewer tests per case prevented.

Conclusions

The current ad-hoc screening system in Hong Kong achieves poor coverage, whilst over-screening a minority of lower risk women. Thus the system is inefficient and may be resulting in unnecessary harm. At best, the effectiveness of the current system is equivalent to an organised programme with 10 yearly screening, but at much greater cost.

3.2 Introduction

Cervical cancer is an important cause of morbidity and mortality among women world-wide[175]. However, despite good evidence that effective prevention can be provided by screening[5], not all women attend. There has been much research to investigate the reasons for screening attendance and non-attendance in different communities (see section 3.2.1), and what factors are associated with uptake. However, few have been done in Chinese populations. Although many industrialised countries have adopted organised screening programmes, this is by no means universal. Reported uptake of screening in regions with no organised programme, vary widely (see section 3.2.2) and there are few studies formally comparing ad-hoc with organised programmes. This study, funded by the Health Services Research Committee in Hong Kong, was an attempt to address some of these issues by providing information relating to the uptake of screening in Hong Kong.

3.2.1 Factors associated with uptake and barriers to attending for screening

Socio-demographic factors, knowledge, other health protective behaviour

Many studies have shown that low socio-economic status is related to non-attendance, even where screening coverage is high[176-180]. However, this is not confirmed in other studies[181; 182], based on regions with organised screening programmes. Other factors shown to be associated with non-attendance include low educational level[183; 184], being single[177; 182; 184] and older age[183-188]. These factors are reported in regions with and without organised screening.

Poor knowledge about the purpose of screening has also been shown to be a risk factor for non-attendance[179; 180; 189; 190]. In a cross-sectional study of women in Canada,

of almost 9,500 women who had not had a recent screening test, over half reported they did not think it was necessary[184]. Another study including 2,510 women aged 35 to 69 in Iceland, found that the most common reason given by non-attendees was that they did not want to participate[191]. Similar barriers have also been shown to be important in qualitative studies. One study in Mexico, where the incidence of cervical cancer is relatively high and there is no screening programme, used focus groups to explore barriers[192]. Lack of knowledge about cervical cancer and not knowing that a screening test exists were the main themes emerging as reasons for non-attendance. Other themes included problems in doctor-patient relationships, long waiting times and perceived high costs. Women with negative health protective and lifestyle characteristics are also generally less likely to attend for cervical screening[184]. In a survey of 843 women over the age of 50 years in the USA, those who attended for cervical screening[193] were also more likely to have attended for mammography.

The characteristics of women attending for screening in Hong Kong have not been previously examined, and we therefore sought to determine if the pattern observed elsewhere was also applicable to this region.

Risk, risk perception and screening

Perceptions of risk are thought to be important motivators of action, encouraging individuals to take part in preventive programmes such as screening[194]. Risk perception is the central construct within many theoretical models of health behaviour[195], including the "Health Belief Model"[196]. Beliefs about disease risk and severity are thought to influence adherence to health promoting behaviours and aid in decision making for appropriate use of health services. Studies aimed at influencing risk perception lend some support to these theories, suggesting that behaviour can be

modified in this way[197]. A meta-analysis of the relationship between perceived risk of breast cancer and uptake of mammography screening found a significant positive association[198]. However, reviews of studies of cervical or colorectal cancers showed no conclusive association between risk perception and screening behaviour [195]. This was partly because of the small number of studies that have examined such relationships, particularly for cervical screening. Worry about cancer has also been shown to be strongly and positively associated with uptake of screening for colorectal[199] and breast [198; 200] cancer. Although some suggest that worry is an aspect of perceived risk, the two measures are poorly correlated[201]. Previous studies have not reported the relationship between worry and uptake of cervical screening.

In contrast to perceived risk, there is much evidence that women with higher objective risk for disease are less likely to access preventive health care[202-205]. In relation to cervical screening however, some studies suggest that women at higher risk are better screened, or no less likely to be screened than those at low risk[206-209], particularly where there are organised programmes. Several studies have examined the relationship between perceived risk and objective measures of risk for breast cancer[195]. These have had mixed results, some showing no association, while others found some relationship between these measures. No previous published study has compared objective risk with perceived risk for cervical cancer.

3.2.2 Effectiveness and efficiency of opportunistic screening compared with organised screening

Evidence of the efficacy of Pap smear screening comes mainly from historic studies describing the effects of the introduction of well organised screening programs[94-96] and case control studies[151; 156]. These clearly show that screening results in a reduction in both the incidence and mortality from invasive cervical cancer. Two aspects of a

screening programme contribute to these benefits. First, there is a strong correlation between the extent of screening coverage and fall in mortality[99; 101]. Second, the screening interval is important in determining the amount of risk reduction. Analysis of data from large screening programmes in eight European and North American centres for a period of over 20 years has been used by the IARC to quantify the reduction in the probability of developing cervical cancer with varying screening intervals[102] (adapted in Table 21). As discussed in chapter 1, these estimates are considered valid and credible (see page 18).

Table 21: Percentage reduction in cumulative rate of invasive cervical cancer in women (age 35 to 64) screened at different intervals (source reference [102]

(Assuming the woman has had at least one previous screen)

Frequency of screening (IARC data)	**Screening interval (months)**	**Percentage reduction in cumulative incidence**	**Percentage having screening test in 1 year**	**Number of tests in lifetime**
Yearly	0 - 11	93.5	100	30
2-yearly	12 - 23	92.5	50.0	15
3-yearly	24 - 35	90.8	33.3	10
	36 – 47[a]	87.1	25.0	8
5-yearly	48 –71[b]	83.6	20.0	6
	72 – 119[c]	71.3	12.5	4 – 5
10-yearly	120	64.1	10.0	3
	≥ 120 [d]	37.5	6.7	1 – 2
No screening		0	0	0

[a] *Interpolated as square root [90.8 x 83.6]*

[b] *Average benefit during interval assumed to be same as 5 years*

[c] *Average benefit during interval assumed to be same as 8 years. The % reduction in cumulative incidence from a screening interval of 5 years (83.6%) compared to 10 years (64.1%) is equivalent to a reduction in benefit of 94.8% per year*

[d] *Based on assumption that reduction in benefit continues at 94.8% per year for another 10 years*

The incremental benefit achieved by reducing the screening interval from three years to one year is small. Furthermore, even screening once every 10 years reduces the incidence of invasive cancer by almost two thirds. Following one negative screening test result, a second test reduces the chances of false negatives, and therefore improves the sensitivity of screening[102]. The IARC study was based on women with at least two negative screening test results, which probably explains why the level of risk reduction exceeds that expected from the relatively low sensitivity of cervical smear tests[22]. The IARC study also showed that the protection offered by screening was independent of age. In particular, women under the age of 35 were at no greater risk of developing fast growing tumours. The data on older women is sparse, but what is available suggests the same relative benefits would be expected[102].

A recent analysis of screening programmes in the European Union found that only six out of 15 countries have nationally organised programmes[210]. Seven others have regionally organised programmes some of which only cover parts of the national population. The 3-year population coverage of screening among these countries varied from 50 to 82%[211]. Furthermore, in some parts of North America and most low-resource countries, screening is offered opportunistically. In the absence of an organised call and recall system, opportunistic screening tends to achieve a lower coverage [55; 183] although opportunistic screening rates as high as 91% have been reported[212]. Previous studies have not attempted to estimate the effectiveness and efficiency of opportunistic screening, and how this would compare with an organized system.

This study aimed to explore a method for assessing the effectiveness and efficiency of opportunistic screening programmes, and using data from the cross-sectional study in Hong Kong. Hong Kong has no organized screening programme, though various

public and private providers offer opportunistic screening. Information on age-group specific screening coverage and frequency is used to estimate the potential benefits of the current system and compare this with what could be expected from various screening policies within an organized programme.

3.3 Aims and objectives

The aim of this study was to examine the pattern of cervical cancer screening in Hong Kong. The main questions addressed were:

3.3.1 Coverage and pattern of screening

1. What proportion of Chinese women living in households in Hong Kong had been screened for cervical cancer at least once in specific periods?
2. What was the age specific coverage for cervical cancer screening (i.e. the percentage of women in each age group who had been screened at least once during defined periods) amongst women living in a household in Hong Kong?
3. What was the screening interval for women who attended screening regularly?

3.3.2 Factors associated with screening and barriers to uptake:

4. What was the level of knowledge about, and attitude towards, cervical cancer and screening among Chinese women in Hong Kong?
5. What factors were associated with the uptake of cervical cancer screening?
6. What were the reasons for women not participating in screening?

3.3.3 Risk, risk perception and screening behaviour

7. What was the relationship between perceived risk, objective risk and screening behaviour in relation to cervical cancer in Hong Kong?

3.3.4 Effectiveness and efficiency of current screening system in Hong Kong

8. How effective was the existing system of screening in Hong Kong, in terms of number of cases of invasive cervical cancer prevented?
9. How efficient was the existing system, in terms of number of screening tests per case prevented?
10. How did the existing level of effectiveness and efficiency compare with what could be expected in an organised system?

3.4 Materials and methods

During 1997 to 1998, a cross-sectional study was completed, using telephone interviewing to contact Chinese women resident in Hong Kong. Telephone coverage in this population is close to 100%.[174] The Health Services Research Committee of Hong Kong funded the study and approval was obtained from the ethics committee at the University of Hong Kong.

3.4.1 Sample size estimation

We sought to recruit equal numbers of women from each of three age groups: 20-39, 40-59 and 60 or over. In order to estimate the coverage of screening in each age group with a precision of 4%, we calculated that at least 577 women would be required in each group.

3.4.2 Subjects and sampling method

Eligible subjects were Hong Kong Chinese women who were aged 20 years or more. Women who had a hysterectomy were excluded. Initially, telephone numbers were selected using a random digit dialling method. If there was no response, three further attempts were made over two weeks. Once contact was established, all eligible women in the household were identified, and one was randomly selected and invited to participate in the study. This method resulted in a greater proportion of women in the younger age group being identified, representing the distribution of age groups in the population. Once sufficient numbers in this group were recruited, sampling criteria were changed to include only women in the older age groups. Because very few women in the oldest age group responded, convenience sampling was used to complete recruitment in this group. Two researchers attended twenty elderly centres

in different parts of Hong Kong and conducted face-to-face interviews with women attending for health and social activities.

3.4.3 Study Instrument:

Trained researchers conducted all interviews according to a strict schedule, using a standard introduction, algorithm and questionnaire for selection and interviewing. The questionnaire was developed based on instruments used for a similar purpose in other published studies[164; 165]. Questions were adapted, and translated to Chinese from English. The final questionnaire was piloted and validated on a sample of 30 women and amended before the final version (Appendix 1). The main outcome measure was whether the woman had ever had a cervical smear and the reason for their last test. Women whose last smear was done because of a gynaecological symptom were classified as having had a diagnostic smear, whereas those who had this as part of a routine or opportunistic check up were regarded as having had a screening smear. The time of the last screening smear and the frequency of screening, for those who were regular attendees, were also determined. In addition, all women were asked about their intentions to attend for screening in the future. Other variables measured included:

- Socio-demographic data
- The individual's main risk factors for cervical cancer;
- The reasons for non-attendance amongst those who have not been screened;
- Other factors that may contribute to attendance or non-attendance;
- Willingness to pay for cervical screening (not presented in this thesis).

3.4.4 Data collection and management

A project manager supervised data collection, monitored a sample of interviews conducted by interviewers and conducted a validation study by making a repeat call to 5% of the women some days after the interview, to recheck key variables, including the date of last Pap smear. After data entry, coding, logical checks and data cleaning were carried out.

3.4.5 Data Analysis:

Data were analysed using the SPSS statistical software. Descriptive analysis was used to illustrate screening coverage and frequency, as well as the reasons for non-attendance and the barriers to screening. In addition, the relationship between the uptake of screening, risk perception and risk factors for developing cervical cancer were examined. A combination of descriptive and multivariate analyses were used to address these objectives.

Assessment of knowledge and attitude

Women were asked whether or not they agreed with certain statements, which assessed knowledge, attitude and perceptions of their risk for cervical cancer (box 2).

Box 2: Statements to assess knowledge attitude and perceived risk

1) Permissive sexual behaviour will increase risk of cervical cancer
2) Having regular smear test can help preventing cervical cancer
3) A Pap smear can detect signs of pre-cancer before it develops
4) If the result of Pap smear is abnormal, it means cancer has developed
5) Women who get cervical cancer have only themselves to blame
6) It's completely a matter of chance who gets cervical cancer
7) I think I'm personally at risk of cervical cancer
8) I'm less likely than average to get cervical cancer
9) Women should have regular smears
10) Diagnosis of cervical cancer would be worrying

Responses to statements 1 and 2 (knowledge) and 5 and 6 (attitude) completed were combined to form a knowledge score and attitude score respectively (Table 22). The total scores ranged from –2 to +2. Screening practice was compared with knowledge and attitude scores.

Statement 3 was initially presented to all women, but interim analysis suggested that the question was badly worded and almost all women were agreeing with it. The statement was replaced by statement 4, part way through the study.

Table 22: Scoring system used for assessing knowledge and attitude

Statements	Score according to whether agree		
	Agree	**Disagree**	**Unsure/ neutral**
Permissive sexual behaviour will increase risk of cervical cancer	+1	-1	0
Having regular smear test can help preventing cervical cancer	+1	-1	0
Women who get cervical cancer have only themselves to blame	-1	+1	0
It's completely a matter of chance who get cervical cancer	-1	+1	0

Objective and perceived risk assessment

The objective assessment of risk was based on a validated risk scoring system[213]. This system categorises women to higher and low risk, according to their history of smoking, number of sexual partners, level of education and use of the oral contraceptive pill (Table 23). Using a cut-off value of score 3, gives the maximum sensitivity of 85% for risk of being diagnosed with pre-invasive cervical lesions.

Table 23: Basis for risk scoring system used in study

Risk factor	Risk level	Score
Educational level	Matriculation or above	0
	Other	1
Smoking status	Never smoker	0
	Ever smoker	1
Use of oral contraceptive pill	<5 years	0
	>5 years	1
Number of lifetime sexual partners	1	0
	2	1
	3 or more	2
TOTAL RISK SCORE		Range 0 – 5

Using this risk score assessment, women were categorised as being at higher risk (3-5) or lower risk (0-2). Women were compared in relation to their screening history and their perceived risk, according to their risk factors and risk scores.

For the subjective assessment, women were asked whether they considered themselves to be less likely than average to develop cervical cancer, and those responding affirmatively were categorised as having low perceived risk. Women were further categorised into four broad groups according to how their perceived risk compared to their objective risk (Table 24). The screening history and demographic characteristics of these women were compared. First, among women with lower risk scores, those who had low risk perception (low risk realists) were compared with those who overestimated their risk (pessimists). Next, among those with high risk scores, women who did not have low risk perception (high risk realists) were compared with those who underestimated their risk (optimists). Women's level of worry about a diagnosis of cervical cancer was assessed on a five-point scale, ranging from "extremely worrying" to "not at all worrying".

Table 24: Perceived risk category according to objective and subjective risk assessment

Perceive risk lower than average	Objective risk	
	Low (risk score 0-1)	Higher (risk score 2-5)
Yes	Realist (low risk)	Optimist
No	Pessimist	Realist (high risk)

Assessment of effectiveness and efficiency of screening

Modelling was done using Excel, using the results of the cross-sectional study. The model was based on combining Table 21 with the data obtained on the screening coverage, frequency and the interval since the last screening test in our population. The effectiveness of the current screening system was estimated, in terms of number of cases potentially prevented and percentage reduction in incidence as a result of screening. Details of the calculation are in Appendix 2. The calculations were repeated using different assumptions for age-group and interval-specific screening coverage, to obtain the most extreme estimates for the benefit derived from the current system. For the most pessimistic scenario, it was assumed that only women who currently attend regularly will continue to do so and their screening frequency was adjusted for when they had their last screening test. Thus, for example, if a woman said she attended regularly every 2 years, but in fact had not had a test for 5 years, a screening interval of 5 years was used for the calculation. It was further assumed that for irregular attendees, and women who have only had one screening test, the benefit was the same as for screening every 10 years. For the most optimistic scenario, the stated likelihood of attending for screening in future was used, and what the women thought the screening frequency should be, whether or not they had

specific plans for attendance. This scenario was based on women following through with their stated intentions.

For the basic model several assumptions were made. First, it was assumed that all women could derive the same level of benefit from screening, irrespective of age, screening attendance and other risk characteristics. Second, that compared with those who had never been screened, women who had their last test over 10 years ago still derived some benefit. Finally, it was assumed that the screening process in Hong Kong achieved the same level of benefit as that demonstrated in the IARC report (i.e. the test sensitivity and effectiveness of treatment offered to screen positives was the same). A sensitivity analysis was performed by adjusting the key variables in the model, including the background incidence of disease among those screened, and the sensitivity of screening.

It was estimated the efficiency of the current screening system by predicting the number of screening pap smears per case of invasive cancer potentially prevented per year (the number needed to screen). The number of screening tests per year was estimated from the proportion of women in each age group who were screened at various intervals and applied to the total number of women in the population. Thus for example, the proportions that were screened at 6-monthly, yearly and 2-yearly intervals would have 2, 1 and 0.5 smears per year respectively. Sensitivity analysis were also performed for the estimates of efficiency.

The effectiveness and efficiency of hypothetical programmes in an organised screening system, which achieve high coverage, were predicted. The current system was compared with these predictions.

3.5 Results:

A total of 1,826 women between the ages of 20 and 77 were interviewed during the period from September 1997 through December 1998. The majority completed the whole interview schedule, although 122 (6.6%) were only partially completed.

Among those interviewed, 1,121 (61.4%) were sampled using random digit dialling. Once the minimum number of women in the 20-39-year age group sampling targeted women over the age of 40. A further 255 interviews were performed by telephone, and the remaining 450 women were recruited by convenience sampling from 20 elderly centres situated in 14 different districts of Hong Kong (Table 25 and Table 26).

The overall response rate for the study was 62.5%. For the telephone interviews, the response rate was 56.0% and for the face to face interviews 99.3% (Table 27).

Table 25: Numbers of women recruited by each sampling method, by age group

Age group	Sampling method	Number interviewed
20 - 39	Random telephone survey	584
40 - 59	Random telephone survey Targeted telephone survey	461 161
60-77	Random telephone survey Targeted telephone survey Face to face interview at elderly centre	88 82 450

Table 26: Sources used for recruiting older participants and numbers interviewed at each location

Elderly Centre	No. interviewed	District
Aberdeen Social Service Centre	12	Southern
Yan Oi Tong Woo Chung Multiservice Centre	22	Tuen Mun
St James' settlement Social Centre	26	Wan Chai
Sha Tin Multi-service Centre	25	Sha Tin
Lei Tung Social Centre	14	Southern
Hong Kong Christian Service Multi-service Centre	12	Kwun Tong
SAGE Chan Tseng Hsi Tsuen Wan Multi-service Centre	12	Tsuen Wan
SAGE Fong Shu Chuen Social Centre	21	Eastern
Mong Kok Social Service Centre	30	Yau Tsim Mong
YWCA Sai Wan Estate Social Centre	28	Mid Western
The Salvation Army Tai Po Multi-service Centre	26	Tai Po
Asia Women's League, Yau Ma Tei Social Centre	44	Yau Tsim Mong
Women's Welfare club Young Shu Cheung social Centre	38	Eastern
SAGE Eastern District Multi-service Centre	28	Eastern
Social Service Centre Wan Sing Mem. Social Centre	55	Yuen Long
Oi Man Social Centre	5	Kowloon city
Cheung Hong Baptist Church Social Centre	16	Kwai Tsing
The Endeavourers Bert James Young Social Centre	11	Eastern
Hong Kong Baptist Hospital Au Shue Hung Health Centre	16	Kowloon city
Hong Kong YWCA Cheung Ching Social Centre	9	Kwai Tsing

Table 27: Summary of response rates by survey method

	Telephone survey	Elderly centre interviews
Successful completion of interview	1,253	450
Partial completion of interview	123	0
Interview refused	1,134	3
Unable to contact*	3,051	-
Non-residential telephone line	2,711	-
No eligible women in household		
Age or no women	1,898	-
Hysterectomy	73	-

** Households where there was no response from telephone on at least 4 attempts over two weeks, at different times of day (includes households where a family member responded, but contact with the women eligible for the study was not possible on successive occasions, because she was not at home).*

3.5.1 Validity and reliability of sampling

The women interviewed using the random telephone survey were fairly similar to the census population of women in terms of social class, and district of residence. However, the study was designed so that the overall sample (including those interviewed by targeting and convenient sampling) had a different age structure from the census population. The overall sample had a different age and educational profile, but was similar in terms of residential location and social class compared with the census population (Table 28).

Based on the 5% sample of women re-contacted, the overall repeatability of key responses was 95% and for the question on screening status it was 100%. For the main variable in our estimates, coverage, we compared the women in the oldest age group recruited by telephone with those interviewed at elderly centres. Both groups were similar in terms of overall and interval-specific coverage.

Table 28: Comparison of survey population with the Hong Kong Census population

Characteristic	**Total survey population (%) N = 1826**	**Random digit dial (%) N = 1113**	**1996 HK Census (%)**
Level of education			
None	314 (17.2)	790 (7.10)	9.49
Primary/ Lower secondary	829 (45.4)	486 (43.67)	41.55
Upper secondary / 6th form	493 (27.0)	395 (35.49)	33.79
Tertiary	190 (10.4)	153 (13.75)	15.17
Age group			
20 – 34	380 (20.8)	376 (33.8)	38.6
35 – 44	477 (26.1)	393 (35.3)	26.8
45 – 54	293 (16.0)	213 (19.1)	14.6
55 – 64	203 (11.1)	82 (7.4)	10.8
65 – 74	473 (25.9)	47 (4.2)	9.3
District of residence			
Hong Kong Island	447 (24.5)	209 (18.8)	22.2
Kowloon	498 (27.3)	317 (28.5)	32.8
New Territories	875 (47.9)	573 (51.5)	44.4
Social class			
I	442 (24.2)	295 (26.5)	32.9
II	526 (28.8)	341 (30.6)	23.1
III	540 (29.6)	299 (26.9)	27.7
IV	318 (17.4)	178 (16.0)	15.4

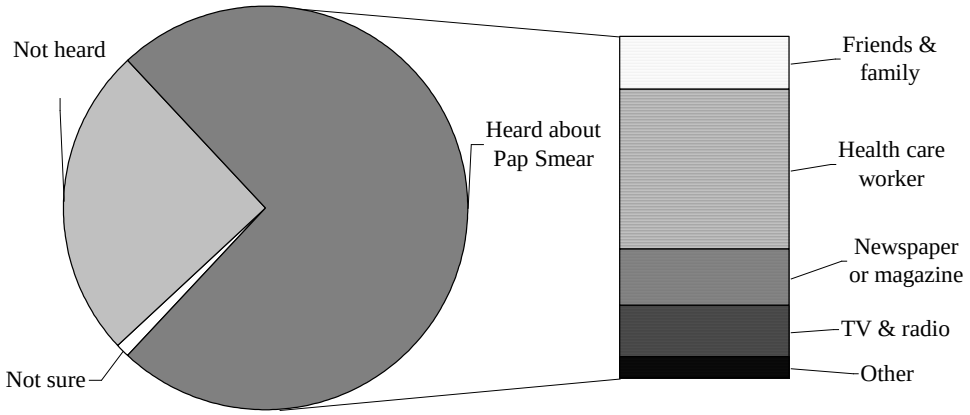
3.5.2 Sources of information on cervical screening

In general, more than two thirds of women (1250/1826 = 68.5%) had heard of cervical screening before the interview. The most common source of information about the test was health professionals, particularly GPs and family planning clinics (FPC). However, friends and family members and the media were also important sources of information (Table 29 and Figure 10).

Table 29: Summary of reported sources of information on cervical screening

Source of information	Number (%) who heard from this source
Health professionals (mainly GP and FPC)	467 (25.6)
Media (mainly TV and newspaper)	265 (14.5)
Friends & family (mainly friends and neighbours)	131 (7.2)
Health professionals and media	166 (9.1)
Friends & family and media	79 (4.3)
Friends & family and health professionals	53 (2.9)
All sources	39 (2.1)
Never heard	570 (31.2)
Not sure or missing data	56 (3.1)

Figure 10: Knowledge of cervical smear and main source of information



In terms of socio-demographic factors, those who had not heard of the test were more likely to be single, to be in the lower social classes (based on own or partner's current employment, whichever was the higher) and have a lower level of education. Women who were 30-49 years old were most likely to have heard of the test, and elderly women least likely (Table 30).

Table 30: Logistic regression model for socio-demographic factors associated with having heard of cervical screening

Woman's characteristics	Number (%) heard of test	Adjusted OR for hearing about test (95%CI)	Significance (p-value)
Age (70+ years as referent)			
20 – 29 years	109 (15.0)		
30 – 39 years	328 (17.4)	2.25 [1.31 – 3.85]	0.003
40 – 49 years	385 (32.7)	4.90 [3.07 – 7.83]	<0.001
50 – 59 years	105 (44.0)	4.65 [3.03 – 7.12]	<0.001
60 – 69 years	202 (57.9)	2.07 [1.27 – 3.36]	0.003
	121 (38.9)	1.56 [1.09 – 2.21]	0.014
Marital status (single as referent)	83 (49.7)		
Married or co-habiting	980 (74.5)	5.05 [3.19 – 8.00]	<0.001
Divorced / widowed / separated	187 (54.4)	6.03 [3.48 – 10.46]	<0.001
Social class (4 as referent)	339 (29.1)		
1	370 (33.7)	1.64 [1.10 – 2.44]	0.014
2	356 (42.7)	1.64 [1.16 – 2.31]	0.005
3	181 (31.3)	1.37 [1.00 – 1.89]	0.050
Highest level of education (No formal schooling as referent)	132 (40.7)		
Primary / lower secondary	588 (70.9)	1.96 [1.44 – 2.68]	<0.001
Upper secondary / matriculation	384 (79.3)	3.07 [2.00 – 4.72]	<0.001
Tertiary	144 (77.4)	4.19 [2.31 – 7.58]	<0.001

3.5.3 Coverage and pattern of screening

History of Pap smear screening (Objectives 1 to 3)

Among responders, 111 (6.1%) claimed to have never had sexual intercourse, and were therefore at low risk of cervical cancer and not strictly eligible for screening. A further 87 (4.8%) did not want to answer this question. Excluding those with no previous sexual partners, 795 women (43.5%) had ever had a cervical smear test and

25 (1.5%) were unsure (22 of these reported having a gynaecological examination at some time, which may have been a smear). Among those who had a previous test, 54 women (6.8%) had this as a result of gynaecological symptoms (classified as a diagnostic smear). Thus the proportion of women who have ever had a screening smear test in this population was 40.7% (95% CI 38.4 – 42.9). This is equivalent to coverage of 44.5% in Hong Kong, after standardising to the age structure of women in the population. The screening history of responders is summarised in Table 31.

Table 31: History of Pap smear testing according to sexual history

		Had Diagnostic smear	**Ever had screening Pap smear**				**Total**
			Yes	**No**	**Unsure**	**Missing**	
Ever had sexual intercourse	Yes	52	706	843	23	-	1624
	No		3	108		-	111
	Prefer not to answer	2	32	51	2	1	88
	Missing	-	1	2	-	-	3
	Total	54 (3.0%)	742 (40.6%)	1004 (55.0%)	25 (1.4%)	1 (0.05%)	1826

Among women who reported no previous sexual intercourse, 3 (2.7%) had attended for a screening test. One of these women was being screened regularly (3 tests in previous 5 years).

Women who reported no previous sexual intercourse (n=111) were excluded for the remaining analysis on coverage, as they would not be eligible for screening within a programme. Screening coverage over the last 3 and 5 years (Table 32) was 33.8% (95% CI 31.6 – 36.0) and 37.8% (95% CI 35.5 – 40.1) respectively (equivalent to 36.3% and 40.8% respectively when standardised to the Hong Kong population).

When examined by age group, screening coverage was lowest in the oldest age group, where just over one in five women reported ever having had a screening test (Table

33). Among women eligible for screening (n=1715) 104 (6.1%) had only had one such test and only 427 (25.0%, 95% CI 23.1 – 27.2 of all responders) attend for regular screening. The majority of regular attendees (345/427 = 80.8%) attended at least once per year and 99% (n= 423) attended at least 3 yearly. The maximum screening interval was 3-4 years. A proportion (n= 94, 5.5%) attended for screening more than once per year. Smear tests taken for screening at intervals of less than three years are considered as "excess smears"[212]. Overall 24.7% of women (n=423) had attended more than 3-yearly, contributing to 780 excess smears over this period (calculation based on number of smears in excess of one every 3 years among 423 women. Thus 94 had between 4 and 5 smears in 3 years (=433), 250 had between 2 and 3 (=625), 54 had 2 tests (=108) and 25 had between 1 and 2 (=37). Of these smears, 780 [1240 – 423] were excess).

Table 32: Time since last screening test by age group, for women with ≥2 previous tests, or one test but planning to re-attend

Screening interval (months)	**Number (%) in each age group**						**ALL GROUPS (n=1,712)**	
	20-39 (n=497)		**40 – 59 (n=609)**		**60 + (n=606)**			
0-11	139	(28.0)	168	(27.3)	38	(6.3)	343	(20.0)
12-23	73	(14.7)	74	(12.2)	25	(4.1)	172	(10.1)
24-35	23	(4.6)	25	(4.1)	15	(2.5)	63	(3.7)
36-47	11	(2.2)	16	(2.6)	6	(1.0)	33	(1.9)
48-71	12	(2.4)	19	(3.1)	5	(0.8)	36	(2.1)
72-119	7	(1.4)	12	(2.0)	6	(1.0)	25	(1.5)
≥ 120	0		14	(2.3)	14	(2.3)	28	(1.6)
Only 1 test, no plans for future attendance	11	(2.2)	11	(1.8)	17	(2.8)	39	(2.3)
Diagnostic smear only	13	(2.6)	23	(3.8)	18	(3.0)	54	(3.1)
Never screened (or unsure)	208	(41.9)	249	(40.9)	461	(76.2)	918	(53.7)

Table 33: Screening coverage over the last 3years, 5 years, or in lifetime, by age group

	Proportion (95% CI) screened in time period in each age band		
	20 – 39	**40 – 59**	**60+**
Ever screened	47.3 (43.2 – 51.3)	54.7 (50.7 – 58.5)	20.6 (17.6 – 24.0)
Screened within 5 years	45.4 (41.4 – 49.4)	48.9 (45.0 – 52.8)	15.5 (12.8 – 18.5)
Screened within 3 years	41.1 (37.2 – 45.1)	44.1 (40.2 – 48.0)	14.0 (11.5 – 17.0)

Consequences of screening

Of the 795 women who had a previous cervical smear test, 21 (2.6%) had an abnormal result for their last test, and a further 17 (2.1%) probably did so. Among these 38 women without a normal result, 8 (21.1%) had a diagnostic smear, as a consequence of gynaecological symptoms, but the remainder had attended for screening. This translates to an abnormal smear rate of 4% (30 of 741 routine smears) for all women attending for screening. Among those with an abnormal result, 18 mentioned their treatment (Table 34).

Table 34: Type of follow-up or treatment following last abnormal cervical smear

Type of follow up treatment	**Number (%) with definite abnormal smear**
Repeat smear in 6 months	1 (4.8)
Medical treatment (tablet or ointment)	13 (61.9)
Invasive treatment (surgery/ radiotherapy)	5 (23.8)
No response	2 (9.5)
	Number (%) with probably abnormal smear
Had treatment (not specified what)	9 (52.3)
Not recall what type of assessment/ treatment	8 (47.1)

3.5.4 Factors associated with screening and barriers to uptake

Knowledge and attitude towards screening (objectives 4 – 5)

The majority of women had good knowledge about the risk of cervical cancer and the benefits of screening. For almost all statements, women who had previously attended for screening themselves were significantly more likely to be more knowledgeable and to have more positive attitudes favouring screening. However, over half of those responding to these questions, wrongly believed that if the test results are abnormal, it means cancer has developed. Women who had a previous screening test were more likely to have good knowledge (Table 35).

Table 35: Knowledge, attitude and perceived risk in relation to cervical screening, by screening status

Statements (*number of responders*)	Number (%) who agreed			p-value for difference between screened and unscreened (based on χ^2)
	Ever had a screening test			
	No	Yes	Total	
Permissive sexual behaviour will increase risk of cervical cancer (*1740*)	682 (67.5)	567 (77.8)	1249 (71.8)	<0.001
Having regular smear tests can help prevent cervical cancer (*1740*)	811 (80.1)	620 (85.2)	1431 (82.2)	0.004
A Pap smear can detect signs of pre-cancer before it develops (*736*)	262 (70.8)	288 (78.7)	550 (89.9)	0.009
If the result of Pap smear is abnormal, it means cancer has developed (*565*)	220 (53.7)	76 (49.0)	296 (52.4)	0.187
Women who get cervical cancer have only themselves to blame (*1742*)	425 (42.0)	174 (23.9)	599 (34.4)	<0.001
It's completely a matter of chance who get cervical cancer (*1738*)	594 (58.8)	317 (43.5)	911 (52.4)	<0.001
I think I'm personally at risk of cervical cancer (*1747*)	331 (32.5)	300 (41.2)	631 (36.1)	<0.001
I'm less likely than average to get cervical cancer (*1739*)	433 (42.9)	239 (32.8)	672 (38.6)	<0.001
Women should have regular smears (*1741*)	827 (81.7)	707 (97.0)	1534 (88.1)	<0.001
Diagnosis of cervical cancer would be worrying (*1742*)	750 (73.8)	630 (86.8)	1380 (79.2)	<0.001

In terms of attitude and perceived risk, the majority of women responded that they would find a diagnosis of cervical cancer worrying, particularly those who had previously had a screening test. About a third of women believed that those who get cervical cancer only have themselves to blame and half, that getting cervical cancer is completely a matter of chance. Those who had never been screened were more likely to have negative attitudes. These women were also less likely to perceive themselves to be at risk. The majority of responders (88.1%) felt that women should have a regular smear, though women who had previously been screened were more likely to think this (OR 6.62, 95% CI 4.25 – 10.42). Among women who had not been screened before, those who expressed they were willing to attend for screening in future (406/983) were also more likely to say women should attend for screening (375/406) compared with those who were not willing to attend (430/577) [OR 4.09, 95% CI 2.69 – 6.21].

Women who had previously had a screening test compared with those never screened had significantly higher mean knowledge scores (1.44 and 1.30 respectively, p for χ^2 for trend = 0.003) and attitude scores (0.87 and 0.34 respectively p for χ^2 for trend <0.001).

Barriers to screening (objectives 5 and 6)

Among 1,024 women who had never been screened before (or were unsure) and responded, 40.6% (n= 416) stated they were willing to have a screening test, but have not yet been to do this, whilst 45.8% (n= 469) were not willing, and 13.6% (n= 139) were unsure. Two thirds of these (n =620/931, 66.5%) stated they did not know where they could have a screening test. This was more likely among those who would not

consider attending (n= 310, 71.2%) compared with those who were willing to attend screening (n= 227, 59.9%) [OR 1.65 (1.26 – 2.18)].

The reasons given for non-attendance were varied (Table 11). All women were asked whether or not they agreed with a number of statements, outlining various barriers. Relatively few women cited lack of time, fear of results or finding the test humiliating as barriers, whereas high proportions said they did not want or need a test, and over half believed cost was a barrier. They were then asked what their main reason was for non-attendance. The most common responses were that women did not think they needed to, or that they did not know what the test is for (Table 36).

There were 420/1200 women (35%) who had heard of a cervical smear test, but had never had one. These women were less likely to say they didn't know what the test is for, but otherwise gave similar reasons to those who had never heard of a pap smear before (Table 36). Excluding those giving these two statements as their top reason for non-attendance, the next most common reason was lack of time.

Figure 11: Proportion of women who agree these reasons contributed to their non-attendance for screening

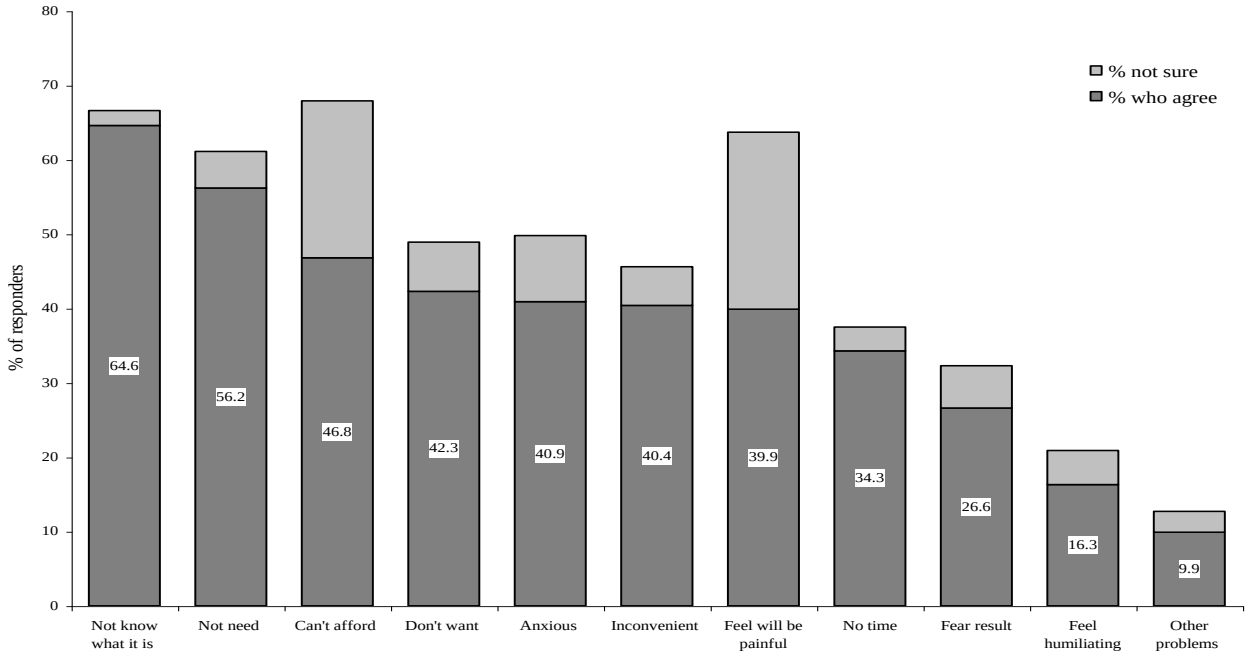


Table 36: Main reasons given for non-attendance for screening

Main reason	**Number (%) of women giving this reason**			
	All women never screened (n= 1007)		**Never screened, but heard of test (n=460)**	
Not need a test	526	(52.23)	249	(54.13)
Not know what it is for	256	(25.42)	71	(15.43)
(%) Giving this reason, excluding those who don't know what it is for or "don't need a test"	(n = 225)		(n = 140)	
Lack of time to attend	79	(35.11)	51	(36.43)
Problems with accessibility	42	(18.67)	20	(14.29)
Problems with affordability	31	(13.78)	21	(15.00)
Psychological aspects (anxiety, fear, humiliation)	31	(13.78)	25	(17.86)
Don't want to have a test	22	(9.78)	13	(9.29)
Other reasons	20	(8.89)	10	(7.14)

Women who perceived the test as unnecessary, did not want it or did not know what it is for, tended to be older, whilst fear, anxiety, pain and humiliation were relatively more common reasons among younger women (Table 37).

Table 37: Main reason given by women for non-attendance for screening by age group

Main reason for no test in past	**Number (%) giving this reason**			
	Age groups			**Total**
	20-39 n=301	**40-59 n=273**	**60+ n=484**	**n =1058**
Not know, not need, don't want	206 (68.4)	176 (64.5)	426 (88.0)	808 (76.4)
Inconvenient, costly, timely	63 (20.9)	63 (23.1)	28 (5.8)	154 (14.6)
Fear, anxiety, pain, humiliation	15 (5.0)	9 (3.3)	7 (1.4)	31 (2.9)
Other	3 (1.0)	5 (1.8)	6 (1.2)	14 (1.3)
Non-responders	14 (4.6)	20 (7.3)	17 (3.5)	51 (4.8)

Stated intention of attending for screening in future

Nearly two thirds (64.3%) of women responding to this section (n=1148 of 1785), whether or not they were previously screened, stated that they were likely or very likely to attend for screening in future (Table 38). Over half (54.8%) of all women who stated they were likely to have a test in future (n=1159) had specific plans for when they would attend; 40.4% (n= 468) within 11 months and 9.0% (n=104) within 12 to 36 months. There was a decreasing trend for 20-39 (85.0%), 40-59 (77.2%) and 60+ (33.8%) age groups in stated likelihood of attending (χ^2 for trend = 324.8, p <0.001). Women who had previously been screened (n= 736) were more likely (n=649, 88.2%) to say they would re-attend compared with those never screened (n=515/1075, 47.9%) (RR 1.93, 95% CI 1.79 – 2.07). The main reasons given by those not intending to attend were, again, not knowing what the test was for, or

perceiving that it was not necessary. Accessibility, time and cost issues were the next most important, whilst fear, anxiety, pain and perceiving the test as humiliating were least important in determining intended uptake. Among women who had previously been screened (n= 736), 6.9% (n= 51) stated they definitely did not intend to attend for further tests. The main reasons given by these women were, no longer needing a test, not wanting it and lack of time.

Table 38: Women's stated likelihood of attending for screening in future by screening status

	Likelihood of attending for screening in future Number (%)				
Ever been screened	**Very likely n=536**	**Likely n=612**	**Not likely n=242**	**V. unlikely n=197**	**Don't know n=198**
No n=1050	103 (9.8)	397 (37.8)	206 (19.6)	182 (17.3)	162 (15.4)
Yes n=735	433 (58.9)	215 (29.3)	36 (4.9)	15 (2.0)	36 (4.9)
All n=1785	536 (30.6)	612 (34.3)	242 (13.6)	197 (11.0)	198 (11.1)

** There were 41 non-responders*

All women were asked about their perceptions of positive and negative aspects of attending for screening, based on statements that they could agree or disagree with. Women without a recent screening test significantly differed from those who had, in relation to their agreement with these statements (Table 39). Recent attendees were more likely to believe that screening would give them peace of mind and that the test results would be confidential. They were also significantly less likely to expect embarrassment or anxiety, though just as likely to expect pain. They generally had a more positive attitude towards the clinical services, and less likely to see time and expense as barriers. Also, they were more likely to fear that abnormalities would be found and to perceive themselves at risk.

In terms of stated likelihood of future attendance, different factors appear important for screened and unscreened women. Among those without a recent screening test the most significant barriers were embarrassment and fears about confidentiality. Women, who stated they were likely to attend for a test in future, were more likely to expect anxiety and pain associated with the test, but also to believe they were personally at risk and expected screening to give them peace of mind. Among women with a recent screening test, anxiety and lack of time were the most significant barriers to re-attendance. Those who intended to re-attend were more likely to believe the doctor would find something wrong, and that having a test would give them peace of mind.

A logistic regression model was developed to examine socio-demographic factors, beliefs, knowledge and attitudes associated with screening uptake. In the adjusted model, women who said they were unlikely or very unlikely to attend for screening in future were significantly older, in lower social class groups and single (Table 40). They were also less likely to have had a previous smear test, had less knowledge about cervical cancer and screening, and less likely to believe they were personally at risk. They were significantly more likely to think the test would be embarrassing and for the clinical atmosphere to be cold, and less likely to believe having a test would give them peace of mind.

Table 39: Relationship between beliefs and expectations about screening and stated likelihood of attendance in future, by previous screening history

Likelihood of attendance in future:	**No. (%) screened within 5 years**	**No. (%) not screened within 5 years**	**p-value for χ2 test** †
Believe screening will give peace of mind	622 (95.7)	972 (87.3)	<0.001
Likely/ very likely	579 (96.3)	514 (93.3)	
Not likely/ very unlikely/ don't know	43 (87.8)	458 (81.3)	
*p-value for χ2 test**	*0.014*	*<0.001*	
Believe results will be confidential†	561 (86.5)	903 (81.3)	0.005
Likely/ very likely	520 (86.7)	466 (84.6)	
Not likely/ very unlikely/ don't know	41 (83.7)	437 (78.0)	
*p-value for χ2 test**	*0.556*	*0.005*	
Believe test will be embarrassing†	155 (23.8)	407 (36.5)	<0.001
- Likely/ very likely	139 (23.2)	182 (33.1)	
- Not likely/ very unlikely/ don't know	16 (32.7)	225 (40.0)	
*p-value for χ2 test**	*0.134*	*0.017*	
Believe will be very anxious†	289 (44.3)	639 (57.4)	<0.001
- Likely/ very likely	260 (43.3)	336 (61.1)	
- Not likely/ very unlikely/ don't know	29 (59.2)	303 (53.8)	
*p-value for χ2 test**	*0.032*	*0.014*	
Believe the test will be painful	228 (36.0)	423 (38.9)	0.232
- Likely/ very likely	208 (35.7)	225 (41.9)	
- Not likely/ very unlikely/ don't know	20 (41.7)	198 (36.0)	
*p-value for χ2 test**	*0.406*	*0.046*	
Believe clinical atmosphere will be cold†	147 (22.6)	329 (29.6)	0.001
- Likely/ very likely	132 (22.0)	171 (31.1)	
- Not likely/ very unlikely/ don't know	15 (30.6)	158 (28.2)	
*p-value for χ2 test**	*0.168*	*0.285*	
Believe the clinical staff will be rude†	53 (8.1)	127 (11.4)	0.016
- Likely/ very likely	49 (8.2)	61 (11.1)	
- Not likely/ very unlikely/ don't know	4 (8.2)	66 (11.8)	
*p-value for χ2 test**	*1.000*	*0.724*	
Believe problems found will be curable	466 (71.9)	803 (72.3)	0.876
- Likely/ very likely	431 (71.9)	399 (72.7)	
- Not likely/ very unlikely/ don't know	35 (71.4)	404 (72.0)	
*p-value for χ2 test**	*0.952*	*0.805*	
Believe it's difficult to find the time to go	143 (22.7)	408 (37.4)	<0.001
- Likely/ very likely	125 (21.4)	208 (38.7)	
- Not likely/ very unlikely/ don't know	18 (37.5)	200 (36.2)	
*p-value for χ2 test**	*0.010*	*0.407*	
Believe the test will be expensive	212 (33.5)	498 (45.8)	<0.001
- Likely/ very likely	193 (33.1)	243 (45.3)	
- Not likely/ very unlikely/ don't know	19 (39.6)	255 (46.4)	
*p-value for χ2 test**	*0.361*	*0.713*	

Likelihood of attendance in future:	**No. (%) screened within 5 years**	**No. (%) not screened within 5 years**	**p-value for χ2 test †**
Fear that the doctor will find abnormalities	281 (44.4)	375 (34.7)	<0.001
- Likely/ very likely	266 (45.6)	189 (35.3)	
- Not likely/ very unlikely/ don't know	15 (31.3)	186 (33.9)	
p-value for χ2 test*	0.319	0.045	
Believe personally at risk of cervical cancer	271 (41.6)	365 (32.6)	<0.001
- Likely/ very likely	256 (42.6)	225 (40.8)	
- Not likely/ very unlikely/ don't know	15 (30.0)	140 (24.7)	
p-value for χ2 test*	0.083	<0.001	

† Significance test for difference in level of agreement with statement between women recently screened and not-screened
* Significance test for difference in likelihood of future attendance for screening, within subgroups of screened and not-screened

Table 40: Logistic regression model for stated likelihood of uptake of screening in future

Unlikely or very unlikely to have pap smear in future:	**Odds ratio (95.0% C.I.)**	**p-value**
Increasing age*	1.072 (1.06 - 1.08)	<0.001
Lower social class *	1.178 (1.04 - 1.34)	0.012
Marital status (single as reference)		
- Married / cohabiting	1.621 (0.89 - 2.94)	0.113
- Divorced / widowed / separated	0.731 (0.51 - 1.04)	0.085
Believe personally at risk ***	0.513 (0.39 - 0.68)	<0.001
Increasing knowledge score ***	0.754 (0.66 - 0.87)	<0.001
Had previous screening test ***	0.214 (0.16 - 0.29)	<0.001
Believe screening will give peace of mind ***	0.438 (0.28 - 0.68)	<0.001
Believe test will be embarrassing **	1.498 (1.11 - 2.02)	0.008
Believe the clinical atmosphere will be cold *	1.460 (1.08 - 1.98)	0.014
Increasing attitude score	0.970 (0.88 - 1.07)	0.549
Believe results will be confidential	1.067 (0.75 - 1.51)	0.712
Believe will be very anxious	0.952 (0.71 - 1.27)	0.739
Believe any problems found will be curable	0.833 (0.62 - 1.12)	0.229
Believe the clinical staff will be rude	1.400 (0.91 - 2.15)	0.123

When asked about factors that would make attendance for screening easier, 393 women (21.5%) gave a response. Tthe most common suggestions were increased publicity and education (Table 41).

Table 41: Factors suggested by women that would encourage them to attend for screening

Enabling factors	Number (%) who suggested this
Publicity / education	146 (36.2)
Reducing the cost	43 (11.0)
Advice from doctors	35 (8.9)
Increasing accessibility	34 (8.7)
Improved test attributes	24 (6.1)
Other (personal factors)	110 (28.1)

Factors associated with screening uptake (objective 5)

The relationship between socio-demographic and lifestyle factors and screening uptake were examined (Table 42). In general, women who were younger, in higher socio-economic groups and married were more likely to have attended for screening within the past 5 years. About half of the responders (906/1815) were born in Hong Kong. The rest were mainly born in Mainland China, though 4.8% (n=87) were born in other Asian countries, and 0.2% (n= 4) in the west. Those born in Hong Kong were more likely to have attended for screening. Within Hong Kong, those living in Kowloon were least likely to have attended for screening.

Table 42: Socio-demographic and lifestyle factors related to screening uptake

	Number (%) screened within last 5 years (n=665/1826)	OR (95% CI) for screening attendance
Age group		
- 20 to 39	265 (45.4)	1.00
- 40 to 59	304 (48.9)	1.15 (0.92 – 1.44)
- 60+	96 (15.5)	0.22 (0.17 – 0.29)
Social class (1 missing)		
- IV	81 (25.6)	1.00
- III	176 (32.8)	1.41 (1.04 – 1.93)
- II	201 (38.5)	1.82 (1.33 – 2.47)
- I	206 (46.8)	2.55 (1.86 – 3.50)
Marital status		
- Single	12 (7.2)	1.00
- Married/ co-habiting	603 (45.9)	10.93 (6.02 – 19.87)
- Divorced/ widowed	59 (14.5)	2.20 (1.14 – 4.25)
Country of birth (14 missing)		
- Hong Kong	434 (65.3)	1.00
- Other place	231 (34.7)	0.36 (0.30 – 0.44)
Area of residence (1 missing)		
- Hong Kong Island	172 (38.5)	1.00
- Kowloon	152 (30.0)	0.68 (0.52 – 0.90)
- New Territories	333 (39.1)	1.03 (0.81 – 1.30)
- Outlying Islands	7 (36.8)	0.93 (0.36 – 2.41)
Had attended for mammography (283 missing)	146 (57.5)	3.07 (2.33 – 4.05)
Had regular dental check-ups (282 missing)	207 (53.5)	2.85 (2.25 – 3.61)
Smoking history (2 missing)		
- Never smoker	624 (37.3)	1.00
- Ex-smoker	19 (23.8)	0.52 (0.31 – 1.20)
- Current smoker	25 (30.1)	0.72 (0.43 – 1.20)

Women who had attended for cervical screening, were also more likely to have attended for a mammogram, to have regular dental check ups and to have never smoked. Attendees also had higher mean family income ($23,898 / month [exchange rate: £1 = $12 (HK)]) compared with non-attenders ($13,657 per month) (t-test for difference between means = 12.6, $p<0.001$). Logistic regression was used to obtain adjusted odds ratios for factors associated with screening uptake (Table 43).

Table 43: Logistic regression model of factors associated with screening uptake in last five years

	Adjusted OR	(95.0% C.I.)	p-value
Increasing age	0.97	(.95 – 0.98)	<0.001
Decreasing social class	0.82	(0.72 – 0.95)	0.007
Birthplace outside of Hong Kong	0.64	(0.48 – 0.86)	0.003
Marital status (single as reference)			
- Married / cohabiting	21.62	(10.83 – 43.17)	<0.001
- Divorced / widowed / separated	9.72	(4.17 – 22.71)	<0.001
District of residence (Hong Kong Island as reference)			
- Kowloon	0.60	(0.41 – 0.89)	0.011
- New Territories	0.92	(0.65 – 1.29)	0.616
- Outlying Islands	0.60	(0.15 – 2.42)	0.472
Believe personally at risk of cervical cancer	1.32	(1.00 – 1.72)	0.052
Increasing attitude score	1.17	(1.06 – 1.31)	0.003
Increasing knowledge score	1.27	(1.08 – 1.48)	0.004
Previously had mammograms	3.16	(2.21 – 4.53)	<0.001
Previously had dental check ups	1.86	(1.36 – 2.53)	<0.001
Having never smoked	1.83	(1.07 – 3.13)	0.028

In the logistic regression model, previous screening was significantly associated with younger age, higher social class, being married, being born in Hong Kong, and not living in Kowloon. Better knowledge and more positive attitude were also associated with higher rates of screening, as was belief that they were personally at risk. Participation in other health protective activity was also significantly associated with screening.

3.5.5 Risk, risk perception and screening (objective 7)

Information on risk factors to allow a risk score to be constructed was available for 1546 (84.7%) of women. The majority had a low objective risk score (median risk score =1), with just over 6% (n= 97) (95% CI 5.1 – 7.5) scoring greater than 3. There

were 1765 (96.7% of responders) who answered the question on perceived risk. In contrast with objective risk, only 38.4% (n=678) perceived their risk to be low.

Objective risk and screening history

History of screening within the last 5 years was compared among women with different risk factors for cervical cancer (Table 44). In general, women with higher risk score were no more likely to have been screened than those with lower risk. In relation to risk factors, women in the lower socio-economic groups, smokers and older women were all significantly less likely to have attended for screening. The only risk factor that was significantly positively associated with screening was long-term OCP use.

Table 44: Variation in having had a screening test within the last 5 years, by risk factor

Risk Factor (number of non-responders)	Number (%) screened within last 5 years	Crude OR (95% CI) for screening	Significance level
Social Class (1)			
IV	75 (12.5)	1.00	
III	160 (26.6)	1.47 (1.09 – 1.99)	
II	183 (30.4)	1.85 (1.37 – 2.49)	
I	184 (30.6)	2.57 (1.89 – 3.50)	P <0.001
Level of education (0)			
Form 5 and below	509 (32.3)	1.00	
Matriculation and above	94 (37.7)	1.27 (0.96 – 1.67)	P = 0.090
Number of sexual partners (152)			
3or more	25 (37.3)	1.00	
2	42 (38.9)	1.07 (0.48 – 1.32)	
1	481 (32.1)	0.79 (0.48 – 1.32)	P = 0.251
Smoking Status (1)			
Ever smoker	32 (22.1)	1.00	P = 0.003
Never smoker	571 (34.0)	1.82 (1.21 – 2.73)	
Age group (0)			
60+	87 (14.4)	1.00	
40 – 59 years	271 (45.6)	4.78 (3.72 – 6.16)	
20 – 39 years	241 (40.0)	3.52 (2.73 – 4.55)	P <0.001
Use of oral contraceptive pill (0)			
Never or <5 years use	506 (31.2)	1.00	P <0.001
Used OCP ≥ 5 years	97 (47.1)	0.52 (0.39 – 0.70)	
Total risk score (154)			
Higher (score 3-5)	35 (36.1)	1.00	P = 0.87
Lower (score 0-2)	511 (35.3)	0.97 (0.63 – 1.48)	

Perceived risk and screening history

Perceived risk was also compared with screening history (Table 45). There was a significant positive association between higher perceived risk and screening. There was also a significant increasing trend in likelihood of having had a screening test with increasing levels of reported worry associated with cervical cancer.

Table 45: Relationship between perceived risk and history of screening in last 5 years

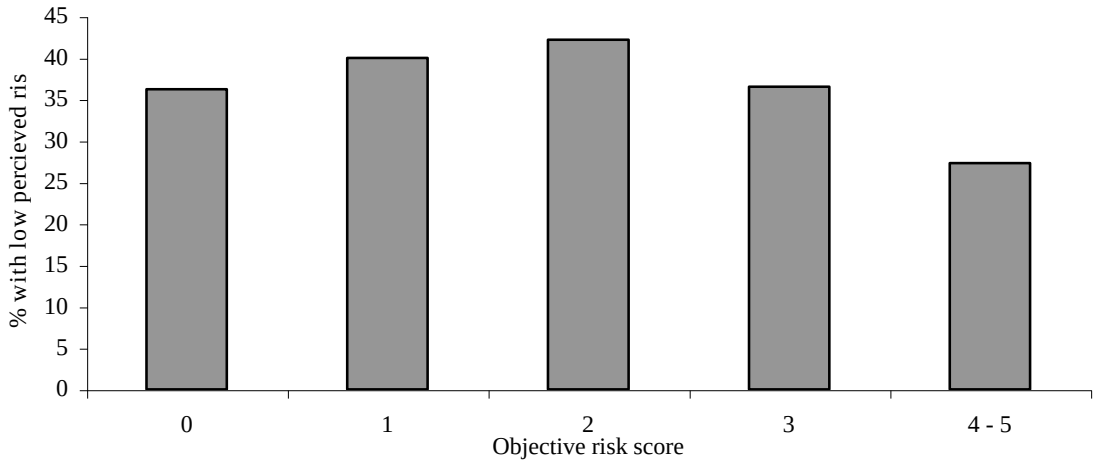
	Number (%) screened within last 5 years (n=665/1826)	**Crude OR (95% CI) for screening**	**Significance level**
Perceived risk compared to average			
Less than average	191 (28.2)	1.00	P < 0.001
Not less than average	401 (36.9)	1.48 (1.20- 1.82)	
Level of worry about a diagnosis of cervical cancer			
Not at all worrying	11 (11.0)	1.00	P < 0.001
Not very worrying	60 (22.1)	2.29 (1.15 – 4.57)	
Fairly worrying	214 (37.7)	4.88 (2.55 – 9.33)	
Very worrying	150 (33.0)	3.98 (2.07 – 7.67)	
Extremely worrying	152 (40.6)	5.52 (2.86 – 10.68)	

Women who had a previous abnormal cervical smear result, were more likely to perceive themselves at risk of cervical cancer, compared to those with previously normal result and those who had never had a screening test (51.4% n= 12, 41.0% n= 305 and 31.5% n= 333 respectively). They were also least likely to believe that their risk was less than average (24.3% n=6, 32.6% n= 243, and 43.4% n=459).

Relationship between objective and perceived risk

The relationship between perceived risk and objective risk factors and risk score were compared. Women with risk factors were no more likely to perceive their risk to be higher, except for older women (OR 3.19 [95% CI 2.49 – 4.07] for oldest compared with youngest group) and those with lower levels of education (OR 1.41 [1.06 – 1.88]). However, low risk perception was not related to low objective risk score (Figure 12).

Figure 12: Variation of perceived low risk in relation to objective risk score



Among women with low objective risk score, pessimists (who overestimate their risk) were significantly younger than realists (mean age 47.8 and 55.6 respectively, t-test for comparison of means = 10.9 $p<0.001$), but were no different in terms of other risk factors. They were significantly more likely to have attended for screening in the last 5 years. Among women with higher objective risk score, optimists (who underestimate their risk) were significantly older than realists (mean age 46.1 and 36.0 respectively, t-test for comparison of means = 2.3, $p=0.001$) and more likely to have been long-term OCP users (46.9% compared with 25%, $\chi 2=13.2$, $p=0.03$).

However the two groups were similar in terms of other risk factors and screening practice.

After adjusting for age and social class, realists with high risk were least likely to have attended for screening, and were not significantly different from those with high score and optimistic perception of risk. Those with a pessimistic perception of risk and realists with low risk were significantly more likely to have been screened (Table 46).

Table 46: Logistic regression model for screening behaviour according to risk perception

	Adjusted OR (95% CI) for screening in last 5 years	**Level of significance**
Risk perception		
High risk realist	1.00	0.03
Optimist	1.81 (0.71 – 4.63)	0.22
Pessimist	2.34 (1.33 – 4.11)	<0.01
Low risk realist	1.94 (1.08 – 3.50)	0.03
Increasing age	0.96 (0.95 – 0.96)	<0.01
Decreasing social class	0.80 (0.71 – 0.89)	<0.01

Screening behaviour in relation to subjective and objective risk, and level of worry about cervical cancer was then compared, adjusting for age and social class (Table 47:). In the adjusted model, objective risk was significantly inversely associated with screening up to risk score 2, but not those with higher risk scores. Subjective risk perception remained just significant as a predictor of screening uptake. In addition, increasing worry was significantly associated with screening uptake.

Table 47: Logistic regression model of relationship between risk perception and other factors associated with screening uptake in last five years

	OR (95% CI) for screening in last 5 years	Level of significance
Low perceived risk	0.80 (0.64 – 1.00)	0.05
Objective risk score		<0.01
- 0	1.0	
- 1	1.64 (1.13 – 2.38)	<0.01
- 2	2.24 (1.47 – 3.43)	<0.01
- 3 to 5	1.37 (0.80 – 2.35)	0.26
Level of worry about diagnosis of cervical cancer		<0.01
- Not at all worrying	1.0	
- Not very worrying	1.98 (0.98 – 4.01)	0.06
- Fairly worrying	2.26 (1.14 – 4.48)	0.02
- Very worrying	2.67 (1.36 – 5.24)	<0.01
- Extremely worrying	2.96 (1.49 – 5.89)	<0.01
Increasing age	0.97 (0.96 – 0.98)	<0.01
Decreasing social class	0.80 (0.71 – 0.89)	<0.01

3.5.6 Effectiveness and efficiency of screening (objectives 8 –10)

Benefit of current screening system

The potential number of new cases of invasive cervical cancer prevented by the current screening system in one year is 335 (Table 48). Given the observed number of incident cases, the present system is likely to have prevented 40% of all cases. Based on the pattern of screening observed in this study population, there would have been 734,775 smear tests among women aged 20 or over per year in Hong Kong, or 2,192 screening smears per case of invasive cancer prevented.

Table 48: Estimation of potential number of new cases of invasive cervical cancer prevented in one year, from the current system of screening in Hong Kong

Age group	Age-group specific incidence per 100,000 (based on 5 year average, 1990-1994)[214]	Number of cases expected if no screening:	Potential number of cases prevented
20-39	6.1	146	73
40-59	32.1	473	228
60+	52.1	214	34
All groups	21.6	**833**	**335**

Using the most pessimistic estimates of coverage and screening interval led to a more conservative estimate of benefit, suggesting that 31.6% of expected cases per year would be prevented, with 3,426 screening tests per case prevented. In the most optimistic scenario, we estimate a 65.1% reduction in the number of cases with 1,220 screening tests per case prevented.

A sensitivity analysis was performed based on the key variables in the model. We first tested the model by adjusting the expected incidence of cancer in each group. If women who attend for screening currently were at lower risk of cervical cancer than the general population, this would affect the incidence of disease. Reducing the expected incidence of disease in the screened population compared to those who rarely or never attend for screening made little difference to the outcomes of the model. If we assume those who attend for screening are at 10%, 20% or 30% lower risk, the percentage reduction in incidence as a result of the current screening pattern would reduce from 40.2% to 40.0%, 39.8% and 39.5% respectively. Correspondingly, the numbers of smear tests per case prevented would increase from 2,192 to 2,311, 2,444 and 2,594 respectively.

We then adjusted the estimated effectiveness of screening. If we adjusted the effectiveness of screening at yearly intervals to 80% and 60% and at other intervals accordingly, the percentage reduction in incidence would reduce from 40.2% to 33.9% and 24.1% respectively. The corresponding number of smear tests per case prevented would increase from 2,192 to 3,843 and 6,195 respectively.

Benefits of screening in an organised system

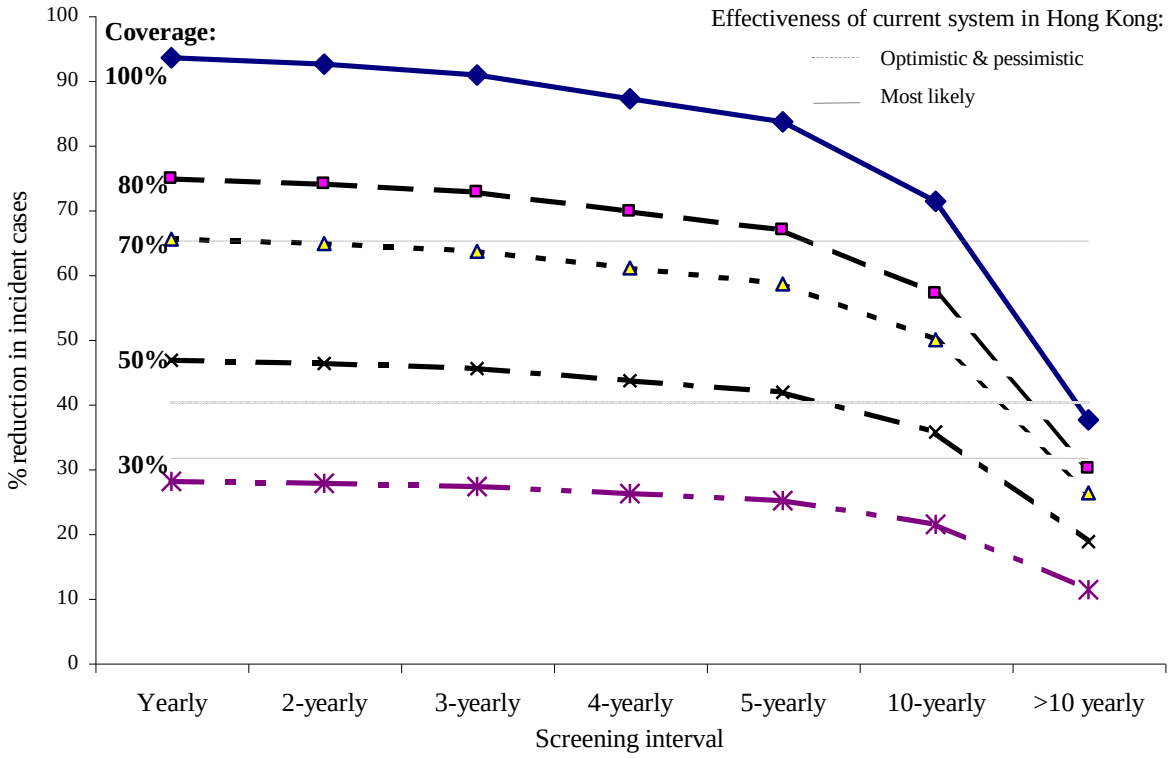
We considered the effectiveness and efficiency of screening under various policies within an organised screening system (Table 49). Generally, increasing coverage results in an increase in effectiveness as measured by the expected percentage reduction in incidence (Figure 13). Increasing coverage has no effect on efficiency under our assumptions, though the total number of tests would increase (Figure 14). Decreasing the screening interval also increases effectiveness but at the cost of reducing efficiency. Thus for a screening programme with 3 – 5 yearly interval (as in most organised screening programmes), increasing the coverage has more influence on effectiveness than any further decrease in screening interval, and this is achieved with no loss in efficiency.

Table 49: Effectiveness and efficiency of adopting various screening policies, targeting all or selected groups in the population & with varying screening intervals and coverage

Screening interval (months)	Percentage reduction in incidence of cervical cancer expected in organised screening (Number of smears per case potentially prevented)			
	80% coverage	70% coverage	Ad hoc <40, 80% coverage ≥ 40's	No screening <40, 80% coverage ≥ 40's
0 - 11	74.8 (2958)	65.5 (2958)	70.4 (2198)	61.7 (1723)
12 - 23	74.0 (1495)	64.8 (1495)	69.7 (1457)	61.0 (871)
24 - 35	72.6 (1015)	63.6 (1015)	68.6 (1222)	59.9 (592)
36 - 47	69.7 (794)	61.0 (794)	66.2 (1134)	57.5 (463)
48 -71	66.9 (662)	58.5 (662)	63.9 (1091)	55.2 (386)
72 - 119	57.0 (485)	49.9 (485)	55.8 (1107)	47.0 (283)
120 +	30.0 (492)	26.3 (492)	33.5 (1660)	24.7 (286)
Present ad hoc system:	40.2 (2192) [65.1 (1,220) to 31.6 (3,426)]			

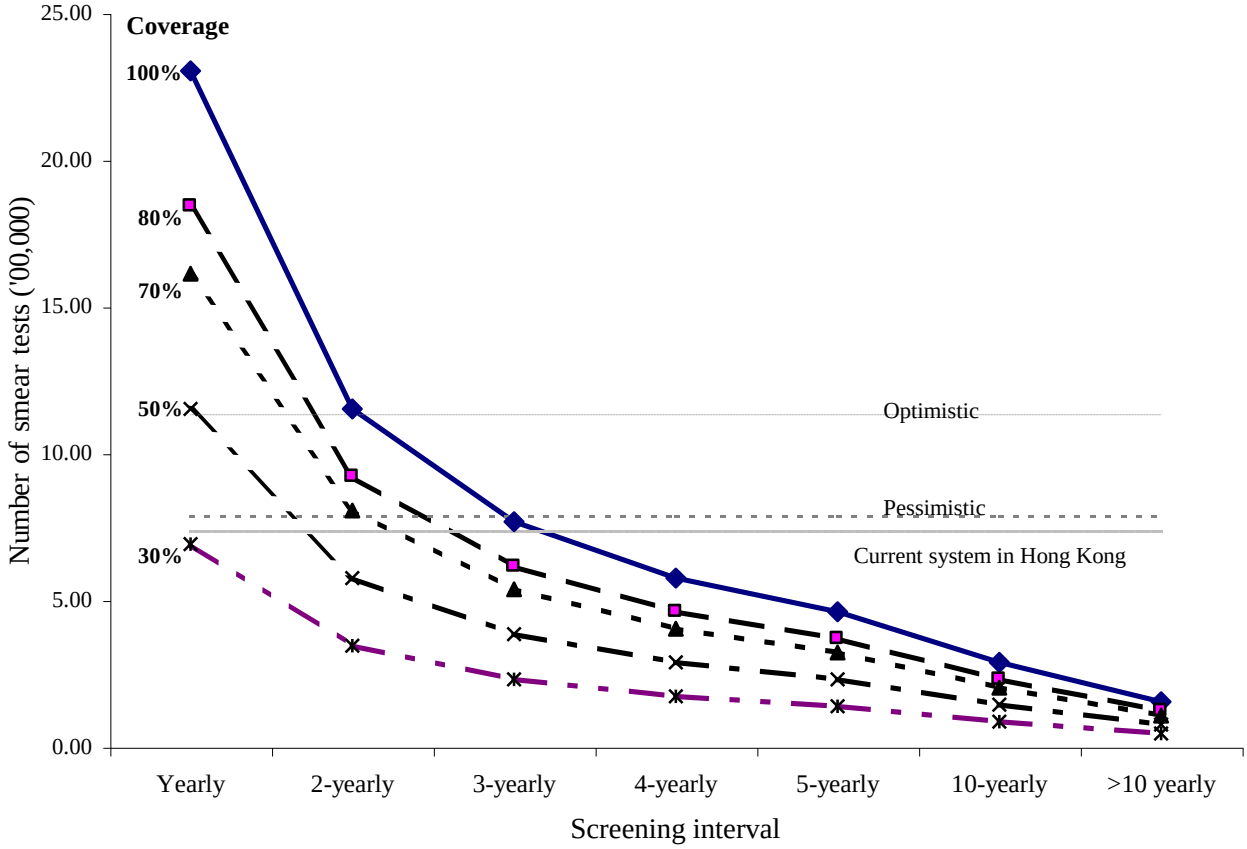
Since the current system is predominantly screening women in the younger age groups, we considered the effects of adopting policies to target older women (over 40 years), either whilst allowing screening in younger women to continue in an ad-hoc fashion, or by stopping all screening in under 40's. The former policy would be both less effective and less efficient than an organised system targeting the whole population. The latter would also be less effective, but far more efficient than a non-targeted policy.

Figure 13: Expected percentage reduction in incidence of cervical cancer based on screening policies with different target coverage and screening intervals



(Horizontal lines show level of protection offered by screening in Hong Kong)

Figure 14: Number of cervical smear tests (’00,000s) per year based on screening policies with different target coverage and screening intervals in Hong Kong



Comparison of current system with an organised system

Using the most likely benefit estimates, the current screening system in Hong Kong is less effective and less efficient than would be expected in an organised screening programme. The level of effectiveness achieved is poorer than an organised 10-yearly programme achieving 80% coverage (Figure 13), though the numbers of screening smear tests are equivalent to a 2 to 3-yearly programme. Even the most optimistic estimate would mean the effectiveness of the current system is similar to an organised 5 to 10-yearly programme, with 80% coverage, but at about twice the cost per case prevented (Table 49 and Figure 13). Compared with the most likely estimate of benefit (achieving 40% reduction in incidence), a 3-yearly or 5-yearly screening policy targeting the whole population and aiming for 80% coverage would prevent an extra 32.4% (equivalent to 267 new cases per year) and 26.7% (222 new cases per year) respectively. This could be achieved with more efficient use of resources, reducing the number of tests per case prevented from 2,192 to 1015 and 662 respectively.

3.6 Discussion

This was a large study of a representative sample of Hong Kong Chinese women in different age groups, regarding their knowledge, attitudes and screening practice in relation to cervical cancer. The modest overall response rate was 62.5%, with only 56% of telephone contacts having been successful. Use of telephone interviews for assessing cervical screening coverage has been used in other countries[185] and the response rate, although not high, was in keeping with those obtained in that (52%) and other telephone surveys[215; 216]. Responders to the random digit dialling part of the study were similar to the general Hong Kong population in terms of age, education and social class, suggesting that responders were representative of the population. Information was successfully collected on screening practice, reasons for non-attendance and risk factors for cervical cancer.

3.6.1 Screening coverage

Screening history was assessed by self-report. This is commonly used in epidemiological studies and is simpler than checking pathology reports. Although it was found reliability of this variable to be good, verification studies have demonstrated that self-report results in over-reporting of screening[168; 169] and women believe they have had screening more recently than they actually have[217]. One study in Sweden, where women's self-report of screening was compared with information from their screening database, found that 99% of women screened within 5 years and 95% of those who had a screening test over 5 years ago correctly reported this. However, half of those who had not had a screening test (based on n=42), falsely reported having had one[181]. Another study in the USA based on low-income minority women, found that 67% of women correctly reported a previous screening test, but on

average they believed they had the test 23 months earlier than they actually had[217]. Furthermore, non-responders to the survey are less likely to have ever been screened. Therefore our finding of 43% ever screening coverage, is likely to be an overestimate, and the proportion who are regular attendees are probably less than a quarter of all women.

Other regions with no organised call and recall system achieve similar coverage. A study in Catalonia in Spain found coverage of 42% in the absence of a programme[183], whilst a study in Italy showed a coverage of 52% ever screening, and 37% screening within 3-years prior to introduction of an organised programme[55]. However, higher coverage was reported in countries with central organisation. In the Netherlands where screening is both by organised and spontaneous screening, coverage in areas where there was an organised call and recall system was 91% compared with 68% where screening was spontaneous[186]. Similarly a study in Italy found that an organised programme with call and recall increased coverage, particularly among disadvantaged, previously poorly screened subgroups, and also reduced over-screening among previously screened women[187]. There is a relationship between the level of reduction in cervical cancer incidence and mortality and the intensity of organisation of screening[99].

3.6.2 Age specific coverage and screening interval

It was found that screening coverage was lowest among older women (over the age of 60). Less than 10% of these women have regular screening, compared with a third of younger women. Other studies have also shown that the older age groups are least likely to have been screened[183; 185-188]. Even within organised screening programmes,

older women and those in lower social class groups tend to be less likely to be screened[177].

It was also found that most women, who are currently being screened regularly, attend annually. Annual screening has little benefit over 3-yearly screening and was not recommended in organised programmes. Such over-screening (at intervals less than 3 years) is a common feature in other countries where there is no organised programme, particularly among younger women[55; 185].

3.6.3 Factors associated with screening uptake

In this study population, screening uptake was higher among younger women, those in higher socio-economic groups, who engage in other health promoting behaviour and who perceived that they were personally at risk of cervical cancer. They had a better knowledge and attitude towards cervical screening and perceived cervical cancer as a worrying diagnosis.

Few other studies like this have been done in Chinese populations in Asia. One study among Singapore Asian women (age 50 to 64) found that having a good social network, less fatalistic attitude towards health, belief that screening could improve outcome and higher education were related to screening attendance among women[218]. Another survey of 4,400 women over the age of 20 in Taiwan, found that age (younger than 30 and older than 65) was the strongest predictor of non-screening[219]. Low levels of education, being single and living outside of the city were also related to non-attendance.

Engaging in other health protective behaviour (such as mammography) had also been shown to be associated with Pap screening in other studies[188]. Several studies also confirm that screening coverage tended to be lower among women with lower levels

of education or in lower socio-economic groups and women who were single[183; 185-188].

3.6.4 Barriers to screening

This is the first study in Hong Kong to explore potential barriers to screening among a large cross-section of women. The barriers to screening that were explored, were based on those identified in studies elsewhere. It was found that lack of knowledge about the Pap test and not perceiving it as necessary were the major reasons for non-uptake of screening. In countries where there is organised screening; not wanting to attend; or believing that screening is unnecessary also accounted for a large proportion of non-attendance[191]. Lack of knowledge and not having heard of the Pap smear had been cited as important reasons for non-attendance in other countries[192; 220; 221]. The most common source of information on the Pap smear screening in this study was health professionals. The media, friends and family were also important sources. Other studies have also shown that health personnel and the mass media are principal sources of information about the test[222]. This would suggest routes for promoting information on screening to other women.

It was found that the majority of women who had been previously screened expressed their intention to have further screening tests. After adjusting for previous screening experience, women who were older, single and in lower social groups were significantly less likely to indicate they would want to have a test in future. Perception that the test would be embarrassing or that the clinical atmosphere would be cold were associated with negative views on future attendance. Similar findings were found in a Scottish study, where women in lower social classes and those who thought the test

was embarrassing were less likely to say they would attend in future[223]. However, in that study perceived pain associated with screening was also a barrier, which was not the case in our population. Embarrassment and discomfort had been suggested as barriers in other studies[224-226], particularly among younger women[227]. The proportion reporting discomfort among women who had been screened in this study, is similar to those reported elsewhere[228].

3.6.5 Risk and risk perception

Some studies showed that women with higher epidemiological risk (e.g. multiple partners, use OCP, smokers, sexual intercourse at young age) were better screened, or no less likely to be screened than those at low risk[177; 185; 229]. It was also found that in relation to epidemiological risk score, there was little difference in screening behaviour between women at higher and lower risk. However, when individual risk factors were examined, there was a significant inequality in screening, so that smokers and those in lower social classes were less likely to be screened. Those with multiple sexual partners were no more likely to have had screening, and the only group that were more protected were women taking the oral contraceptive pill.

It was found that personal risk perception was an important factor in determining screening uptake. Similarly, stated intention to attend for screening in future was more likely among those who perceived they were personally at risk, or who thought screening would give them peace of mind. A community based study of beliefs and attitudes towards cervical cancer in Singapore, had similar findings, with belief in personal susceptibility being an important determinant of screening intentions[225]. Another study of low-income women in the USA, also found personal susceptibility,

belief in the efficacy of screening tests and benefits of screening to be associated with screening uptake[230].

There are several studies providing evidence to support the effectiveness of educational messages in changing risk perceptions[231-235]. Some[231; 236], but not all of these showed an effect on screening behaviour. However, it was not clear whether increasing the accuracy of risk perception would necessarily influence screening behaviour according to risk. Other studies suggested that women who overestimate their risk (pessimists) may either over-screen[237], or they may stop attending for screening[238]. Here it was found that women who overestimated their risk were significantly more likely to attend for screening, whereas women who underestimated or accurately perceived their risk as high, were less likely to have attended for screening. Further studies are needed to assess the impact of influencing risk perception on screening behaviour.

3.6.6 Effectiveness and efficiency of screening

Overall it was found that an organised screening programme, aiming to achieve at least 80% coverage across all age groups would be the most effective and efficient policy. Effectiveness was increased with increasing coverage, whilst reducing the screening interval had relatively less influence. It was found the current system of ad-hoc screening in Hong Kong was likely to be less effective than would have been expected from an organised 10-yearly screening programme achieving a realistic 80% coverage. The current system was also inefficient, with 30% of women being over-screened.

The estimates of screening effectiveness were based on the estimates of screening interval-specific benefit demonstrated in the IARC study. The effectiveness of

screening depended partly on the sensitivity of the screening test, and partly on appropriate management of those who tested positive. The IARC estimates suggested higher test sensitivity than demonstrated in other studies, mainly because sensitivity was improved after two negative tests. A meta-analysis of smear test sensitivity showed a wide variation in estimates, ranging from 30 to 87%[22]. The sensitivity analysis showed that variations in the estimate can have a marked effect on the model results. The calculation of the effectiveness of the current system was likely to be an overestimation. One of the features of organised systems of screening was an improvement in the quality of smear taking, cytology diagnosis and follow-up. This would allow programme effectiveness to approach more towards the findings in the IARC study.

It was assumed that women who were not screened have the same level of risk as those screened. However, studies in populations where there is no organised screening suggest women who attended for cervical screening were at lower risk[55; 239]. The sensitivity analysis suggested that variation in background risk among those attending for screening has little effect on the benefits achieved. Therefore any overestimation of benefit as a result of this estimate is likely to be small. On the other hand, introducing an organised programme has been shown to reduce inequalities in access, and increase coverage in higher risk groups[187].

Given that actual coverage is likely to be lower than the study indicates, the true benefit achieved from the current system is likely be more towards a pessimistic estimate. Among the responders, two thirds expressed their intention to attend for screening in future. This means that even if they follow through with their intentions, further effort is required if coverage is to be increased. Higher coverage is reported in

countries with central organisation and achieving 80% coverage is a realistic goal. In the Netherlands where screening is both by organised and opportunistic screening, coverage in areas where there was an organised call and recall system was 91% compared with 68% where screening was opportunistic[186]. Similarly in the UK, coverage has increased to 80%, since introduction of a national call and recall system[240].

We also found that most women (79%) who are currently being screened regularly attend annually. This has little benefit over 3-yearly screening and is not recommended in organised programmes. Such over-screening is a common feature in other countries where there is no organised programme, particularly among younger women[183; 185]. However this can be minimised with introduction of an organised call and recall programme[187]. Some studies suggest that screening has more benefit in the older age group, suggesting that an organised programme would actually be more effective than we have demonstrated.

Apart from improving effectiveness, it was found that an organised system would improve the efficiency of screening in terms of Pap smears per case prevented. The estimates of the number of smear tests are based on the number of women attending for screening. However, this does not take account of the additional smear tests consequent to an initial false positive result. With over screening and non-targeting of high risk women, the risk of false positive results is high, and the estimates of efficiency of the current system are likely to be generous. Other studies have also shown that cost-effectiveness can be improved by introducing an organised programme instead of spontaneous screening[241]. The efficiency of the current system

is limited because of two reasons: poor overall coverage means that the effectiveness of the system is reduced, whilst over-screening and excess smears wastes resources.

In conclusion, it was found that an ad-hoc cervical screening system achieves poor coverage, over-screening of a small group of women and was less effective and efficient than an organised programme was likely to be. Given that in many ad-hoc systems, screening activity was subsidised by public organisations, it was important to ensure that resources were used more efficiently. If any screening activity is carried out, particularly by public organisations, this should be within an organised system with call and recall and adequate systems for quality assurance.

4 PROVISION OF CERVICAL SCREENING SERVICES IN HONG KONG

4.1 Summary

Given the mixed medical economy in Hong Kong, there are many different providers of screening services. There have been no previous studies to try to describe the diversity of practices and to what extent these relate to current best evidence. The aim of this study was to identify the range and characteristics of practitioners providing cervical screening services in Hong Kong, and to compare practitioners' and women's knowledge of risk factors for cervical cancer and views on factors influencing screening uptake.

Methods

A postal questionnaire was sent to a range of practitioners working in the private, government and non-government sector organisations that were likely to offer screening. These were identified through the relevant professional colleges, the Department of Health and Hospital Authority. Participants were asked about their professional background, details of screening services they offered, their perceived training needs and their management of abnormal smears. They were also asked about what they perceived as the main factors encouraging or discouraging women from attending for screening.

Results

There were 384 practitioners responding to the survey (overall response rate of 22%). Responders came from a variety of organisations including the private sector, the Hong Kong Family Planning Association, Department of Health clinics and the

Hospital Authority. There were a wide variation in professional training, experience and service provided by responders. The age range for which screening was offered varied from a limited range (30 – 64) to having no limit and recommended screening intervals ranged from one to three yearly. Waiting times for screening, time allocated to the screening session, time to receiving results and charge for the service all varied between and among provider types. The most frequent charge was between $100 and $300, although one third of providers had no charge for screening, whilst over 2% charged over $500. Providers with a higher charge tended to have shorter waiting times, longer consultations and to use a private laboratory for analysing smears. They also were more likely to recommend a shorter screening interval.

There was no clear consensus among responders on the management of abnormal smears. Early colposcopy for mild dyskaryosis was recommended by a third of responders from an obstetrics and gynaecology specialty, whilst most other practitioners would repeat the test within 6 to 12 months. On the other hand, a minority of practitioners (3%) did not recommend colposcopy even for severe dyskaryosis.

Most practitioners mentioned sexual activity as a risk factor for cervical cancer, but relatively few recognised smoking as a risk factor. On the other hand among both practitioners and women responding to the telephone survey (chapter 3) a proportion believed that diet, exercise and stress reduction would reduce cervical cancer risk. Most practitioners recognised the main barriers to screening uptake among women, but over half underestimated the role of anxiety related to getting test results and the time needed for attending as barriers to uptake.

Conclusions

The lack of a centrally co-ordinated screening system was apparent by the diversity in which screening services were offered. There is no uniform policy for training in smear taking and no clear management plan among practitioners for dealing with abnormal screen results. These issues need to be tackled as part of setting up an organised screening programme.

4.2 Introduction

A range of factors influence whether or not women attend for screening. In chapter 3, factors related to the woman's socio-demographic characteristics, knowledge, attitudes and beliefs were examined. In addition, there was evidence that external influences, such as the way screening was organised and the qualities of providers of screening, were all important. Several studies suggested that the gender, discipline and skills of the practitioner, all influenced uptake [242-244]. Both the technical and interpersonal skills of practitioners have had an effect on the woman's experience during screening and affect subsequent uptake[243; 245]. The delivery and organisation of services, including their accessibility[246] and cost, as well as methods used to notify women of their results[247; 248], also influenced uptake and re-attendance.

As an aid to planning screening services and to improve uptake, it is also important to explore the views of providers of screening services. The actions and motivation of health care providers are important factors for increasing screening uptake and promoting behaviour change among women[244; 249]. It is also important to understand perceived barriers to screening from the practitioners' point of view, and to compare these with barriers cited by women.

4.3 Aims and objectives:

This chapter, draws on the results from two studies; the cross-sectional study described in chapter 3, and a separate study of providers of cervical screening in Hong Kong. The main questions addressed by this chapter include:

1. Who are the main current providers of cervical screening services in Hong Kong?
2. What are the characteristics of current providers of cervical screening services in Hong Kong?
3. What are the characteristics of services provided, in terms of waiting time, charges, recommended screening interval and provision of other services?
4. How do women and practitioners' views compare in relation to barriers and factors influencing uptake of screening?

4.4 Methods:

The method for the cross-sectional study of women in Hong Kong was described previously (chapter 3). In addition, funding was sought for a two-stage study to investigate provider characteristics. The first stage involved a survey of practitioners in Hong Kong regarding cervical screening. The second stage involved more detailed interview with a selection of practitioners, and also focus groups with a sample of attendees and non-attendees for screening, identified from the first study. This thesis will focus on the quantitative data in the first stage only, and not address the qualitative component in the second stage.

For stage one, a confidential postal questionnaire was sent to a range of practitioners in the private, government and non-government sectors providing preventive health screening for women. In order to access relevant practitioners with responsibility for cervical screening, the questionnaire was sent to a range of organizations. These included members of the Hong Kong College of Family Physicians, the College of Obstetricians and Gynaecologists, the Department of Health, Hospital Authority and private Hospitals and Non-Government Organizations (NGOs). NGOs included organizations such as the Family Planning Association Hong Kong (FPA), United Christian Hospital and Shatin Community Clinical Screening Centre. The Hong Kong Colleges did not allow us access to their list of members, instead sending out the questionnaire on our behalf. No reminder letters were allowed.

4.4.1 The study instrument

The self-administered questionnaire was developed in consultation with a group of expert practitioners, and piloted on a group of five clinicians for content validity. No revisions were required following the pilot. The questionnaire consisted of three distinct sections (Appendix 3). The first section sought information on the practitioner's professional background, training and experience. The second, related to the administration and management of screening services within the organisation where the practitioner worked. This included data related to eligibility criteria for women screened, waiting times, charges, screening technique and laboratories used. Participants were also asked about how they would manage three types of abnormal smears; those with mild, moderate or severe dyskaryosis. For each result, they were asked to indicate whether they would repeat the smear or, refer for colposcopy for the woman involved. The final section sought information on the individual practitioner's views and perceptions of women's understanding of cervical cancer and factors

affecting their uptake of screening. Practitioners were asked to indicate whether they believed certain factors would encourage or discourage a woman from attending for a smear, and which, in their opinion, was the main reason for non-attendance among women who had never had a smear. They were also asked to rank screening locations in terms of whether women would find them accessible (cost, appointment system and waiting times) and 'user friendly' for screening. In relation to cervical cancer, they were asked whether they believed any of a range of defined behaviours would reduce women's risk of cervical cancer and to what extent women had discussed their attitudes and beliefs about cervical cancer and screening with them. These questions were derived from the women's telephone survey. The list of behaviours to reduce risk included a mixture of well described factors from the literature, and other behaviours mentioned by women in an open-ended question in the survey. Practitioner responses to section three of the questionnaire were compared with responses from the relevant sections of the women's survey.

4.4.2 Analysis

From the women's survey, the sections of the questionnaire related to their current use of, experience of and preference for screening services was described. In the practitioner survey, descriptive statistics were used to describe the range of provider organisations, their characteristics, qualifications and experience. Comparative analysis was used to assess the relationship between these characteristics and the way services were provided, such as waiting times, charging and use of protocols and guidelines. The management of abnormal smears between different providers was also compared. Finally, we compared the perceptions of practitioners with those of the women surveyed, in relation to cervical cancer and screening.

4.5 Results:

For the practitioner study, a total of 1,759 questionnaires were sent out, and 384 returned (overall response rate of 22%). However, the response rate varied widely according to the organisation (Table 50). The method used for distributing questionnaires, meant that many practitioners could have received more than one copy. This may have been a contributing factor to the low response rate, the implications of which are discussed later (see discussion). Of the questionnaires returned, 50 were not completed, as the practitioner was not involved in smear taking. There were therefore 334 usable questionnaires.

Table 50: Response rate by organisation for the practitioner survey

Organisation	**Number questionnaires sent**	**Number (%) returned**
Department of Health	80	16 (20)
NGO (including FPA)	35	19 (54)
Private hospitals	84	19 (23)
Public hospitals	210	36 (17)
Hong Kong College of Obs & Gynaecologists	325	99 (30)
Hong Kong College of Family Physicians	1025	195 (19)
Total	**1759**	**384 (22)**

4.5.1 Characteristics of providers of screening services:

Smear takers responding to the survey come from a range of sectors, the majority being from the private sector (n=145, 37.7%) and general practice (n=83, 21.6%). The next main group of providers responding to the practitioner survey were those working in the Hospital Authority, followed by those working in NGO's. This is broadly similar to the main providers women reported using (Table 51). However, the

FPA, which was reported as the main provider for screening outside the private sector, was not as well represented in the practitioner study.

Table 51: Providers used by women for cervical screening compared with those responding to practitioner survey

Screening provider	**Number (%) women screened at organisation (n=741)**	**Number (%) responders to practitioner survey**
Private sector doctors	300 (40.4)	198 (59.3)
Private practitioner	238 (32.1)	
Private hospital	62 (8.4)	
Hospital Authority	145 (19.5)	78 (23.4)
Public hospital	121 (16.3)	
HA Well Woman clinic	24 (3.2)	
HKFPA (NGO)	165 (22.2)	32 (9.6)
Department of Health	87 (11.7)	26 (7.8)
Maternal Child Health Clinic	65 (8.8)	
Well Woman clinic	17 (2.3)	
Family Planning clinic	5 (0.7)	
Overseas	19 (2.6)	
Others	22 (3.0)	
Missing	3	

Practitioners providing screening, who responded to our survey, were predominantly doctors. However 8 (2.4%) were HMO employees who did not necessarily have a registerable medical qualification. One third of responders (n=110) had only a basic medical qualification. The rest had post-graduate, including professional qualifications (n = 186) and academic degrees at diploma (n=28), bachelors (n=3), masters (n=4) or doctorate(n=3) level. Overall there was a higher proportion of males

(n= 194, 58%), from a variety of specialties and grades (Table 52). The mean number of years they had worked in their current position was 8.6 years (range 0.17 to 40).

Table 52: Grade and post of responders to practitioner survey

Position in current post	**Number**	**(%)**
GP/family practice	97	(29.0)
Managerial (chief, Chief of Service, director, HMO coordinator)	21	(6.3)
Specialist (SMO, consultant, O&G specialist, GUM specialist)	94	(28.1)
Junior (HO, MO)	111	(33.2)
Academic	11	(3.3)

4.5.2 Screening related activity and formal training of providers

Practice and frequency of screening

Most responders (n= 270/329, 82%) reported taking a Pap smear at least once per month, and of these, 60% (n=163) took at least one per day. Frequency of smear taking was unrelated to duration of experience, but was related to speciality and grade (Table 53). Those in primary care generally took smears less frequently than the others.

Table 53: Frequency of smear taking by grade and specialty

	Frequency of smear taking - Number (%)			
	< 1/month	**At least 1/month**	**At least 1/week**	**At least 1/day**
GP/family practice	35 (36.5)	23 (24.0)	22 (22.9)	16 (16.7)
Managerial	3 (14.3)	2 (9.5)	2 (9.5)	14 (66.7)
Specialist	5 (5.5)	5 (5.5)	13 (14.3)	68 (74.7)
Junior	15 (13.6)	8 (7.3)	26 (23.6)	61 (55.5)
Academic	1 (9.1)	2 (18.2)	4 (36.4)	4 (36.4)
TOTAL	**59 (18.0)**	**40 (12.2)**	**67 (20.4)**	**163 (49.5)**

Data missing for 5 practitioners

Course attendance

Less than a quarter of practitioner responders (n = 79/334, 23.7%) had ever attended a course on smear taking. The likelihood of having attended a course increased with increasing number of years of experience in their current post (χ^2 for trend = 7.1, p = 0.008) [Table 54]. Responders were also more likely to have been on a course with increasing years of experience in smear taking, though the trend was not significant (χ^2 for trend =1.8, p= 0.18).

Table 54: Relationship between years of work experience and attendance at smear taking course

Years working in current post	Number (%) who had attended a course
<5	25 (17.6)
5 -	22 (27.8)
10 -	7 (17.9)
15 -	8 (34.8)
20 -	6 (35.3)
25 +	10 (38.5)
Missing data	8

Course attendance was related to the frequency of smear taking, with those who were taking smears on a weekly or more frequent basis, being more likely to have attended (Table 55). However, even among this group, only a minority (n=60, 26%) had ever attended a course.

Table 55: Relationship between frequency of smear taking and attendance at a course

Frequency of smear taking (per year)	Number (%) who have attended a course (n=76/329)
Less than one smear done per year	1 (5.3)
At least one smear done per year	6 (15.0)
At least one smear done per month	9 (22.5)
At least one smear done per week	19 (28.4)
At least one smear done per day	41 (25.2)

A higher proportion of those with a post-graduate qualification (n= 58/218, 26.6%) had attended a course, compared with those who had just their basic degree (n= 21/114, 18.4%), though the difference was not significant (χ^2=2.8, p = 0.10). The proportion who had attended a course was similar in different workplaces (n=79/334, 24%), although those working in NGO's were generally more likely (n=12/38, 32%) and those working in the HA less likely (n= 9/72,12.5%) to have done so. HMO employees were also more likely to have attended a course (n=4/8, 50%). There was no difference by gender.

Using a logistic regression model (backward LR), the most important predictors of attendance at a course were increased frequency of smear taking, increased number of years in current position, having a post basic qualification and not working in the HA obstetrics and gynaecology department. The gender of the smear taker and whether there was a charge for the service were not predictors of course attendance (Table 56).

Table 56: Results of logistic regression model for factors associated with course attendance

Variables included in LR model	**Odds ratio (95% CI)**	**Statistical significance**
Frequent smear taking (at least once / week)	2.37 (1.19 - 4.73)	0.01
Years in current position (per increasing year)	1.04 (1.00 - 1.07)	0.03
Workplace (NGO as reference)		0.016
- GP	0.84 (0.32 - 2.19)	0.73
- Private practice	0.41 (0.16 - 1.04)	0.06
- HA	0.20 (0.07 - 0.59)	<0.01
- Department of Health	0.76 (0.23 - 2.46)	0.65
Post-graduate qualification	1.71 (0.89 - 3.28)	0.10

Perceived need for further training

Perceived need for further training was inversely related to the number of years experience in taking pap smears and whether the smear taker had a post-graduate qualification. Those with 1 year or less experience were more likely to express a need for training compared with those with more experience (OR 2.97, 95% CI 1.14 - 7.76), and those with no post-graduate qualification perceived a greater need (OR 1.87, 1.13 - 3.09). Need was also significantly related to current workload (Table 57). Those who took smears less than once per week, were 2.5 times as likely to perceive a need for training, compared to more frequent smear takers (OR 2.45, 95% CI 1.47 to 4.1). There was a tendency for those who had already attended a course to perceive they need further training (OR 1.6, 95% CI 0.9 to 2.8).

Table 57: Relationship between perceived need for training and frequency of smear taking

Frequency of smear taking (per year)	**Number (%) who think they need more training**
At least 1 smear done per year	26 (44.1)
At least 1 smear done per month	13 (32.5)
At least 1 smear done per week	15 (22.4)
At least 1 smear done per day	33 (20.4)

P for trend <0.001

Need for further training was perceived most by those working in community health (n=10/14, 71.4%), followed by those working in primary care (n=58/163, 35.6%), and was seen as least necessary among those working in Obstetrics and Gynaecology (n= 18/143,12.6%). When viewed in relation to grade, those in managerial positions were more likely to perceive a need for training (n= 36/138, 26%), whilst those in academic (n=1/11, 9%) and specialist (n=12/79, 15%) posts were less likely to do so.

Using a logistic regression model (backward LR), the most important predictors of perceived need for further training were having been to a previous course, being an infrequent smear-taker, having no post graduate qualifications and working with an NGO (Table 58). Gender of the smear taker, years of experience and whether a charge was made for the service, were not predictors of perceived need.

Table 58: Results of logistic regression model of factors related to perceived need for further training

Variables included in LR model	Odds ratio (95% CI)	Statistical significance
Attendance for previous course	1.99 (1.06 - 3.71)	0.03
Infrequent smear taking (< once / week)	2.78 (1.49 - 5.21)	<0.01
No post graduate qualification	1.73 (0.97 - 3.08)	0.06
Workplace (NGO as reference)		0.063
GP	0.39 (0.16 - 0.96)	0.04
Private practice	0.39 (0.16 - 0.91)	0.03
HA	0.21 (0.07 - 0.62)	<0.01
Department of Health	0.52 (0.16 - 1.67)	0.27

Screening protocol and practices

Two thirds of responders set no age limit for who they offered a Pap smear to. Those working for the DH were more likely to have set criteria for screening, whilst those in primary care had the most diverse range of criteria (Table 59). For the majority of responders, there was no waiting time for an appointment for screening. However, 14% (mainly HA and NGOs) had waiting times of up to 3 or more months (Table 59). Overall, about two thirds of organisations offered a walk in service for screening, whereas others, particularly the HA and NGOs would only take referrals. Most allowed less than 10 minutes for a consultation for screening, whereas over 10% allowed more than 20 minutes (Table 59). Over half the providers (56.4%) reported

giving women the results of their pap smears within one week of taking it. However, about one in 12 women would have to wait over one month, with the DH providers reporting the longest waiting times.

Table 59: Screening practice by provider

	GP n=72	**Private practice n=126**	**HA O&G n=26**	**DH n=26**	**NGOs n=38**	**Total (%) n= 334**
Age range eligible						
18-64	8 (11.1)	19 (15.1)	7 (9.9)	7 (26.9)	2 (5.3)	43 (12.9)
30-64	6 (8.3)	10 (7.9)		4 (15.4)	4 (10.5)	24 (7.2)
18-70	4 (5.6)	10 (7.9)	1 (14.1)	1 (3.8)	9 (23.7)	25 (7.5)
No limit	*53 (73.6)*	*87 (69.0)*	*62 (87.3)*	1 (3.8)	*21 (55.3)*	*224 (67.3)*
Other variation	1 (1.4)		1 (14.1)	*13 (50.0)*	2 (5.3)	17 (5.1)
Missing			1			1
Average waiting time for an appointment						
None	56 (77.8)	109 (86.5)	8 (12.3)	20 (80.0)	13 (35.1)	206 (63.4)
Up to 1 week	9 (12.5)	16 (12.7)	3 (4.6)		6 (16.2)	34 (10.5)
Up to 1 month	5 (6.9)	1 (0.8)	19 (29.3)	5 (20.0)	11 (29.7)	41 (12.6)
Up to 3 months	1 (1.4)		25 (38.5)		6 (16.2)	32 (9.8)
Up to 4 months	1 (1.4)		10 (15.4)		1 (2.7)	12 (3.7)
Missing			7	1	1	9
Consultation time allocated for screening						
<=10min	17 (23.9)	37 (32.5)	*41 (80.4)*	*21 (80.4)*	*19 (57.6)*	*135 (45.9)*
11-20min	*46 (64.8)*	*60 (52.6)*	8 (15.7)	3 (12.0)	11 (33.3)	128 (43.5)
>20min	8 (11.3)	17 (14.9)	2 (3.9)	1 (4.0)	3 (9.1)	31 (10.5)
Missing	1	12	21	1	5	40
Time to receive results						
<1week	*46 (63.9)*	*110 (88.0)*	15 (22.1)	2 (8.0)	12 (31.6)	*185 (56.4)*
1-2 weeks	18 (25.0)	14 (11.2)	*34 (50.0)*	2 (8.0)	*13 (34.2)*	81 (24.7)
>2 to 4 weeks	3 (4.2)	0	13 (19.1)	6 (24.0)	12 (31.6)	34 (10.4)
>1 to 2 months	5 (6.9)	1 (.8)	6 (8.8)	*15 (60.0)*	1 (2.6)	28 (8.5)
Missing		1	4	1		6
Recommended screening interval						
Yearly	*32 (45.1)*	*91 (74.0)*	*27 (37.5)*	1 (3.8)	*14 (38.9)*	*165 (50.3)*
2 yearly	13 (18.3)	21 (17.1)	16 (22.2)	3 (11.5)	4 (11.1)	57 (17.4)
3 yearly	16 (22.5)	7 (5.7)	19 (26.4)	4 (15.4)	12 (33.3)	58 (17.7)
Yearly x 2 then every 3 years	10 (14.1)	4 (3.3)	10 (13.9)	*18 (69.2)*	6 (16.7)	48 (14.6)
Missing	1	3				4

In our telephone survey of women, the reported waiting times for results were generally similar to those reported by most providers (Table 60), though there were a few exceptions. Women tended to report longer waiting times for the HA and for the FPA (an NGO), than the respective responders to the practitioner survey. However, the practitioner survey responders were only from the obstetrics and gynaecology sector of the HA, whereas the women's reports are based on a wider range of providers from the HA (including well women's clinics). Similarly, the main NGO provider reported by women was the FPA, whereas our practitioner study included a wider range of NGO providers.

Table 60: Comparison of time taken for reporting results of screening by provider, reported by practitioners and by women (numbers and (percentages))

Time to receive results, as reported by:	**Private practice (including GP)**		**HA**		**DH**		**NGO**		**Others**	
	P	***W***	**P**	***W***	**P**	***W***	**P**	***W***	**P**	***W***
< 1 week	156 (79.2)	233 (73.7)	15 (22.1)	22 (16.7)	2 (8.0)	6 (9.7)	12 (31.6)	17 (15.5)		13 (29.5)
1-2 weeks	32 (16.2)	51 (16.1)	34 (50.0)	21 (15.9)	2 (8.0)	4 (6.5)	13 (34.2)	25 (22.7)		11 (25.0)
2-4 weeks	3 (1.5)	11 (3.5)	13 (19.1)	24 (18.2)	6 (24.0)	12 (19.4)	12 (31.6)	18 (16.4)		8 (18.2)
>1-2 months	6 (3.0)	11 (3.5)	6 (8.8)	52 (39.4)	15 (60.0)	33 (53.2)	1 (2.6)	36 (32.7)		11 (25.0)
Not sure		10 (3.2)		13 (9.8)		7 (11.3)		14 (12.7)		1 (2.3)

P = practitioners, W = women

Half of all practitioners recommend women to have yearly screening (Table 59). This was more conservative than the perception of the women responding to our telephone survey. The majority of women who had ever had a screening test (n= 608/706); (86%) thought that screening should be performed at least yearly, and only 3.3% (n=

23/706) thought that the interval should be 3 or more years (Table 61). Overall, 1% (16/1533) suggested that screening should be at least once per month (all had never been screened before). Women with no previous screening test were generally more likely to suggest a shorter screening interval.

Table 61: Women's reported optimal screening interval following a normal smear

Number (%) of women reported screening interval following a normal smear			
Screening interval	**Previously had screening**	**No previous screening**	**Total**
Less than yearly	41 (5.8)	121 (15.4)	162 (10.9)
Yearly	567 (80.3)	513 (65.3)	1080 (72.4)
2 yearly	57 (8.1)	55 (7.0)	112 (7.5)
3 yearly	16 (2.3)	18 (2.3)	34 (2.3)
5 yearly	7 (1.0)	5 (0.6)	12 (0.8)
Other / not sure	18 (2.5)	74 (9.4)	92 (6.2)
Non responders	31	258	289

Less than half of providers (n= 144/324; 44.4%) claimed to use a protocol for screening. There was little difference between organisations, apart from those working for the HA, where 92.3% (n= 24/26) reported using one. There was no relationship between the use of a protocol and the recommended screening interval.

One third of providers (n = 113) reported a policy of not routinely informing women if their smear result was negative, although all notified women when the result was positive. This was similar to the 29% (230/792) of women who reported not having been informed of their screening results. Most women in this situation had been told that they would not be informed of a negative result. The most common method of informing women was to invite them back to the clinic (Table 62). However, some

used a letter or told women by telephone. There was some discrepancy between providers' and women's reported method of getting the results of smears (Table 62). For private practitioners and the HA, providers were more likely to report not routinely notifying women, whereas more women reported having had a result from these providers. In contrast, more women tended to report not having had a result from DH providers and the FPA, compared with that reported by the providers themselves.

Table 62: Comparison of reported method for reporting negative screening results by provider, reported by practitioners and by women (numbers are percentages)

Method of informing negative result	Private practice		HA		DH		NGO		Others	
	P	**W**	**P**	**W**	**P**	**W**	**P**	**W**	**P**	**W**
By letter	2 (1.0)	4 (1.2)	1 (1.4)	11 (6.6)	1 (3.9)	8 (9.0)	9 (23.7)	21 (12.5)		8 (17.8)
By phone	63 (32.1)	171 (52.8)	-	12 (7.2)	-	6 (6.7)		12 (7.1)		2 (4.4)
In clinic	61 (31.1)	123 (38.0)	8 (11.1)	71 (42.8)	8 (30.8)	29 (32.6)	8 (21.0)	39 (23.2)		27 (60.0)
Combination / other	34 (17.3)	4 (1.2)	4 (5.6)	8 (4.8)	9 (34.6)	2 (2.2)	11 (28.9)	-		4 (8.9)
Not routinely notify	36 (18.4)	22 (6.8)	59 (81.9)	64 (38.6)	8 (30.8)	44 (49.4)	10 (26.3)	96 (57.1)		4 (8.9)

P = practitioners (10 non-responders), W = women (3 non-responders)

For positive smear results, many providers (41.3% n= 136/329) reported using a combination of letter, telephone and/ or clinic visit for informing women. One third reported inviting women back to the clinic to inform them of the results. However, almost a quarter (23.8%; n=78/329) reported telling women over the telephone, and just over 1% (n= 5/329) informed women by letter only.

Screening techniques and laboratories used

The majority of providers (n= 185/320; 57%) exclusively used the Ayre's spatula for taking smears, whilst a further 25% (n=80) used this and / or the cytobrush. There was no relationship between the sampling method used and the charge for taking a pap smear (χ^2 for trend =0.2; p=0.68). More than half of the providers (186/313; 59.7%) reported sending their smears to private laboratories for assessment. These laboratories were also most likely to use automated screening instruments for screening (Table 63).

Table 63: Type of laboratory cervical smears were sent to, and proportion of those that used automated screening methods

Laboratory type (number of providers using)	Use of automated screening instruments
Government laboratories (n = 36)	1 (2.8)
Laboratories in HA hospitals (n = 77)	18 (23.4)
Private laboratories (n = 186)	83 (44.6)
University Department of Pathology (n = 14)	6 (42.9)

Charge for cervical screening

The most frequent charge for a smear test among the provider responders was between $100 and $300 (HK). One third of providers ((111/328) had no charge, whilst 2.2% (n= 7) charged more than $500. Among women, the reported charge for screening varied considerably, ranging from the test being free (n= 164/760; 22%) to one women reporting having paid over $4000 (0.1%). The median charge was $250. Most of the women reporting screening had the test as part of a women's check up package (n= 415/793; 52.3%), or other health package (n=135, 17%) rather than as a

pap smear alone. For the women who had a cervical screening test on its own, the median charge was $131.5, with a range from zero to $1,200 (Table 64).

Table 64: Charge for cervical screening, as reported by providers and by women

PROVIDERS							WOMEN*
Charge for Pap smears	**GP**	**Private practice**	**HA O&G**	**Dept of Health**	**NGOs**	**Total (%)**	
Free	13 (18.3)	2 (1.6)	63 (91.3)	22 (84.6)	11 (28.9)	111 (33.8)	77 (31.8)
<$100	4 (5.6)	2 (1.6)	6 (8.7)	4 (14.6)	5 (13.2)	21 (6.4)	43 (17.8)
$101-300	32 (45.1)	95 (76.6)			16 (42.1)	143 (43.6)	47 (19.4)
$301-500	19 (26.8)	22 (17.7)			5 (13.2)	46 (14.0)	44 (18.2)
$501-700	2 (2.8)	2 (1.6)			1 (2.6)	5 (1.5)	19 (7.9)
$701-1000	1 (1.4)	1 (0.9)				2 (0.6)	11 (4.5)
>$1000						-	1 (0.4)

** Only women where the charge was for a cervical screening test alone are included*
Missing data for 6 practitioners

Among providers, there was a significant relationship between the charge for screening and waiting times. Those who offered the service for free were more likely to have long waiting times, over a third having a waiting time over three months. In contrast, the maximum waiting time for those charging over $500 was 1 week ($\chi^2$ for trend= 99.8; p<0.001). There was also a relationship between allocated time for screening and the charge for the service (Table 65), so that those charging more tended to spend more time with their patients (χ^2 for trend=54.5; p <0.001).

Table 65: Consultation time allowed for screening according to fee charged

Charge for Pap smear	**Number (%) of providers allowing this amount of time**			***Non-responders***
	<=10min	**11 - 20min**	**>20min**	
Free	72 (79.10)	16 (17.60)	3 (3.30)	*10*
<$100	11 (57.90)	7 (36.80)	1 (5.30)	*2*
$101-300	41 (31.10)	73 (55.30)	18 (13.60)	*11*
>$300	10 (20.40)	31 (63.30)	8 (16.30)	*4*
Non responders	*1*	*1*	*1*	

Yearly screening tended to be more commonly recommended by those who charged more for the service (χ^2 for trend= 25.7; p<0.001). Providers using private laboratories were likely to charge more for their service; 96.8% (179/185) using a private lab, compared with 4.8% (6/125) of those using other laboratories charged over $100. However there was no relationship between the charge and whether the laboratory used automated screening.

Logistic regression was used to identify factors that were related to providers charging $100 or more for a Pap smear (Table 66). After adjusting for other factors, they were more likely to charge $100 or more if the smears was sent to a private laboratory and they offered a shorter waiting time for an appointment. NGOs were more likely to charge than those working in general practice or private practice, though this was of borderline statistical significance. Those charging a high fee, were less likely to have attended a course for taking smears and there was no relationship with having a postgraduate qualification, consultation time or recommended screening interval following a smear.

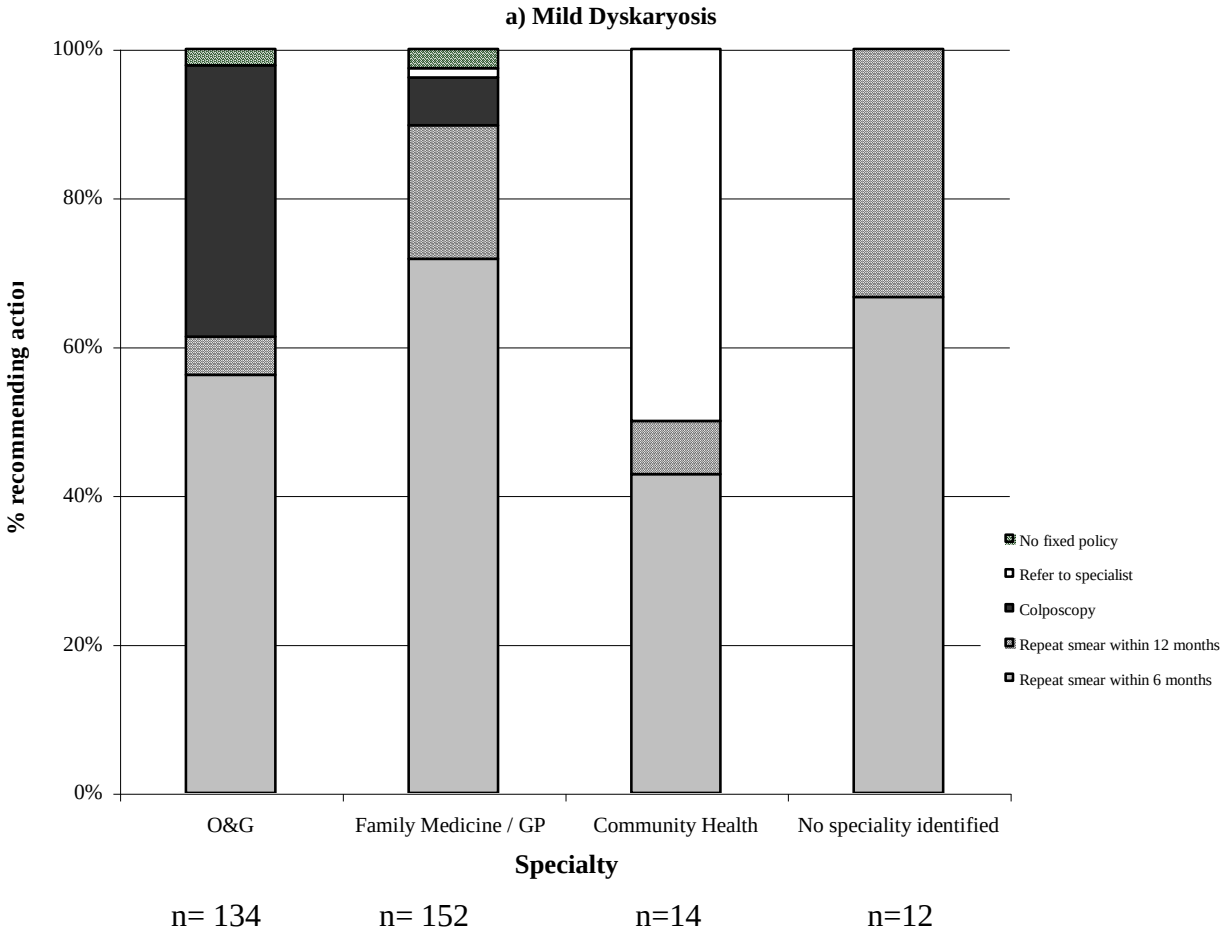
Table 66: Factors associated with providers charging over $100 for screening

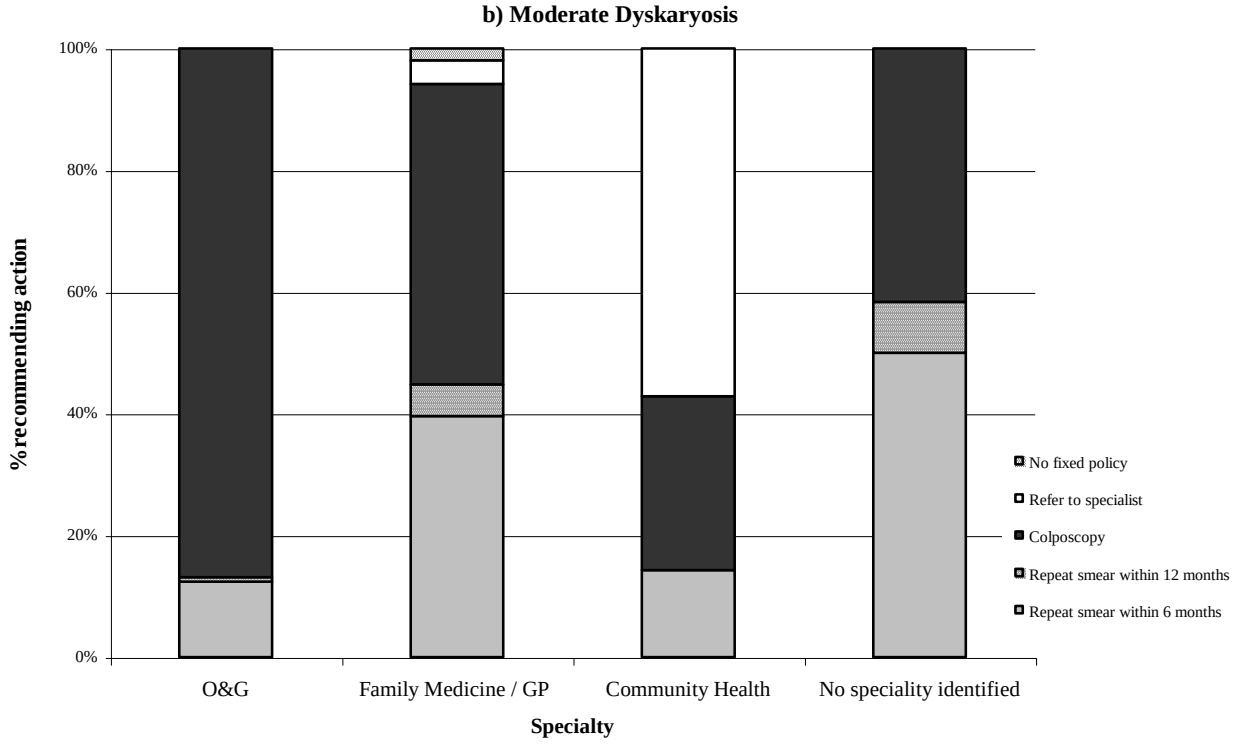
Charging $100 or more	**OR (95.0% C.I.)**	**Significance**
Private labs	1851.52 (64.90 -52824.34)	<0.001
Consultation time	0.91 (0.26 -3.19)	0.881
Waiting time for appointment	0.37 (0.15 -0.88)	0.024
Having post-graduate qualification	1.71 (0.39 - 7.49)	0.474
Attendance for pap-smear course	0.12 (0.02 - 0.67)	0.015
Workplace (NGO as reference) - General practice / private practice - Government funded (HA / DH)	 0.08 (0.01 – 1.03) 0.00 (0.00 – infinity)	 0.05 0.73
Recommend one-yearly screening	1.70 (0.71 – 4.06)	0.23

4.5.3 Management of abnormal smears

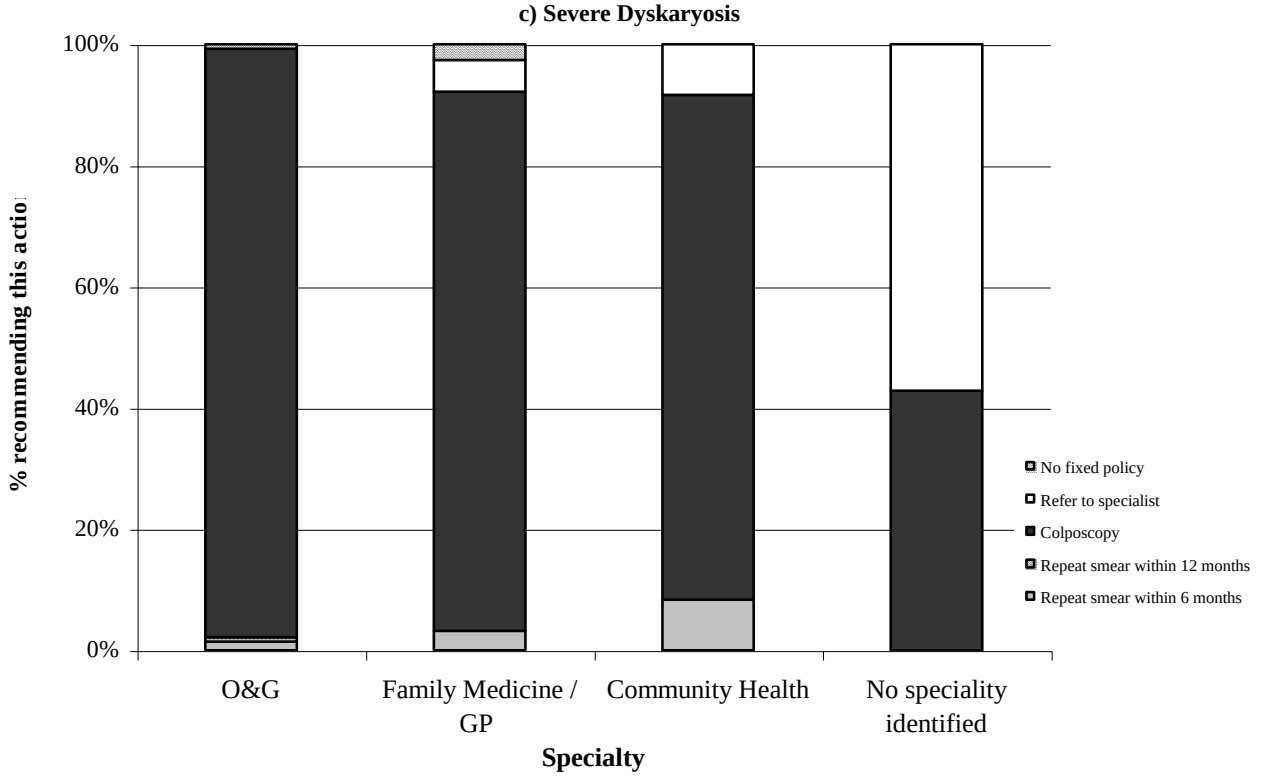
The reported management of abnormal smears was compared among providers (Figure 15 a to c). For mild dyskaryosis, the majority (n=243/312; 77.9%) of responders stated they would repeat the smear as the first step. However, over a third (n=50/134) of those specialising in obstetrics and gynaecology (O&G) would consider colposcopy at this stage; a higher proportion than those in other specialties. For moderate dyskaryosis, over two thirds of providers (n=218/314), particularly specialists in O&G (n=119/137), would recommend colposcopy. For severe dyskaryosis, a minority of providers (n=9/313; 2.9%), predominantly those not specialising in O&G, would still consider recommending a repeat smear.

Figure 15: Reported management strategy for different types of abnormal smear result, by specialty





n= 137 n= 151 n=14 n=12



n= 137 n= 150 n=14 n=12

The main difference in management was between specialists in O&G and others. For mild and moderate dyskaryosis there was a significant difference between the groups in their suggested management strategies (Table 67). In general, O&G specialists were more likely to intervene and offer more invasive tests at an earlier stage than others reported being prepared to.

Table 67: Comparison of O&G specialists with others in relation to recommendations for management of abnormal smear results

	Number (%) recommending colposcopy/ referral rather than repeat smear		
Smear result	**O&G specialist (n=143)**	**Other specialist (n=191)**	**Difference in proportions**
Mild dyskaryosis	50 (37.3)	19 (10.7)	P <0.001
Non responders	*9*	*13*	
Moderate dyskaryosis	119 (86.9)	99 (55.9)	P <0.001
Non responders	*6*	*14*	
Severe dyskaryosis	134 (97.8)	170 (96.6)	P = 0.522
Non responders	*6*	*15*	

4.5.4 Practitioners' perceptions of women's attendance for Pap smear

Barriers and factors encouraging uptake of screening

Among practitioners, the majority thought that if women had knowledge of the reason for a Pap smear (n=322/327; 98.5%), or were aware of the need for having a test (n=314/327; 96.0%), this would encourage them to attend for a test. These were also the most common reasons cited by the 1024 women interviewed, who had not previously attended for screening. Nevertheless, among this group, about a third (n=343/1024; 33.5%) did not attribute their non-attendance to lack of knowledge and a similar proportion (n=173/445; 38.9%) disagreed that they were unaware of the need for a pap smear. Practitioners tended to overestimate the role of accessibility as a factor in encouraging women to attend (Table 68). The questions are not directly

comparable, as the wording was different. However, they explore similar concepts and are grouped together for the presentation of results (see discussion).

Table 68: Comparison of practitioner and women's views on factors encouraging attendance

Factors affecting attendance	Number/total responding to question (%)		
	Practitioners who perceive this would encourage attendance	Women who disagree with this being a reason for non-attendance*	Women who agree this is reason for non-attendance*
Knowledge of reason for smear	322/327 (98.5)	343/1024 (33.5)	661/1024 (64.6)
Awareness of need for the test	314/327 (96.0)	173/445 (38.9)	250/445 (56.2)
Convenience of access to clinic	288/325 (88.6)	237/436 (54.4)	176/436 (40.4)

*Women who had not attended for screening before. Those who did not know what a smear test is, were excluded from the remaining questions regarding reasons for non-attendance. Hence the smaller denominator for the remaining questions.

Practitioners generally recognised anxiety, pain, embarrassment and other medical problems as being important barriers to attendance, although fewer women perceived them as barriers compared with practitioners (Table 69). Practitioners tended to underestimate the discouraging effects of time needed for the test and the anxiety related to getting the results, as barriers.

Table 69: Comparison of practitioner and women's views on factors discouraging attendance

Factors affecting attendance	Practitioners who perceive this would discourage attendance	Women who agree with this being a reason for non-attendance*
Anxiety associated with the test	216/322 (67.1)	178/435 (40.9)
Embarrassment/ humiliation associated with test	251/323 (77.7)	71/436 (16.3)
Pain associated with the test	211/322 (65.5)	174/436 (39.9)
Medical problems preventing attendance	135/316 (42.7)	43/434 (9.9)
Cost of the test	151/324 (46.6)	204/436 (46.8)
Time needed for the test	92/322 (28.6)	149/434 (34.3)
Anxiety related to test results	14/318 (4.4)	116/436 (26.6)

**Women who did not know what the smear test was were not asked the other questions. Therefore the denominator is smaller for remaining reasons for non-attendance*

When comparing women's stated *main* barriers to attending for screening with the perceptions of practitioners, they agreed on the major barriers being lack of knowledge about the test and unawareness of the need for the test. However there were differences in perception between practitioners and women in the importance of other barriers. The results are not directly comparable, because in the women's survey, only one main reason for non-attendance was taken, whereas practitioners could give several reasons, and 30% (77 individuals) did so (Table 70). Overall, very few women perceived anxiety, embarrassment or pain associated with the test as barriers to attendance, whereas relatively more practitioners thought these discourage women. Relatively more patients than practitioners felt that time needed for a test, and fear of what the results would show, to be important barriers.

Table 70: Comparison of women and practitioners' views of the main reasons for non-attendance at screening

Main reason for not having a test before	**Practitioner (1)**	**Practitioner (2)**	**Women**
Knowledge of reason for Pap smear	131 (39.9)	131 (43.0)	340 (33.8)
Awareness of need for the test	152 (46.3)	95 (31.1)	446 (44.3)
Convenience of access to clinic	14 (4.3)	7 (2.3)	42 (4.2)
Anxiety associated with the test	26 (7.9)	13 (4.3)	8 (0.8)
Embarrassment/ humiliation associated with test	43 (13.1)	30 (9.8)	2 (0.2)
Pain associated with the test	11 (3.3)	6 (2.0)	4 (0.4)
Cost of the test	18 (5.5)	11 (3.6)	31 (3.1)
Time needed for the test	13 (3.9)	9 (3.0)	81 (8.0)
Other medical problems preventing attendance	1 (0.3)	0	9 (0.9)
Anxiety related to test results	2 (0.6)	0	17 (1.7)
Other	8 (2.4)	2 (0.7)	5 (0.5)

Practitioner (1) = all reasons included - % implies proportion who gave this as a reason
Practitioner (2) = only first reason given is included - % in column adds up to 100%

In addition, two thirds of practitioners (n= 216/321; 67.3%) felt that having a female practitioner taking a smear would be encouraging, and 58.5%, (n=189/323) that having a male practitioner would be discouraging for attendance. They also believed that women would prefer the screener to be a doctor. In general, these perceptions were in agreement with women's stated preferences. However, women, particularly those who had never been screened, were more likely to be neutral in their preference for type of professional than practitioners expected (Table 71). Women who had previously been screened were significantly more likely to state that they wanted their screener to be a doctor.

Table 71: Comparison of practitioner perceptions and women's stated preferences for screener

Preferred screener	**Number (%)**			**Difference between screened and unscreened**	
	Practitioners perception (n=334)	**Women's preference**			
		Never screened (n=1098)	**Previously screened (n=742)**	**χ2 (p value)**	**Total**
Gender	*NR=11*	*NR=25*	*NR=10*	5.32 (0.07)	
Male	1 (0.3)	6 (0.6)	10 (1.4)		16 (0.9)
Female	243 (75.2)	647 (62.6)	473 (64.6)		1120 (63.5)
No preference	79 (24.5)	380 (36.8)	249 (34.0)		629 (35.6)
Profession	*NR=10*	*NR=25*	*NR=9*	52.50 (p<0.001)	
Doctor	282 (87.0)	659 (63.7)	589 (80.4)		1248 (70.6)
Nurse	5 (1.5)	97 (9.4)	40 (5.5)		137 (7.7)
No preference	37 (11.4)	279 (27.0)	104 (14.2)		383 (21.7)
		NR=26	*NR=11*		
Familiar person		176 (17.5)	128 (17.5)	3.77 (0.15)	304 (17.5)
Not familiar		356 (35.4)	289 (39.6)		645 (37.1)
No preference		479 (47.2)	313 (42.9)		788 (45.4)

NR= non-responders

Perceived accessibility of screening services

Practitioners were asked to rank their perceived accessibility and "user friendliness" of different types of clinic that offer women screening (scale of 1 = most and 5 = least favoured). On the whole, practitioners rated their own workplaces as most accessible. However, public hospitals had the lowest overall rating and were ranked lowest by all groups (Table 72). For all practitioners combined, the HK FPA was rated as most accessible, followed by general practice, maternal and child health clinics and well woman clinics.

Table 72: Practitioners' ranking of screening clinics in terms of perceived accessibility for women

Workplace of responder	Mean Rank for screening clinics (lower rank = more accessible)				
	Public Hospitals	**MCHC**	**WWC**	**HK FPA**	**GP / private practice**
General practice/ private practice (n=198)	4.65	2.99	2.86	2.17	**1.85**
HA (O&G) (n=72)	4.15	**2.06**	3.36	2.15	2.76
Dept Health (n=26)	4.60	**1.44**	3.72	2.12	2.80
NGO (n=38)	4.15	2.50	2.72	**1.64**	2.72
Total	4.47	2.56	3.06	**2.10**	2.24

MCHC = maternal and child health clinic, WWC = well women's clinic, HKFPA = Hong Kong Family Planning Association

Most practitioners reported that the cost of the service is an influential factor in women's choice of service provider. Providers charging less than $100 for their service (n=105/130; 80.8%) were more likely to feel this was an important factor compared with those charging more (n=145/187; 77.5%), but the difference was not statistically significant (χ^2=0.48; p=0.49).

In terms of being "user friendly", however, almost all groups rated general and private practice with the highest score. The only exception was the Department of Health responders, who rated the MCHC as best. Overall public hospitals were rated as worst, followed by Maternal and Child Health Clinics (MCHC), Well Women's Clinics (WWC) and the Hong Kong Family Planning Association (HKFPA) (Table 73).

Table 73: Practitioners' ranking of clinics in terms of perceived 'user-friendliness' for women

Workplace of responder	Mean Rank for screening clinics (lower rank = more user-friendly)				
	Public Hospitals	**MCHC**	**WWC**	**HK FPA**	**GP / private practice**
General practice/ private practice (n=198)	4.67	3.27	2.63	2.48	**1.56**
HA (O&G) (n=72)	4.35	2.82	2.65	2.51	**2.16**
Dept Health (n=26)	4.57	**1.88**	3.17	2.58	2.46
NGO (n=38)	4.38	2.80	2.35	2.40	**2.04**
Total	4.55	2.97	2.66	2.49	**1.84**

MCHC = maternal and child health clinic, WWC = well women's clinic, HKFPA = Hong Kong Family Planning Association

The results were compared with women's responses in the telephone survey, about where they would prefer to have a screening test. The preferred place for screening, overall, was a public hospital, followed by a private practitioner (Table 74). Women who had previously had a screening test tended to prefer the provider they had already attended. The main exception was women who had attended the Department of Health (DH) clinics. Only 36% of these women mentioned these clinics as their choice provider. The majority of women who had previously been screened had attended a private practitioner, and the largest single provider was the FPA. However, overall, women rated private practice as their preferred location, followed by a public hospital, with the FPA being the 3rd preferred provider.

Table 74: Women's stated preference for screening provider, according to place of last screening

		Number (%) of women mentioning this as their preferred provider						
		Public Hospitals	**MCHC**	**WWC**	**HK FPA**	**GP / private**	**Other**	**No preference**
Provider for last screening test	GP/ private practice (n=316)	56 (17.7)	2 (0.6)	9 (2.8)	14 (4.4)	**230 (72.8)**	2 (0.6)	3 (0.9)
	HA (n=137)	**88 (64.2)**	6 (4.4)	3 (2.2)	13 (9.5)	17 (12.4)	5 (3.6)	5 (3.6)
	DH WWC or FPC (n=47)	15 (31.9)	4 (8.5)	**17 (36.2)**	3 (6.4)	7 (14.9)	-	1 (2.1)
	FPA (n=165)	43 (26.1)	6 (3.6)	7 (4.2)	**82 (49.7)**	21 (12.7)	3 (1.8)	3 (1.8)
	MCHC (n=65)	20 (30.8)	**28 (43.1)**	2 (3.1)	2 (3.1)	12 (18.5)	-	1 (1.5)
	Other (n=43)	**24 (55.8)**	-	2 (4.6)	4 (9.3)	8 (18.6)	3 (7.0)	2 (4.6)
	Total for ever screened (n=720)	221 (30.7)	44 (6.1)	37 (5.1)	111 (15.4)	**282 (39.2)**	11 (1.5)	14 (1.9)
	Never screened (n=992)	**512 (51.6)**	40 (4.0)	54 (5.4)	103 (10.4)	195 (19.7)	13 (1.3)	75 (7.6)
	Total (n=1712)	**733 (42.8)**	84 (4.9)	91 (5.3)	214 (12.5)	477 (27.9)	24 (1.4)	89 (5.2)

MCHC = maternal and child health clinic, WWC = well women's clinic, HKFPA = Hong Kong Family Planning Association, DH = Department of Health, FPC = Family planning clinic

Action to reduce risk of cervical cancer

Practitioners were asked whether a range of behaviours, in their opinion, could reduce the risk of cervical cancer. These were compared with women's perceptions of factors that would reduce risk. In the women's survey, this was an open-ended question and only 18% (n= 320) of women suggested any activities that they believed would reduce risk (Table 75).

Table 75: Protective behaviours mentioned by women and proportion of practitioners who believe these behaviours would reduce risk of cervical cancer

	Number (%) who believe/ mention this	
	Practitioners (n=334)	**Women (n=320)**
Behaviours where there is reasonable evidence for protection against cervical cancer		
Reduce number of sexual partners	249 (74.6)	61 (19.4)
Reduce smoking	168 (50.3)	18 (5.7)
Use condom	232 (69.5)	7 (2.2)
Medical advice on disease and prevention	195 (58.4)	30 (9.5)
Behaviours where there is no good evidence for protection against cervical cancer		
Reduce intake of carcinogenic food	84 (25.1)	23 (7.3)
More exercise / personal hygiene & diet	37 (11.1)	202 (64.1)
Reduce stress	48 (14.4)	
Reduce alcohol intake	24 (7.4)	8 (2.5)
Take Chinese medicines	15 (4.5)	7 (2.2)
Others	8 (2.4)	36 (11.4)

Among factors where there is some evidence of benefit, only three quarters of all practitioners thought that reducing the number of sexual partners would be effective, and over two thirds (69.5%) recommended the use of condoms. Half thought smoking reduction was useful and 58.4% thought that seeking medical advice to understand more about the disease would be beneficial. In addition, practitioners thought that many other factors, where there is no clear research evidence of benefit, would be useful for reducing risk. These included diet, exercise and use of Chinese medicines. Among women, the most commonly mentioned activity was doing more exercise and paying attention to personal hygiene. Reducing the number of sexual partners was mentioned by 19% of those responding to this section, and only 5.7% mentioned smoking as a risk factor (almost exclusively non-smokers).

4.6 Discussion

Hong Kong has a mixed medical economy and in the absence of any centralised screening programme, there was previously no comprehensive documentation of the range and type of services provided for cervical screening. This is the first study to describe the diversity of providers and to explore the variation in the way screening is administered and provided.

There is great variation in the way that cervical screening is currently provided, both between different organisations, and within specific provider groups. There is no consensus on who should be offered screening, the recommended screening interval, administrative arrangements (waiting times, charge, method of informing women of results) or on how to deal with abnormal smears. One of the features of organised screening programmes is the agreement of guidelines related to these issues.

4.6.1 Providers of screening services

Responders to the practitioner survey were almost exclusively doctors. This may be because the study failed to access non-medical screeners. However, the findings agree with anecdotal evidence that non-medical personnel are rarely involved in cervical screening in Hong Kong. In other countries, nurses have a greater role in smear taking in primary care[250]. In Birmingham, UK (see chapter 6), 61% of smear takers were nurses, and in Sweden, nurse-midwives have responsibility for smear taking in primary care[251]. There is some evidence that involvement of nurses in smear taking reduces the cost of the service[252; 253]. Nurses can be successfully trained to take cervical smears and their performance is at least as good as doctors in this respect[253; 254].

However, having the doctor as the smear taker seems to be important for attendance for some women. A trial in the UK which compared different invitation letters for screening, found that those signed by a doctor resulted in significantly higher attendance, than those signed by non-medical personnel[255]. We found that although the majority of women did state a preference for a doctor to take smears, those who had no prior experience of the system were more likely to accept a nurse. Thus the stated preference is likely to be partly influenced by current practice. Also, practitioners underestimated women's acceptance of a non-medical practitioner taking smears. Almost all women, whether they had previously been screened or not, preferred a woman as smear taker, and most (>80%) preferred not to know the practitioner. Therefore it would seem that having a nurse practitioner taking smears would be socially acceptable for at least a proportion of women. Other studies have examined women's preference for providers of cervical screening. As in the study, most suggested that women prefer a female smear taker[244; 256]. Non-availability of a female smear-taker has been shown to be one of the reasons for non-attendance for screening among women[242]. A survey of 500 women belonging to a Health Maintenance Organisation in the USA found that over half had no preference for the gender of the clinician taking smears, and almost half was happy to see an unfamiliar clinician[257]. In that study, about three quarters of women also were happy to see a nurse practitioner rather than a doctor. A much smaller study in the UK, found that the most popular choice of health professional for taking the test was a nurse[258].

4.6.2 Cervical screening practice

The age range for which screening is provided in Hong Kong varies according to provider. Whilst most of the private providers have no age limit, most of the government funded providers do set a limit. In regions with organised screening

programmes, the target group for screening and recommended screening interval is usually defined. However, there is no consensus on these issues. The age at which screening is recommended to start varies, from 18[259], 20, 23, 25 through to 30 years[260] in most developed countries. In general, international experts suggest that screening should start at around 30 – 35 years of age[261]. Although most guidelines recommend a screening interval of 3 years, this also varies between countries, from one yearly through to 5-yearly[260]. The most common screening interval recommended by practitioners in our study was yearly, and fewer than 5% of women thought that a screening interval of 3 years or longer was appropriate. This has implications for costs and resource use, as well as for increasing anxiety generated as a result of abnormal tests.

4.6.3 Management of abnormal smears

According to the recommendations from the NHS cervical screening programme[262], patients with their first occurrence of mild dyskaryosis should be managed with a repeat smear within 6 months. Anyone with moderate or severe dyskaryosis, or with mild dyskaryosis on repeat smear, should be referred and have colposcopy. The Canadian National Workshop on cervical screening provided the same recommendation for management[259]. A consensus conference of international experts in the field, held in 1999, also considered management and concluded with similar recommendations[261]. The question used in the study did not make it clear that the test results referred to a woman having a first abnormal Pap smear, though this was inferred. From the survey, O&G specialists are likely to manage patients more invasively than the current guidelines recommend, whilst other specialists are likely to be too conservative and not refer women when it would be advisable to do so. In one study in the US, researchers examined women's own preferences for the management

of mildly abnormal smears. Among the 136 women with first mildly abnormal smear result, the majority preferred an active management strategy (colposcopy and biopsy) rather than a passive approach (repeat smear)[263].

4.6.4 Comparison of practitioners and women's perceptions of factors influencing screening uptake

Both women and practitioners cited lack of knowledge or awareness of the need for screening as reasons for non-attendance. These have also been shown to be major barriers in other studies [192; 220; 221]. However, it was found that over a third of women who had not attended for screening did not attribute this to either of these factors. The questions asked to women and to practitioners were worded slightly differently, though they explored the same themes. Women were asked whether they agreed or disagreed with certain statements related to screening, whereas providers were asked whether they believed each of the factors would encourage or discourage women from attending. In terms of planning and encouraging uptake, it is therefore important for providers to recognise all potential barriers cited by women. Practitioners were generally aware of the role of negative emotional factors, such as anxiety, embarrassment and pain associated with the test, in deterring women. However, over half did not recognise perceived high cost, lack of time and anxiety related to the results as barriers. In relation to the main reason for non-attendance, practitioners overestimated the role of anxiety related to the test, embarrassment and pain as deterrents. On the other hand, they tended to underestimate the importance of anxiety related to test results and the time needed to attend for a test as barriers.

Few studies have previously examined practitioners' views of perceived barriers to cervical screening and compared these with women's views. One such study in South Africa, found that health workers tended to identify structural problems, such as a

busy clinic and accessibility as major barriers, whilst women mainly emphasised the screening procedure and their understanding of it as barriers[264]. Another study, used focus group methodology, to explore perceived barriers among 520 health care personnel in the USA[265]. The main barriers perceived by these professionals included structural factors (cost, transport, child care, time) emotional factors associated with the test (fear, discomfort, embarrassment) and women's lack of awareness of the need for the test.

It was found that most women who had previously been screened, and a high proportion of practitioners, believed primary care practices to be an appropriate setting for screening. Other studies also confirmed this finding[230], although a hospital setting has also been shown to be acceptable[266].

4.6.5 Knowledge and beliefs about actions to reduce cervical cancer incidence

Almost three quarters of all practitioners and one in five women responders recognised the importance of sexual activity as a risk factor for cervical cancer. However, relatively few recognised smoking as a risk factor, including half the practitioners. On the other hand, both practitioners and women mentioned several other general health protective measures that are not necessarily related to cervical cancer risk, as means of reducing an individual's cervical cancer risk. In particular, a quarter of practitioners mentioned diet, and almost two thirds of women and a quarter of the practitioners mentioned exercise and stress reduction.

Few studies have previously examined beliefs about cervical cancer risk factors. A survey of 72 women in the UK, using a mixture of open and closed ended questions, showed that women were aware of sexual activity as a risk factor, particularly among younger women[258]. There is no clear agreement on dietary risk factors for cervical

cancer. Some studies have suggested low folate as a risk factor, though the evidence remains uncertain for this cancer[267]. A high level of serum carotenoids[83; 268; 269] and vitamin C levels[83] have been shown to be associated with a lower risk of cervical lesions in some studies, suggesting that fruit and vegetable consumption may be protective. Another case control study showed that high dietary intake of green-yellow vegetables was associated with lower rates of cervical cancer, particularly among older women [270]. However, these findings are not confirmed in other studies[89]. Exercise and stress reduction are considered to be avoidable risk factors for cancer in general, though not specific to cervical cancer[271]. Alcohol consumption, similarly, has not been shown to be a risk factor for cervical cancer[270; 272].

4.7 Conclusions and implications

There is much diversity in the way that cervical screening services are provided in Hong Kong. The lack of central co-ordination and uniform guidelines are apparent from the variability in how often, to whom and how screening is offered, both within and between types of service providers. There is also no clear consensus on how abnormal smears should be managed. There is some agreement between practitioners and women on what the main barriers and promoters of screening are. Nevertheless, practitioners need to be more sensitive to the economic and time constraints related to screening attendance, and the anxiety related to screening results.

Practitioners play an important role in encouraging screening uptake, and should play an active part in promoting appropriate screening. An organised screening programme would require consensus to be formed among providers for some of the above issues, and for a more consistent message to be given to women regarding health behaviours to prevent cervical cancer, and how often they should attend for screening.

5 MONITORING THE NHS CERVICAL SCREENING PROGRAMME – AN EXPLORATORY INVESTIGATION, USING INADEQUATE SMEAR RATES AS AN EXAMPLE OF A QUALITY INDICATOR

5.1 Summary

The aim of this study was to demonstrate the use of statistical process control in monitoring, using inadequate smear rates as an indicator of quality.

Methods

Routine data on inadequate smear rates by general practice were obtained for a 15-month period for Birmingham. For each practice, the quarterly rates were plotted using control charts, and these rates compared with the average from all practices. Practices with persistently high or persistently low inadequate rates were identified and contacted. A telephone interview was conducted with the practice staff in charge of cervical screening in each of these practices. They were asked about the characteristics of smear takers in the practice, including the average number of smears taken by each smear-taker and their training, their use of protocols or guidelines and the laboratory used by the practice. Practices with higher rates were compared with those with lower rates to identify any factors that may be contributing to the observed variation.

Results

Information on inadequate smear rates was available for 237 practices, of which 29 had persistently low and 8 persistently high rates. The only significant difference between the two type of practice was the laboratories they used for analysing smears, suggesting that most of the variation was due to differences in laboratory

interpretation. In addition, there was some evidence that practices with higher volume smear takers, those where staff had attended for training and where protocols were used, were more likely to have lower inadequate rates.

Conclusions

The study demonstrates an efficient and useful method of monitoring quality, as a basis for quality improvement. Further research is needed to see whether adoption of the strategies identified in this study by all practices would result in quality improvement.

5.2 Introduction

The success of a screening programme in reducing the incidence and mortality from cervical cancer depends on several factors. In previous chapters, the importance of identifying the target population, ensuring high coverage and selecting an appropriate screening interval were emphasised and discussed. However, as reviewed in chapter 1, the organisation of the programme and implementation of quality control measures also contribute to the effectiveness and success of the programme. These include ensuring competency of smear takers, having a system for ensuring compliance with, and adequate provision for, follow-up and treatment, and quality assurance systems within cytology laboratories. An integral aspect of quality control is measurement and monitoring. The European Commission developed a set of guidelines for quality assurance in cervical cancer screening, which consider all the issues mentioned above[273]. These guidelines list parameters to be measured for monitoring and suggest targets for programmes. One of the short term measures for monitoring described in the guidelines, is the proportion of smears that are inadequate. These are cytology smears that are of poor quality and cannot be used by the pathologist. This chapter, will review the methods and principles of quality control and quality improvement, focusing on one particular technique; statistical process control (SPC), and will demonstrate the use of SPC, by applying it to monitoring of inadequate smear rates among different GP practices in Birmingham, UK.

5.2.1 Implications of inadequate smears

Inadequate smears are important for several reasons. Given that they are sometimes related to underlying pathology, their misinterpretation can contribute to false negative results [274-276]. A study in one region in the UK, estimated that 18% of deaths

due to cervical cancer were attributed to inadequate smears[277]. Another audit of deaths from cervical cancer over a 2-year period in a district in England, found that 8% of such deaths were related to women with previously inadequate smears[278]. On the other hand, the majority (over three quarters) of women with persistently inadequate smears have a normal outcome at colposcopy[279; 280]. In the UK, women with 3 consecutive inadequate smears are recommended for referral to colposcopy. Around three per 1,000 women screened fall into this category[279], and there is some evidence that the proportion of inadequate smears is increasing[280]. Therefore minimising the rates could contribute substantially to reducing unnecessary colposcopy. This would prevent needless anxiety and inconvenience for the women involved and avoid excessive waste of NHS resources[281].

5.2.2 Inadequate smear rates as a measure of quality within the NHS

Within the NHS cervical screening programme (NHSCSP), national quality assurance guidelines were published in 1996[282]. One aspect of quality assurance is the competency of the smear taker and of the laboratory that evaluates the smear. Several other authorities recommend audit of inadequate smear rates as a quality control measure of smear takers' competence[273; 283; 284]. Inadequate smear rates have also been suggested, and used as a performance indicator for general practice[285]. The NHSCSP has advised an indicative range for inadequate smears of 7.0± 2.0%[262; 286]. The system of quality assurance is co-ordinated and led regionally, and until recently, monitoring of the programme was done at health authority level.

Inadequate smear rates, like other indicators of performance at health authority level, are determined by the combined performance of individual units where smears are

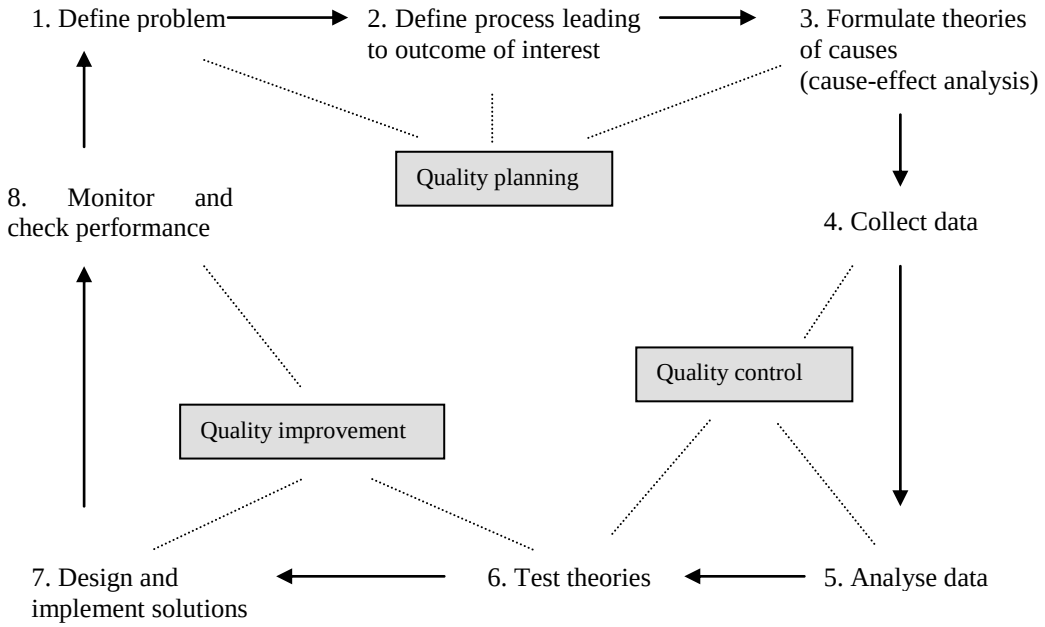
taken. Quality control requires standardisation of procedures at all units, so that performance monitoring and review should be carried out at this level.

In the UK, the government outlined a three-part approach to quality improvement for health services, in a document called "First class service", published in 1998[287]. Monitoring and performance assessment are central to this. Consequently, the government publish annual data on all hospital trusts, based on agreed measures of quality. The aim of this exercise was to ensure that "where there are large and unexplained variations in performance, every effort is made to find out why, and work is put in train to bring about an early improvement."[288] The traditional approach to identifying such variation has been through use of league tables. However, this approach has been met with much criticism and resistance, in part, justifiably[289]. League tables produce a static snapshot of performance, and ranking of individual units is mainly by chance. They contribute to a blame culture, focusing on apparent poor performers, rather than taking a systems approach to quality improvement. The method is often seen as a way of allocating rewards and punishment. An alternative approach to monitoring quality, derived from industrial quality management science is the use of statistical process control and control charts[289].

5.2.3 Quality improvement methods and principles

Continuous quality improvement techniques, mainly derived from industry, are increasingly being applied to health care[290-292]. These techniques, often referred to as total quality management (TQM), are derived from a range of disciplines, including statistics, engineering and psychology[292]. Quality improvement models typically use a problem solving approach, such as the one in Figure 16.

Figure 16: Example of quality improvement model



Adapted from Plsek[292]

These models are based on the work of the statistician Deming and management scientists such as Shewhart and Juran. Juran, a leading expert in the field of quality[292], likened the steps in industrial quality improvement to the scientific method of clinical decision-making. He used terms such as "diagnostic journey" and "remedial journey" to describe steps 4 to 6, and 7 respectively, in Figure 16. Measurement of performance is an integral part of the quality management sciences. Measurement provides the feedback loop to allow performance to be maintained at a set level (quality control and assurance) and signals the need for change (quality improvement) [292].

5.2.4 Use of statistical process control for quality improvement

Statistical process control (SPC) was developed in the 1920s as a way of reducing defects in the process of manufacturing telephones [293]. It is a methodology using basic graphical and statistical tools to analyse, control and reduce variation within a process. This technique has been used to monitor process improvement in industry for

many years, and more recently is being applied to health care[294; 295]. It is based on the recognition that the outputs of even the most perfectly tuned production system inevitably show some variation. This means that even under ideal conditions, similar providers (e.g. practices, or individual nurses) will never match each other's performance exactly, or indeed their own performance from one month to the next.

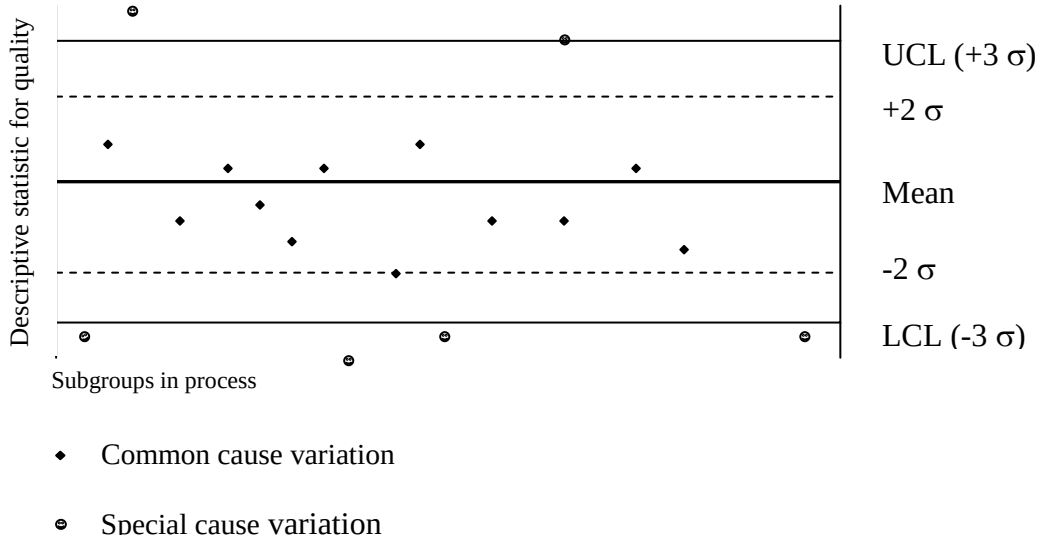
The purpose of any monitoring system is to sort out "signals" from background "noise". In industry, it has long been known that most of the variation detected by a monitoring system results from "common causes", which accounts for the noise in a stable system. These are factors that are an inherent part of any system or process, and affect everyone working in the system at all times. Changing the system cannot reduce the noise and must be avoided if the system is to remain stable[296]. On the other hand, some of the variation in a system results in a "signal" that a "special cause" is operating and its cause should be sought. These causes are not part of the process all of the time or do not affect everyone, but arise because of specific circumstances. Thus the cycle of quality improvement includes stabilisation of the process by identification and elimination of special causes, and then active improvement of the process by tackling the common causes of variation.

5.2.5 Control charts

One of the tools used in SPC is the control chart. This simple graphical method allows us to distinguish between the two sources of variation[297]. The technique allows performance data to be plotted, and for statistically derived upper and lower limits of common cause variation to be shown as control limits. Several different types of control chart are available, depending on the data collected. In general, a control chart consists of at least 5 lines (Figure 17), including the mean line, and lines indicating 2

and 3 standard deviations (sigma, σ) above and below the mean line. The lines 3-σ above and 3-σ below the mean are called the upper and lower control limits (UCL and LCL) respectively.

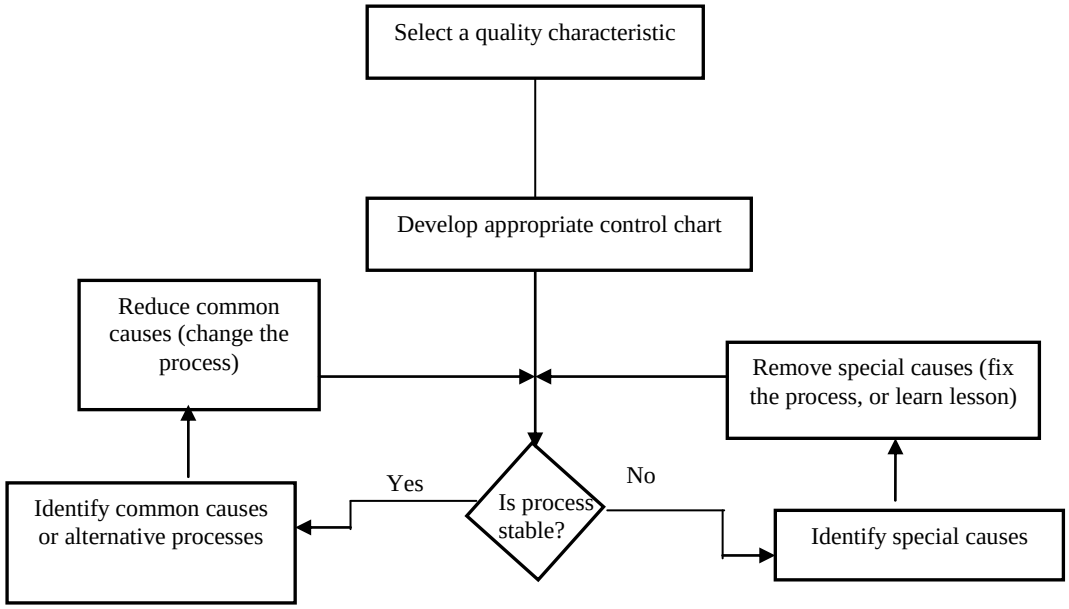
Figure 17: Basic structure of a control chart



In a stable system, all performance measures would be expected to fall within the 3σ control limits. Thus variation that falls within these limits (◆ in Figure 17) is due to common causes. Any unit with a performance measure outside of these limits (⊗ in Figure 17) is demonstrating special cause variation. Such units act as signals of adverse or positive factors that may be contributing to process variation and thus influencing the process outcome. When all special causes have been identified and addressed, the system will move to stability. In this state, the only way to improve performance is to make a fundamental change to the system (Figure 18). Lessons learnt from units showing special cause variation may sometimes be applied to all other units, allowing the whole system to improve. This systems approach to quality improvement, by reducing variation in quality, avoids focusing on individual

components (e.g. individual hospitals, or clinicians), instead encouraging quality improvement across all units.

Figure 18: Approach to quality improvement using control charts



(Adapted from Nolan et al[298])

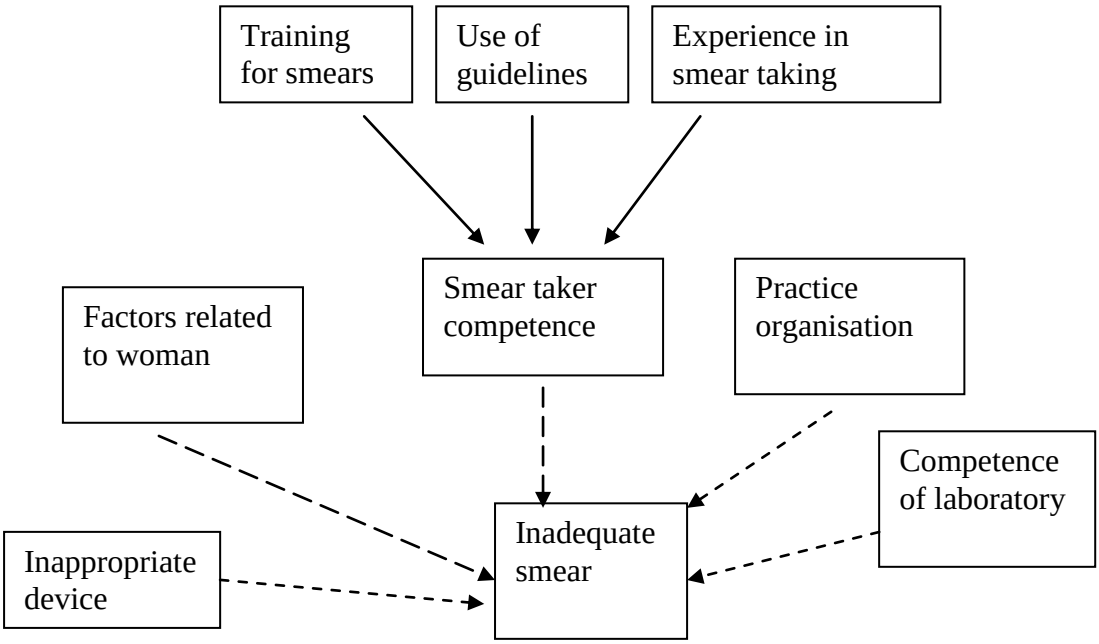
5.2.6 Inadequate smears as a process

A process can be defined as a set of causes and conditions that repeatedly come together to transform inputs into outcomes[298]. The inputs may include people, information or materials. Smear taking can therefore be seen as a process, an outcome of which may be an inadequate result; an outcome we want to minimise. To obtain a cytology smear competently, the smear taker must ensure that the cervix is fully visualised and that sampling includes the whole of the area called the transformation zone[299]. Inadequate smears may be attributed to poor smear-taker technique, for example by inadequate sampling of material, incompetence in spreading or fixation of the smear on a glass slide, or inadequate storage and transfer of specimens[280]. Around half to 70% of inadequate smears are attributable to the smear taker[279]. In this case, inadequate smear rates can be a useful outcome measure of clinicians' competence

and technique[299] and used for quality improvement purposes. Other reasons for inadequate smears include excess red or white blood cells in the sample, which may be due to cervical pathology (infection or malignancy) [280] or physiological changes, such as cervical atrophy, pregnancy or use of the oral contraceptive pill[273]. The laboratory is also an important potential source of inadequate smear reports. Interpretation of smear inadequacy is subjective, and varies from laboratory to laboratory[300; 301].

The process contributing to inadequate smears therefore includes characteristics of the woman's cervix, the ability and technique of the smear taker, the organisation within the practice to store and transfer slides and the policies and practices of the laboratory that analyses them (Figure 19).

Figure 19: The process of smear taking in relation to inadequate results



5.2.7 Application of SPC to this study:

In this study control charts were used to measure inadequate smear rates among GP practices in Birmingham, to see if all practices were performing within expected control limits. A priori, would have been to expect all GP practices to be part of the same system, as components of the NHS cervical screening programme. All were NHS practices and had the same regional co-ordinator for screening. Practice remuneration for screening is under the same scheme and the same group of NHS laboratories, with prescribed quality assurance methods and guideline. There are national guidelines for cervical screening and a number of approved training programmes. Nevertheless, from a review of the literature, several steps in the process of smear taking can contribute to inadequate smears, not all of which are likely to be strictly controlled. Therefore it was sought to identify any practices with performance indicating a special cause. The aim was to formulate hypotheses about causal factors contributing to unusually lower or higher inadequate smear rates. In the quality control model shown in Figure 16, this study follows steps 2 through to 6.

5.3 Aims and objectives:

The questions addressed by this study were:

1) Are all GP practices in Birmingham that performed cervical screening part of a system that is in statistical control, in relation to inadequate smear rates?
2) Are there any practices where a special cause may be operating, leading to unusually high or low inadequate rates?
3) What steps and procedures in the process of smear taking within practices may be contributing to special cause variations in inadequate smear rates?

4) Is there any evidence to support differences in practice procedures contributing to any observed variation?

This study demonstrates the use of control charts in measurement and data analysis, and discusses how the information obtained can be used for quality improvement.

5.4 Methods:

Routinely published data was obtained on screening within all 238 GP practices in the Birmingham area from the Birmingham Health Authority database. Control charts were then used to identify practices whose performance indicated special cause variation. All these practices were contacted and interviewed, using a structured questionnaire. External factors were sought to be identified that may have contributed to special cause variation.

5.4.1 Inadequate smear rates

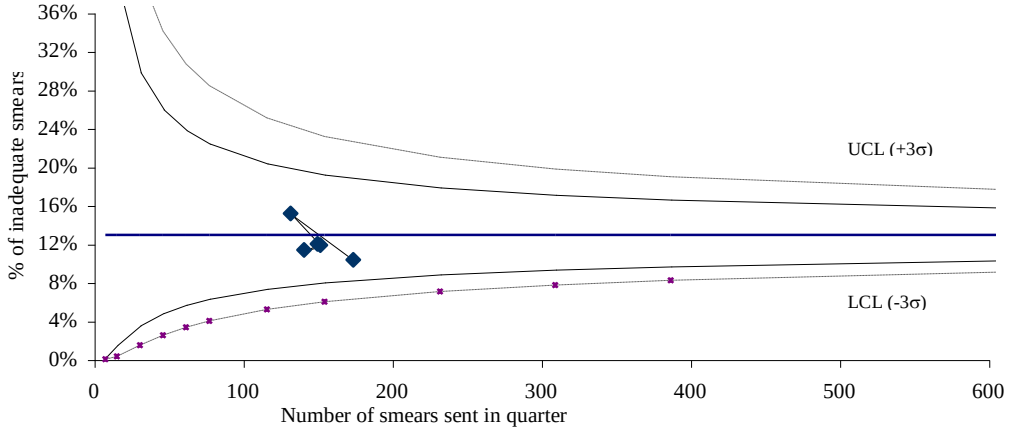
Information on inadequate smear rates by practice has been available at health authority level since January 2000. This data is published on a quarterly basis, and we obtained data based on 5 quarters (January 2000 to March 2001). This data was obtained through the KC53 returns[240] kept at the Health Authority. These are forms that were first introduced at the start of the cervical screening programme in the UK, in 1988. The forms are required to be completed as part of the Department of Health's monitoring of the NHS cervical screening programme. The data come from patient information held on the cytology database of each health authority and provide information on screening coverage and the outcomes of screening. This is a fairly reliable and accurate system, providing good quality data.

5.4.2 Statistical Process Control Chart

The calculation and plotting of control charts was based on the work done by Shewhart[302]. The data on inadequate smear rates for 5 quarters for each practice was entered onto a spreadsheet (Excel).

In the case of inadequate smear rates, where the outcome variable is binary, a variation on the 'P'-chart was used. First data was used from all quarters in all practices, weighted by the number of smears done at each practice, to obtain a weighted mean inadequate rate. This determines the mean line for the control chart. Control limits for the rate were also calculated based on the aggregated data. These were based on the calculation of standard deviation for proportions, according to binomial theory. The control chart is plotted with the proportion of inadequate smears on the y-axis and the total number of smears taken on the x-axis (Figure 20). A control chart was plotted for each practice individually, using the data from each quarter separately.

Figure 20: Example of control chart, based on a typical practice



5.4.3 Signals of special cause variation

A set of rules was developed for detecting the presence of special cause variation on the control charts. Those practices where the inadequate rates were either above or

below the mean for all 5 quarters, or for 4 quarters with at least one measure outside the 2σ level, were identified. This finding would rarely be seen by chance, the likelihood being less than once in 120 occasions. In a minority of practices, relatively few smears were taken overall, and there were extremes of variation in inadequate rates. In these cases, practices were categorised separately as no meaningful analysis could be performed on a quarterly basis. Each chart was reviewed by myself and another colleague independently, and we then compared our results for consistency. In the few cases where there were discrepancies, the chart in question was retrieved and discussed, and consensus was obtained. All practices were then divided into four categories:

1. Practices with persistently low inadequate rates (Figure 21)
2. Practices with persistently high inadequate rates (Figure 22)
3. Practices taking so few smears, that interpretation of performance was not possible (Figure 23)
4. All other practices (Figure 20)

Figure 21: Example of practice with persistently low inadequate smear rates

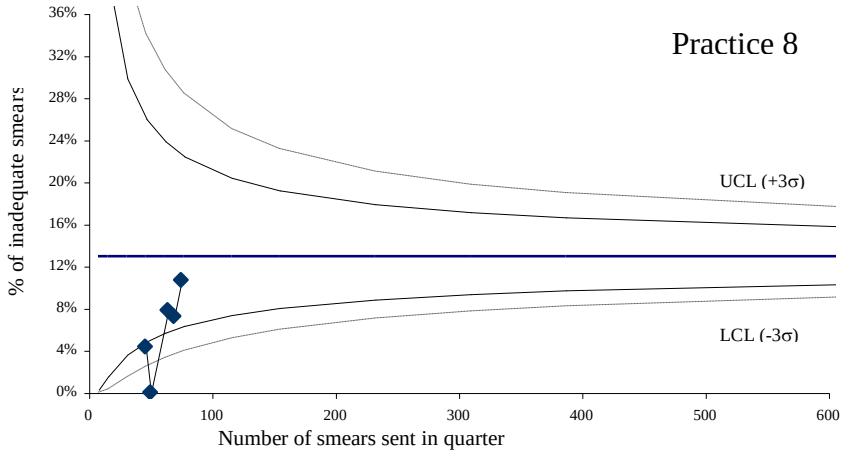


Figure 22: Example of practice with persistently high inadequate smear rates

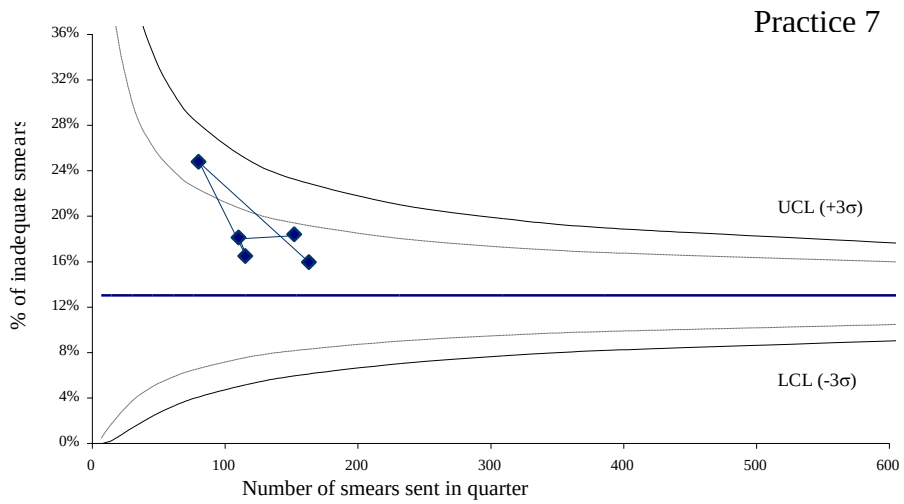
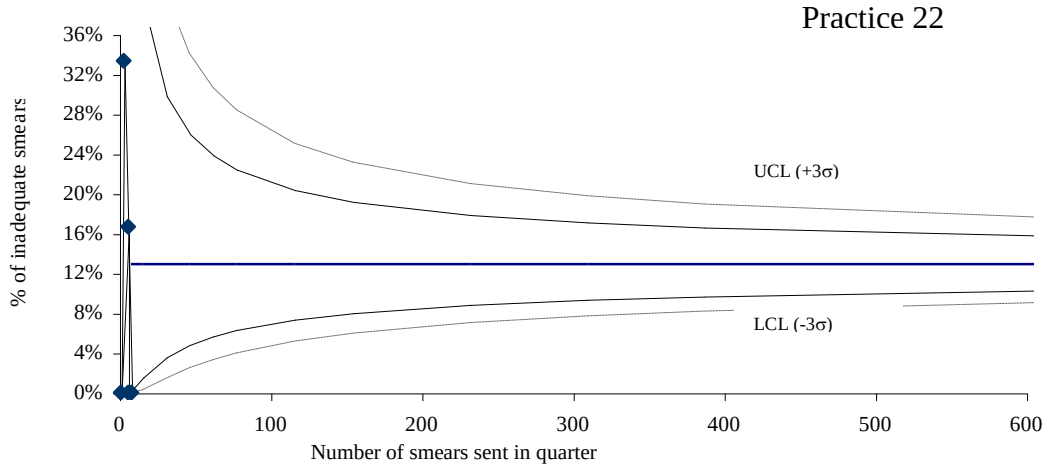


Figure 23: Example of practice with too few smears to analyse



5.4.4 Study questionnaire for practices with special cause variation

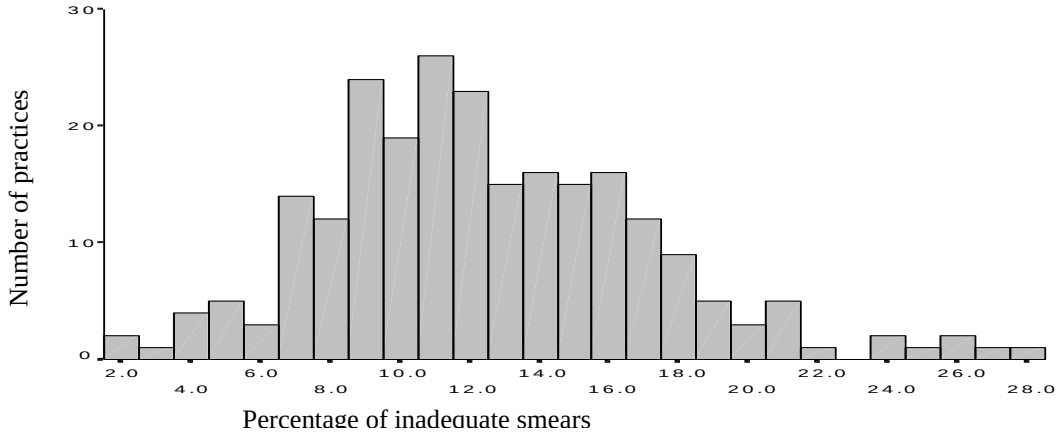
All practices contacted were categorised as those with persistently high or low inadequate rates and interviewed them based on a short structured questionnaire (Appendix 34). The questionnaire contained 6 questions and covered aspects related to the number and type of staff involved in smear taking, whether they had attended any training courses, use of protocols or guidelines and whether the practice had taken part in any audits of cervical screening in the past five years. Also asked was which

laboratory was used by the practice for analysing cervical smears. The questions were based on the process involved in obtaining an adequate smear (Figure 18). In addition, Birmingham Health Authority supplied data on practice cervical screening coverage, Townsend score (an indicator of deprivation), list size, and childhood immunisation coverage (as an indication of practice organisation) on all practices.

5.5 Results:

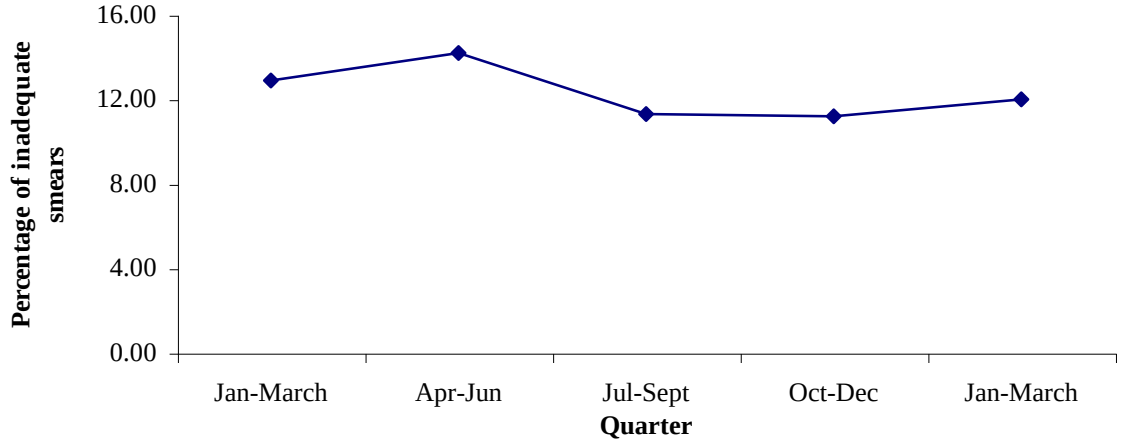
Information on inadequate smear rates was available for all quarters for 237 of the practices (99.6%) in Birmingham. The mean rate of inadequate smears, pooled over the 5-quarters was 12.4%. However there was wide variation between practices, with the inadequate rates ranging from 2.2% to 28.1% (Figure 24). The proportion of inadequate smears varied in each quarter, ranging by practice from zero to 50%.

Figure 24: Percentage of smears reported as inadequate by practice (January 2000–March 01)



The quarterly pooled inadequate rate varied little, ranging from 11.2 to 14.2% (Figure 25).

Figure 25: Variation in mean inadequate rates over five quarters among practices



Overall, 37 practices demonstrated special cause variation which was further investigated. There were 8 (3.4%) practices identified with persistently high and 29 (12.2%) with persistently low rates of inadequate smears. In addition, 15 practices (6.3%) took very few smears and demonstrated extreme variation in inadequate rates.

A comparison of practices according to their inadequate smear rates is presented in Table 76. In general, practices that took very few smears differed from others in several respects. Compared with all other practices, they had lower screening coverage and tended to be situated in more deprived areas. Practice list size was also generally smaller than other practices. However childhood immunisation rates were similar to other practices.

Table 76: Variation in practice characteristics according to cytology inadequate rates

	Mean (range) for each category of GP practice			
	Persistently low inadequate rates (n=29)	**Persistently high inadequate rates (n=8)**	**Too few smears (n=15)**	**All other practices (n=185)**
Total number of smears	308 (44 – 1,169)	498 (109 - 857)	52 (12 - 134)	352 (28 – 1557)
Cervical screening coverage (%)	82 (66 - 99)	84 (74 - 89)	71 (21 – 93)	81 (27 – 95)
Childhood immunisation rates (%)	92 (0 - 100)	81 (0 - 98)	95 (75 – 100)	92 (0 – 100)
Townsend score*	-0.24 (-8.20 to 3.80)	-3.11 (-5.50 to -0.30)	3.14 (-1.90 to 5.90)	-0.03 (-11.4 to 5.70)
Practice list size	4,080 (1,141 – 10,647)	4,823 (1,581 – 8,116)	2,702 (779 – 5,008)	4,853 (848 – 24,090)

**Positive score represents higher level of deprivation*

5.5.1 Comparison between practices with persistently high or low inadequate rates

Additional data collected on these selected practices was compared in the two groups. The laboratory used by practices for analysis of their smears was first compared. Other areas of comparison included the characteristics of the practice, as a measure of practice organisation, characteristics of the smear takers, and the recorded use of quality improvement techniques (guidelines and clinical audit) within practices.

5.5.2 Laboratory used for analysis of smear

The most important factor differentiating the two groups of practices was the laboratory they used for analysing cervical smears (Table 77). Practices using Good Hope Hospital were significantly more likely to be in the persistently high inadequate rate group, compared with practices using other laboratories. Nevertheless, there were two practices with persistently low inadequate rates also using Good Hope Hospital. All practices interviewed that used the City or Heartlands Hospital had persistently low inadequate rates.

Table 77: Comparison of practices in relation to the laboratory used for cervical cytology

Laboratory used for cytology	Persistently low inadequate rate	Persistently high inadequate rate	Difference between groups
- Heartlands Hospital	4 (13.8)	0	
- Birmingham Women's Hospital	17 (60.5)	4 (50.0)	χ^2 =10.0
- Good Hope Hospital	2 (6.9)	4 (50.0)	p = 0.04
- City Hospital	6 (18.8)	0	

5.5.3 Practice characteristics:

Relevant data was not available for one of each category of practice. Practices with high inadequate rates tended to be situated in less deprived areas (Table 78). However, there was a significant relationship between practice deprivation scores and the laboratory used for screening. Practices using Good Hope Hospital were generally least deprived, whilst those using Heartlands were most deprived. Practices with high inadequate rates also tended to have lower screening coverage and lower immunisation rates. These practices also were more likely to have either a very large or very small list size, whilst the majority of those with low inadequate rates had average sized lists.

5.5.4 Characteristics of smear takers

In terms of staff, practices with persistently low inadequate rates tended to have a higher proportion of regular (at least once a week) smear takers (Table 79). Subsequently, each smear taker in these practices takes more smears on average than practices with high inadequate rates. Smear takers in the former practices were more likely to be nurses, and to have had specific training. There was high correlation between the proportion of nurses in a practice and the proportion who had been through training (Pearson's $r = 0.74$, $p<0.001$).

Table 78: Characteristics of practices with persistently high or low inadequate rates

Practice characteristic	**Persistently low inadequate rate (n=28)**	**Persistently high inadequate rate (n=7)**	**Difference between groups**
Townsend score			
- Lowest deprivation (≤-2.01)	8 (28.6)	5 (71.4)	χ^2 for trend = 6.1
- Low deprivation (-2.0 to 0)	5 (17.9)	2 (28.6)	p = 0.014
- Some deprivation (0.01 to 3.5)	13 (46.4)	0	
- Most deprived (≥3.51)	2 (7.1)	0	
Screening coverage			
- <70%	1 (3.6)	0	χ^2 for trend = 0.9
- 70.1 – 80%	11 (39.3)	1 (14.3)	p = 0.35
- 80.1 – 90%	14 (50.0)	6 (85.7)	
- >90%	2 (7.1)	0	
Immunisation rate			
- <60%	1 (3.6)	1 (14.3)	χ^2 for trend = 0.9
- 70.1 – 80%	1 (3.6)	-	p = 0.35
- 80.1 – 90%	3 (10.7)	1 (14.3)	
- >90%	23 (82.1)	5 (71.4)	
Practice list size			
- <2000	3 (10.7)	1 (14.3)	χ^2 for trend = 0.2
- 2001 – 6000	21 (75.0)	4 (57.2)	p = 0.64
- >6000	4 (14.3)	2 (28.6)	

Table 79: Characteristics of smear takers in practices with persistently high or low inadequate rates

Characteristics of smear takers	Persistently low inadequate rate (n=29)	Persistently high inadequate rate (n=8)	Difference between groups
% Smear takers taking smears regularly	72.13*	67.81*	p = 0.73
- ≤50	9 (31.0)	3 (37.5)	χ^2 for trend = 0.2
- 50.1 – 80	6 (20.7)	2 (25.0)	p = 0.63
- ≥80.1	14 (48.3)	3 (37.5)	
Number of smear takers/ 1000 smears	10.86*	9.33*	p = 0.63
- ≤5	8 (28.6)	3 (42.9)	χ^2 for trend = 0.8
- 5.1 – 10	12 (42.9)	3 (42.9)	p = 0.38
- ≥10.1	8 (28.6)	1 (14.3)	
% Smear takers that are nurses	59.93	51.77	P = 0.56
- ≤25	8 (27.6)	2 (25.0)	χ^2 for trend = 0.4
- 25.1 – 50	7 (24.1)	4 (50.0)	p = 0.53
- ≥50.1	14 (48.3)	2 (25.0)	
% Smear takers that had training	56.79*	41.98*	0.31
- Up to one third	8 (27.6)	2 (25.0)	χ^2 for trend = 0.4
- One to two thirds	7 (24.1)	4 (50.0)	p = 0.53
- > Two thirds	14 (48.3)	2 (25.0)	
Type of training			
- None	4 (13.8)	1 (12.5)	χ^2 =0.9
- Marie Curie	7 (24.1)	3 (37.5)	p = 0.92
- Palm	12 (41.4)	3 (37.5)	
- Other	6 (20.7)	1 (12.5)	

*Values are number (%), except for values marked *, where the mean is presented*

Amongst the training courses, the most commonly attended was the "Palm" training course, followed by the Marie Curie Cancer Care training course, whilst others either did not specify what training they had (n=3), or mentioned training in family planning (n=2) or through the Health Authority (n=2). Although there was no significant association between training courses and inadequate rates, a higher proportion of practices with staff attending the Palm training course tended to have low inadequate rates compared with practices where staff attended other training courses. We did not

ask for detailed information on training. However, briefly, the Palm training course consists of some theory, visits to the cytology laboratories and a colposcopy clinic, and taking a certain number of smears under supervision. The Marie Curie course covers breast and cervical screening. For the cervical screening aspect, it includes theory and supervised smear taking, but no laboratory or clinic visits. Not all practices responded to the question on when staff attended training and there was no clear relationship between type of practice and how recently staff had been on a course.

5.5.5 Use of quality improvement techniques

In general, practices with persistently high inadequate rates tended to report using protocols or guidelines for smear taking, though there was no statistically significant difference (Table 80).

Table 80: Use of protocols and guidelines, and participation in audit among practices with persistently high or low inadequate rates

Practice characteristic	Persistently low inadequate rate	Persistently high inadequate rate	Difference between groups
Use of protocols or guidelines for cervical screening	21 (72.4)	7 (87.5)	χ^2 =0.8 p = 0.38
Type of protocol/ guidelines used			
- None	8 (27.6)	1 (12.5)	
- Vague description	3 (10.3)	3 (37.5)	χ^2 = 3.6
- Practice developed	13 (44.8)	3 (37.5)	p = 0.31
- Named recognised guideline	5 (17.2)	1 (12.5)	
Undertaken audit of cervical screening	7 (24.1)	3 (37.5)	χ^2 =0.6 p = 0.45
Undertaken audit of inadequate smears	3 (10.3)	1 (12.5)	χ^2 =0.03 p = 0.86

However, practices with persistently low rates tended to specify a named protocol or to have developed their own practice guideline. There was a tendency for more

practices with persistently high inadequate rates to have undertaken audit of cervical screening, and of inadequate smears in particular.

5.5.6 Predictors of persistently high inadequate rates

A logistic regression model was developed to examine characteristics related to persistently high or low inadequate rates, adjusting for other factors (Table 81). In the adjusted model, being a practice with persistently high inadequate rates was associated with using Good Hope Hospital, having no protocol or guideline for screening, having more low volume smear takers, having taken part in audit of cervical cytology and having fewer staff trained in screening. None of these factors were statistically significant, apart from the laboratory used. However, the confidence intervals for all odds ratios were very wide, suggesting that the lack of statistical significance was related to the small sample size.

Table 81: Factors associated with having a persistently high inadequate rate, based on logistic regression

Characteristic	**OR (95% CI) for having persistently high inadequate rates**	**P value**
Laboratory used for cytology analysis		
- Good Hope Hospital	1.00	
- Heartlands	<0.01 (<0.001 to $6x10^{48}$)	0.81
- Women's	**0.01 (<0.001 to 1.05)**	0.05
- City	<0.01 (<0.001 to $1x10^{47}$)	0.79
Type of guideline or protocol used for cervical screening		
- None	1.00	
- Vague	0.08 (<0.001 to 20.33)	0.37
- Practice developed	0.01 (<0.001 to 4.95)	0.16
- Named recognised guideline	<0.01 (<0.001 to 18.07)	0.18
Increasing proportion of staff attended for training	0.98 (0.94 to 1.01)	0.18
Increasing number of smear takers / 1000 smears done	1.19 (0.93 – 1.53)	0.16
Taken part in cervical screening audit in past year	82.52 (0.31 to 21,791)	0.11

5.6 Discussion

5.6.1 Summary of findings

This is the first study demonstrating the use control charts in identifying variations in the processes of care, in relation to cervical smear taking and inadequate smear rates. We identified practices with persistently high or low inadequate rates and compared them in relation to general characteristics and modifiable processes contributing to smear quality. Because of the small number of practices, particularly those with high inadequate rates, most comparisons were not statistically significant. Nevertheless there were some important trends that may suggest strategies for quality improvement. The only significant difference between the two types of practice was the laboratory they used, suggesting that much of the variation in inadequate rates was due to differences in laboratory interpretation. However, even within laboratories there was some variation in practice inadequate rates. The findings suggest that inadequate rates may be reduced by rearrangements of staff, organisation and training within practices. Practices where smear takers take a higher volume of smears and do so on a regular basis were more likely to have low inadequate rates. These practices also tended to be more likely to have nurses being involved in smear taking, and for the nurses to have had specific training in cytology techniques. They were more likely to have guidelines or protocols for screening, particularly ones adapted for the practice or those developed by a recognised source. Participation in audit of cervical screening in the past year was generally low, but more common among practices with high inadequate rates. Because of the cross-sectional design of our study, we cannot assess whether this was in fact a consequence of their high inadequate rates.

5.6.2 Use of quality improvement methods for reducing inadequate cervical smears

TQM methods have been previously used for improving the quality of cervical smears. A project in the USA used various industrial management tools to examine the role of methods used for collecting cervical smears, in relation to inadequate smears[303]. The team identified the collection method as a key factor, and demonstrated that after introducing the use of a combined smear collection method (spatula and Cytobrush) inadequate smear rates fell from around 25% to 10% in their region. However, the focus of that study was the link between individual smear results and the collection method used, rather than the more global approach we used with primary care practices as the unit of analysis. In another US study, quality assurance methods were used to increase adequate smear rates from 82 to 91%[304; 305]. This improvement was mainly attributed to monitoring and feedback of performance to individual clinicians. However, none of these studies had used control charts as the main tool for quality improvement.

5.6.3 Use of control charts for quality improvement

Application of control chart technology for improving health care has been demonstrated in several clinical disciplines. This includes the use of control charts for monitoring and guiding asthma care[306-308], in monitoring and reducing mortality among trauma and intensive care unit patients in hospital[309; 310], for surveillance of infectious diseases[311] and in reducing peri- and post-operative adverse events[312; 313]. These methods have also been used to improve the quality of operational and administrative arrangements [314; 315], and to monitor quality indicators[316]in clinical settings. In addition, the Joint Commission on Accreditation of Health Care Organizations (JCAHO)[317], a major independent organization for standard setting and

accrediting body in the USA, uses control charts as one of its tools for measuring clinical performance of health care organizations.

5.6.4 Implications of this study for practice

There is some evidence that inadequate smear rates in the UK are increasing[240; 280]. One review to investigate the reasons for this rising trend, suggests that the main reason was deterioration in the quality of smears received[279]. Therefore attempts to improve quality can contribute to reversing this trend, in addition to reducing unnecessary anxiety among women and saving resource costs for the NHS.

Use of control charts provides an efficient means for developing hypotheses for care processes that affect quality. In this study only a relatively small number of practices whose performance signalled special cause variation needed to be approached for our questionnaire. This meant that the information obtained could be maximised by targeting those with extremes of performance, whilst minimising the time spent by practices and ourselves. The results of the study can be used to form hypotheses about factors that may be affecting quality and to develop a strategy for quality improvement. The approach avoids practices being stigmatised for their performance, instead allowing a systems approach to be taken in improving quality across all practices. After confirming which factors contribute to special cause variation, the lessons learnt can be applied to all practices, irrespective of their current performance.

The results of this study have implications for laboratories involved in analysing smears. Practices using one particular laboratory were more likely to have high inadequate rates. Introduction of external quality assurance for laboratories, by the NHS cervical screening programme, has been shown to reduce inadequate smear reporting among participating practices[318]. Another study comparing assessment in

different laboratories found fairly high reproducibility of assessment among those who strictly followed the Bethesda System criteria[319]. A review of the external quality assurance system of the laboratories involved would therefore seem reasonable. In the UK, if the smear is considered inadequate, the laboratory is required to differentiate between those where the cause is attributable to the smear-taker, and others. It would therefore be useful to assess the proportion of inadequate results that are attributable to the smear-taker in each laboratory.

In addition, pursuing the other strategies suggested by this study could improve the system and reduce overall inadequate rates. Practices where a higher proportion of smear takers had specific training tended to have lower inadequate rates. Thus training seems to be an important contributor to smear quality. A study in the US showed a negative linear relationship between clinician experience (measured by years of practice) and inadequate rates[320]. Physicians with more years of experience in smear taking had the lowest inadequate rates, suggesting a role for increased training. Several studies have reported on systems for providing feedback to clinicians regarding their individual or group cervical cytology inadequate rates[299; 305; 321; 322]. One of these studies, based in the US, showed that such feedback alone led to a sustained improvement in the quality of cervical smears[305]. In other studies, a programme of training or update training was arranged as part of the audit.

No previous study has specifically examined the relationship between use of guidelines or protocols for smear-taking and inadequate smear rates. However systematic reviews of the effects of introducing guidelines in general, have shown beneficial effects on the process of care [323], but minimal effect on clinical outcomes in primary care[324]. This study showed that practices with high inadequate rates were less likely to have guidelines or protocols for smear taking, suggesting that their use may

reduce inadequate rates. However, having guidelines may also be an indicator of other practice characteristics and organisation. It is not known whether having guidelines per se would contribute to quality improvement.

5.6.5 Statistical control and clinical control

Control charts examined show whether a system is in statistical control. That is, where the system seems free of special causes. When special cause variations are found, identifying and altering the process can bring the system back in control. However, statistical control is not the same as clinical control and it does not mean that a system is organised or implemented in an optimal manner. It would be of little use to have a controlled system, where the lower or upper control limits are considered clinically unacceptable. In this case, intervention should be aimed at altering the entire system. For example, in one study where control charts were used to monitor asthma care for individual patients[306], one patient's daily peak flow readings all fell within control limits over 14 days. This suggested that no special events had occurred in her process of care, or the environment that she was exposed to. However, the lower control limit based on her readings, was well below what would be considered clinically safe. The intervention in this case was therefore to change her treatment plan. On the other hand, another patient's control chart showed a special cause signal, where her peak flow readings were persistently above the control limits for a period of 4 days in the middle of the 14 day observation. On further enquiry, this observation was related to a period when she had visited a relative and been away from her home environment and pets. Thus use of control charts allowed both special cause variation and poor clinical management to be identified.

In this study, the mean inadequate rate for all practices (12.4%) is above the upper level of the indicative range suggested by the NHSCSP (9%). For the period 1999/2000 in England, out of 4.3 million smear tests, 9.8%were inadequate, with a range of 4% to 20.0% [240]. The upper 3σ limit on the control chart is 25% or higher for practices taking fewer than 100 smears per quarter (about two thirds of all practices). This is clearly not an acceptable level for inadequate smear rates, and implies that a systems approach is required to improve the quality of smears in all practices. It was found that practices where few smears were taken were not easy to monitor. Furthermore, practices with lower volume smear takers, or those with fewer staff taking smears on a regular basis, tended to have higher inadequate rates. This suggests that encouraging a few practices or practitioners to take more smears, rather than allowing all to take a few, would be a better strategy for quality improvement. This is supported by a study of 4,000 cervical smears in Israel, which found a direct relationship between the volume of smears taken by an individual and their inadequate rates[325]. In that study, 90% of the inadequate smears (rate of 16.5% overall) were attributed to clinician error, and the findings suggested a threshold for the minimum number of smears to minimise inadequate rates. This association between high volume of work and better outcomes has been shown in several clinical specialties, particularly surgery. Improving the system could also be achieved by applying more widely any interventions found to reduce special cause variation.

5.6.6 Methodological issues

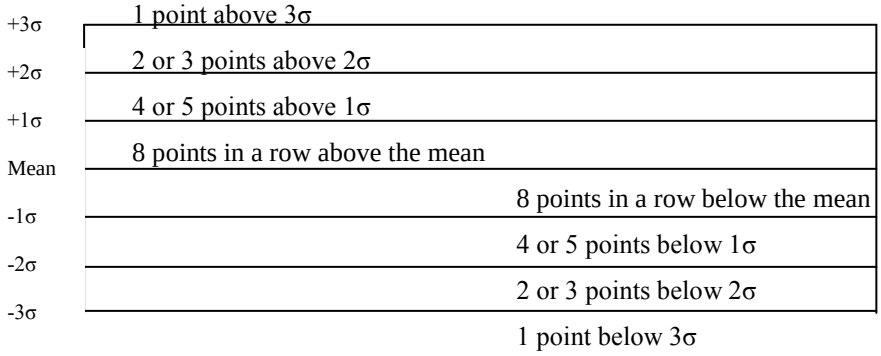
The use of control charts in health care is still relatively new, and there are some methodological issues that need to be considered[326]. The assumption that GP practices in Birmingham were all part of a single "system" in relation to smear taking may have been incorrect. If, for example, single-handed GP practices followed a different

system to other practices, the two types of practices would have had to be plotted on different charts. A priori, there was no reason to believe that there would be different types of practice, and they therefore were analysed all together.

There are also many different type of control chart, depending on the data collected. Outliers based on their pattern of performance over five quarters were chosen to be identified. On the other hand, a single control chart could have been plotted for all practices, comparing the inadequate rates over the total time period. This would have allowed practices based on a larger number of smears to be examined and reduced the range of common cause variation one would have expected. However, this latter approach would have ignored information based on variation over time. This approach allowed real time data to be used as it would normally be generated, and would be a useful way of monitoring practices in the longer term. Practices were identified with rates persistently above or below the average, but where the aggregated average would not have reached outside the control limits.

A pragmatic rule was used for identifying special cause variation. Other rules for detecting special cause variation do exist. The original rules set by Shewhart, were to take action when data fall outside of the 3σ limit[327]. Another statistician suggested additional signals, including 9 successive points on one side of the central line, or 6 points rising or falling in sequence. Another often quoted rule is based on eight signals of special cause variation (Figure 26)[306]. None of these rules are necessarily always right[327]. The different rules increase the sensitivity of the control chart in detecting signals, whilst at the same time increasing the proportion of "false alarms" of detecting a signal, when there is no special cause variation.

Figure 26: The 8 signals of special cause variation



Given that there were only five data points per practice, the rules were a variation of those mentioned above. Nevertheless, practices may have been mistakenly identified as signalling special cause variation, or missed some, where a special cause did in fact exist.

Another drawback to this approach was that because of the small number of practices interviewed, the results were necessarily descriptive, without demonstrating statistical significance. There are also potential problems with the method used for identifying outliers. Practice inadequate rates are based on an aggregate of performance by different smear takers in the practice. This has been shown to mask variation in inadequate rates between smear takers within a single practice[299]. Therefore it could be argued that individual smear-takers whose techniques need improving may have been missed. However, the systems approach is concerned with identifying processes and practices that could be applied across all units, irrespective of their current performance. The method does not replace the need for audit of individual smear-takers, which could be done within practices, so that interventions such as training could be targeted.

Having identified outliers, information was obtained from practices based on self-report. Information was not verified for attendance of training and use of guidelines

or protocols. However, practices where such information was vague, or they could not give the name of the training course or guidelines used were differentiated from others. It was not known whether smear-takers in practices reported owning a guideline, or actually using them. One study which explored the extent to which Dutch GPs adhered to guidelines on cervical cancer screening, including those related to the organisation of smear taking, found poor adherence[328].

Finally, modifiable steps may have been missed in the process of smear taking that could have given rise to variation. In retrospect, a key question that could have been addressed, would have been the method of specimen collection used in practices[303].

5.6.7 Conclusions and recommendations

This study demonstrates an efficient and useful method of monitoring quality, as a basis for a programme of quality improvement. A number of modifiable factors have been identified, which could be introduced across practices to improve the quality of smears taken. Most of the factors identified are supported by previous research findings. Nevertheless, further research is needed to see whether feedback of the findings to practices does lead to changes in procedures and practice. Also there is a need to assess whether implementation of the changes recommended by this study lead to continuous quality improvement, using a system of audit.

6 A RANDOMISED CONTROLLED TRIAL OF THE EFFECT OF EVIDENCE BASED INFORMATION ON WOMEN'S WILLINGNESS TO PARTICIPATE IN SCREENING

6.1 Summary

The aim of this study was to assess whether providing women with additional information on the pros and cons of screening, compared with information currently offered by the NHS, affects their intention to attend for screening.

Methods

This was a randomised controlled trial. Participants were randomly assigned to receive either the control, (based on an NHS Cervical Screening Programme leaflet currently used), or the intervention leaflet (containing additional information on risks and uncertainties). Participants were selected from three general practices in Birmingham and the aim was to include 300 women aged 20 to 64 attending the practices during a one-month period. The main outcome measure was intention to attend for screening.

Results

283 women (94.3%) completed the study. Fewer women in the intervention (79%) than the control group (88%) expressed an intention to have screening after reading the information leaflet (difference between groups 9.2%, 95% confidence interval (CI) 3.2% to 21.7%). The crude odds ratio (OR) and 95% CI was 0.50 (0.26 – 0.97). After adjusting for other factors, the trend persisted (OR 0.60, 95% CI 0.28 – 1.29). Having a previous Pap smear was the only significant predictor of intention to have screening (adjusted OR 2.54, 95% CI 1.03 to 6.21). Subgroup analysis showed no

intervention effect on intended uptake between women at higher and lower risk of cervical cancer (p=0.59).

Conclusions

Providing women with evidence-based information on the risks, uncertainties and the benefits of screening, is unlikely to deter many, including those at higher risk, from undergoing screening.

6.2 Introduction

Most researchers agree that organised population screening has contributed to a reduction in the incidence and mortality from invasive cervical cancer[5; 329; 330]. It has been estimated that about 800[331] cases in England and 1,300 cases in England and Wales[330] per year are prevented as a result of screening. However, this has been achieved at high cost. Approximately 3.8 million women in England had a cervical screening test in the year 1999-2000. [240], at a cost of £132 million to the NHS, or £34 per patient screened [332]. Each year, about 10% of women have an inadequate smear, which needs to be repeated. Of the remainder, between 7% and 8% have an abnormal result[17; 240] and overall about 3% are referred for colposcopy[17]. The number of abnormalities detected and referrals for colposcopy far exceed the number of invasive malignancies that could be prevented[17]. A woman with average risk for cervical cancer (less than one in 10,000), and who has seven pap smears during her lifetime, has a one in two chance of having an abnormal test result[17; 240], and one in five chance of having colposcopy[17]. Furthermore, the test has a false negative rate, estimated by some studies to be around 15 to 25%[20]. For every one woman whose life is saved by the screening programme, over 300 women are called back for further tests, and about 54 would have a colposcopy. Over 10 years, between one and seven women per 10,000 (depending on their age) will live longer as a result of cervical screening[333]. Many people misunderstand the purpose of screening and the accuracy of screening tests[334]. In a survey of 300 women attending a colposcopy clinic following an abnormal smear result, 42% reported that the smear taker had not discussed the reason for having a cervical smear with them, and almost three quarters of had not been told that the test is not 100% accurate[335]. The purpose of information given on cervical screening has tended to be to increase coverage, rather than to promote informed

choice[336]. The NHS Cervical Screening Programme (NHSCSP) and Cancer Research Campaign have jointly produced an information leaflet, and this, or something similar, is sent to all women with their first invitation for cervical screening [337]. Whilst leaflets are an important source of patient information[338], current leaflets on cervical screening have been criticised for over-emphasising the benefits of interventions, and rarely mentioning the risks and side-effects [339]. Such overestimation of the benefits of screening prevents women from making an informed choice, and may contribute to accusations of negligence when screening has "failed"[340]. The General Medical Council in the UK has issued guidance on informed choice for all medical procedures, including screening[341] and has outlined what information should be given. This includes information on the purpose of screening, the likelihood of positive and negative findings and the possibility of false positive/ negative results, the uncertainties and risks attached to the screening process, any significant medical, social or financial implications of screening, and follow up plans. The importance of providing full information and getting informed consent for cervical screening has been highlighted in recent years [342], [343], [344], [333]. In its report of the first 5 years of the programme in 1994, the NHSCSP acknowledged that women were less aware of the limitations of screening than its benefits, but did not feel that addressing this problem was a priority [345]. There may be several reasons for this reluctance. Firstly paternalistic attitudes within part of the medical community promote the idea that patients cannot cope with bad news or uncertainties[338]. Secondly, within the NHS, health professionals (GPs) are financially rewarded for achieving targets for high screening coverage, rather than on the quality of information that they give [339; 346]. It is therefore not in their interest to give women more information, if it may discourage them from attending [347] and result in their

losing their target payments. A less cynical view is that if a high proportion of women are discouraged from attending, the programme would fail to have a significant population impact on reducing cervical cancer incidence and mortality. Thus there is a tension between achieving high coverage, and promoting informed choice, if this results in individuals choosing not to undertake screening[348]. All these arguments assume that providing more information will affect screening uptake. No previous study has assessed whether giving women more information on cervical screening would have an effect on screening coverage, particularly among those at higher risk.

In this study, the main objective was to estimate the effect on expressed uptake, of providing more information on the risks and uncertainties associated with cervical screening, compared with the information previously provided by the NHS[337]. A secondary objective was to examine the effects of any difference in intended uptake between women at higher and lower risk for cervical cancer.

6.3 Methods:

6.3.1 Study design and population

The study was a randomised controlled trial undertaken at three general practices in Birmingham.

Three members of the team (medical students) made visits to the participating practices on several occasions between April and May 2001. Women between the ages of 20 and 64 attending the practices for any reason were invited to participate in the study. Participants were given a questionnaire (Appendix 35) together with either the control, or intervention information leaflet, at the end of which they were asked to indicate whether they would be willing to attend for screening.

Permission for the trial was obtained from South Birmingham Research Ethics Committee and all participants were provided with information on the study before being asked to give written consent.

6.3.2 Intervention

We devised two types of information leaflet on screening. The first (the control leaflet) was based on the NHSCSP leaflet[337], which women received when they were first invited for cervical screening. This includes information on:

- the preventive nature of screening,
- the purpose of the test in detecting pre-cancer,
- what the test involved,
- who it was for,
- the screening interval,
- choice of venue for the test,

- how results would be obtained,
- possible reasons for further tests and
- what to expect if the results were abnormal

In addition the leaflet briefly mentions that screening is not 100% perfect.

The other (the intervention leaflet), in addition to this, contained information on the absolute individual risk for cervical cancer, likelihood of positive and negative findings, the possibility of false positive/ negative results, the uncertainties attached to the screening process, the absolute benefit associated with screening and the cost of the process to the NHS (Appendix 6).

As the NHS cervical screening programme is now well established, and in order to gain the co-operation of participating practices with minimal disruption, all reference to "cervical" cancer, "cervical" screening or "smear test" were removed from the leaflets. Nevertheless, all the facts presented were related to cervical screening and referred to "a cancer" affecting women, and "a screening test".

6.3.3 Protocol and random assignment

A structured questionnaire was developed and piloted on 20 women. A computer-generated list of random numbers, was used to sequence questionnaires to contain either the control or intervention leaflet. Participating general practices were visited on several occasions between April and May 2001 and questionnaires were distributed in random order. Both patients and those distributing questionnaires were blinded as to which information sheet was received. Participants were asked to leave completed questionnaires with the reception before leaving the practice.

6.3.4 Outcome measures

The main outcome measure was expressed willingness to have the "study screening test". In addition, women were asked whether they thought the Government should set up a national programme using this test, irrespective of whether they would attend.

6.3.5 Other measures

The structured questionnaire was piloted on approximately 20 women before being used in the study. Information was collected on socio-demographic factors (including age, marital status, social class and ethnicity), health related behaviours (including smoking, attendance for cervical screening and dental check ups) and whether they had any family or close friends with cancer. In addition, a risk score for cervical cancer was calculated, based on the woman's age, social class, and smoking status. The score increased with increasing age (20 – 35, 36 – 45, 46 – 64 years), lower social class (I & II, III, IV & V) and smoking status (never smoker, former smoker, current smoker). Those with scores below the median were labelled as "lower risk", and the rest as "higher risk".

6.3.6 Sample size

The 5-year uptake of cervical screening in the UK is estimated to be around 80%[240]. It was calculated that in order to detect a difference in intended uptake between groups of 15% or more with 95% confidence and 80% power, a minimal sample size of 276 (138 in each group) was required.

6.3.7 Statistical analysis

The overall current uptake of cervical screening among the study population was assessed. The intended uptake of the study screening test among the intervention and control groups were then compared. Bivariate analysis was used to compare those who intended to have screening, with those who did not, in terms of risk, socio-demographic factors, other health related behaviours and whether they had personal contact with someone with cancer. Any characteristic that was associated with intended uptake at a level of significance of 10% or less was entered in a logistic regression model, to obtain an adjusted odds ratio for the intervention compared with the control group. Subgroup analysis was performed using interaction terms in the logistic regression model, to compare women at higher and lower risk of cervical cancer. All statistical analyses were performed with SPSS (version 10).

6.4 Results

6.4.1 Participant flow and follow-up

During the study period, about 7% of those approached (n =23/329) refused to participate, and were not given a questionnaire. Of the 300 questionnaires distributed to women who had given consent, 283 (94.3%) were returned; 141 (49.8%) from the control arm and 142 (50.2%) from the intervention arm (Figure 27). Overall, 43 questionnaires (15.2%) were only partially completed and these were evenly distributed between the control and intervention groups.

6.4.2 General description

The mean age of responders was 39.4 years (range 20 to 64). A sizeable minority (17.3%) were non-Caucasian, reflecting the population in Birmingham and the practices participating in the study. There were no significant difference between control and intervention group in terms of age, health and health related behaviours, though there was a higher proportion of non-Caucasians in the intervention (23.0%) compared with the control (12.6%) group (Table 82).

6.4.3 Characteristics of attendance for cervical screening

A high proportion of responders (90.5%, n = 256) had attended for a Pap smear in the past, 71.4% (n=202) within the last 3 years, and 80.6% (n=228) within the last 5 years. None of the socio-demographic or behavioural factors enquired about were significantly associated with having had a Pap smear within the last 5 years.

Figure 27: Flowchart of recruitment and participants in trial

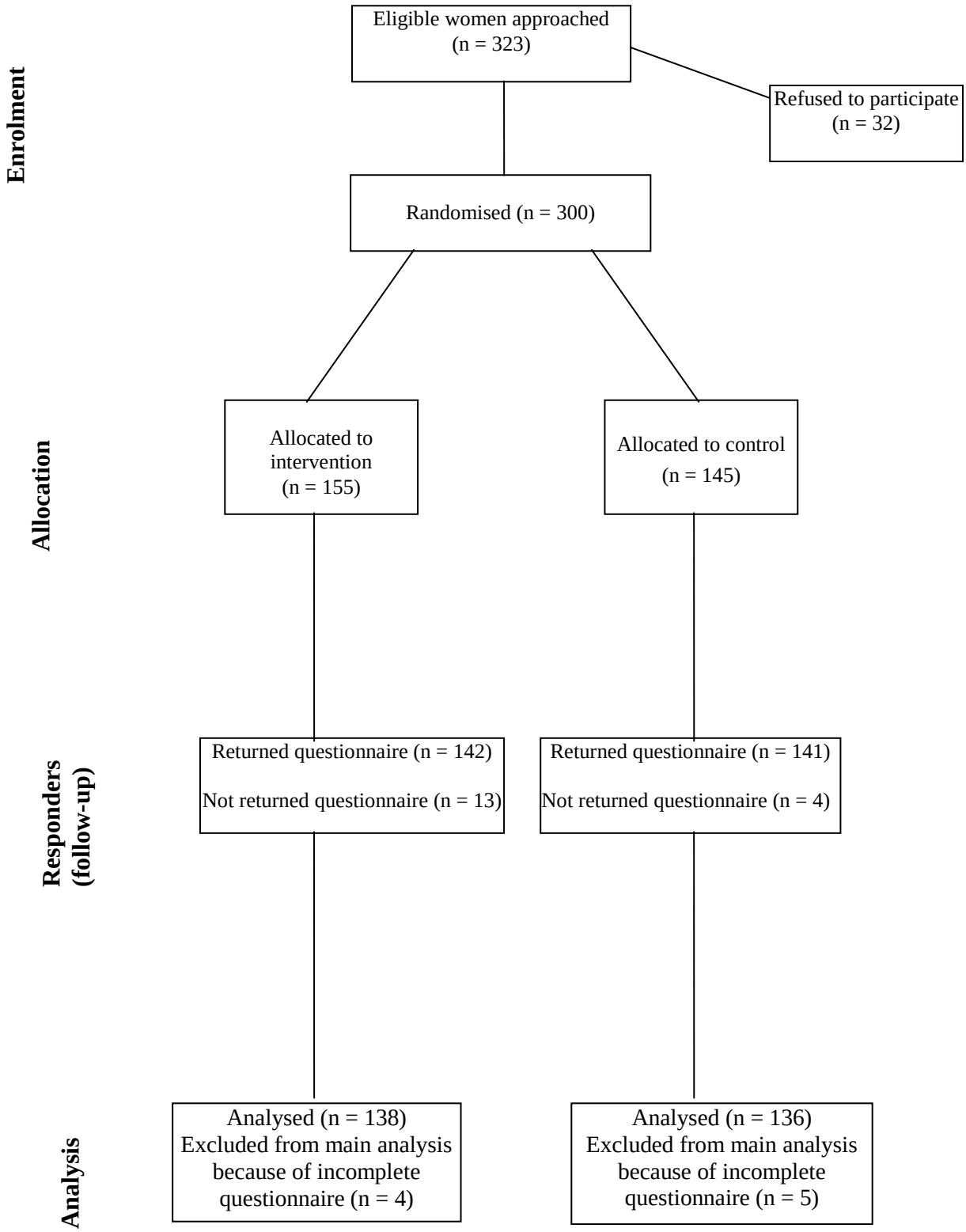


Table 82: Comparison of intervention and control groups at baseline

(Values are numbers and (percentages) unless otherwise stated)

Participant characteristics	Control (n=141)	Intervention (n=142)
Socio-demographic characteristics		
Age*	39.3 (20 – 64)	39.5 (20 –64)
Marital status		
Single / divorced / widowed	54 (39.1)	50 (36.0)
Married / living with partner	84 (60.9)	89 (64.0)
Social class		
I & II	35 (31.3)	37 (32.7)
III	58 (51.8)	60 (53.1)
IV & V	19 (17.0)	16 (14.2)
Ethnicity		
Caucasian	118 (87.4)	107 (77.0)
Non-Caucasian	17 (12.6)	32 (23.0)
Personal contact with someone with cancer		
Having family or close friends with cancer		
Yes	64 (45.4)	57 (40.1)
No	77 (54.6)	85 (59.9)
Health related behaviour		
Pap smear within last 5 years		
Yes	110 (79.7)	118 (84.9)
No	28 (20.3)	21 (15.1)
Make regular visits to dentist		
Yes	120 (85.7)	117 (83.6)
No	20 (14.3)	23 (16.4)
Smoking status		
Never smoker	68 (48.2)	70 (49.3)
Former smoker	36 (25.5)	41 (28.9)
Current smoker	37 (26.2)	31 (21.8)
Risk for cervical cancer		
Risk score* (based on age, social class and smoking status)	5.5 (3 – 9)	5.4 (3 – 9)

** Values are mean (range)*

6.4.4 Intended uptake of screening test

The majority of responders (229/274, 83.6%) expressed their willingness to attend for the study screening test. However, those in the intervention group were significantly less likely to want the test (109/138, 79.0%) compared with the control group (120/136, 88.2%) [χ^2 for difference between groups = 4.3; p=0.04] (Table 83).

Table 83: Factors associated with current and intended uptake of screening

	Intended screening uptake		**Pap smear within last 5 years**	
	Number (%)	OR (95% CI)	Number (%)	OR (95% CI)
Information sheet				
Control	120 (88.2)	2.00 (1.03 - 3.87)*	110 (79.7)	0.70 (0.37 – 1.49)
Intervention	109 (79.0)		118 (84.9)	
Dentist visits				
Regularly	198 (86.5)	3.19 (1.52 - 6.73)*	194 (84.0)	1.80 (0.83 – 3.89)
Not regularly	28 (66.7)		32 (74.4)	
Family/friends with cancer				
Yes	102 (88.7)	1.98 (0.99 - 3.96)	99 (81.8)	0.94 (0.51 – 1.75)
No	127 (79.9)		129 (82.7)	
Self-rated health status				
Very good/good	187 (83.1)	1.13 (0.47 – 2.72)	186 (81.6)	1.50 (0.60 – 3.78)
Poor/very poor	39 (84.8)		40 (87.0)	
Marital status				
Married/ living with partner	146 (85.4)	1.28 (0.67 – 2.46)	144 (85.2)	1.49 (0.79 – 2.83)
Single	83 (81.4)		81 (79.4)	
Social class				
I, II and III	161 (85.2)	1.75 (0.73 – 4.35)	160 (86.0)	2.13 (0.90 – 5.00)
IV and V	26 (76.5)		26 (74.3)	
Smoking status				
Current smoker	55 (82.1)	0.87 (0.42 – 2.00)	587 (86.6)	3.40 (0.69 – 3.33)
Current non-smoker	174 (84.1)		170 (81.0)	
Ethnicity				
Caucasian	187 (83.9)	1.12 (0.53 - 2.69)	184 (82.1)	0.72 (0.29 – 1.85)
Non-Caucasian	39 (81.3)		38 (86.4)	
Risk				
Higher risk	93 (82.3)	0.80 (0.39 – 1.64)	88 (79.3)	0.47 (0.22 – 1.01)*
Lower risk	93 (85.3)		97 (89.0)	

* p <0.05

Women who had previously attended for cervical screening were significantly more likely to say they would attend for the study screening test (OR 2.3, 95% CI 1.1 – 4.8). Other factors associated with intention to take up the study screening test included attending regularly for dental check-ups (OR 3.19, 95% CI 1.52 - 6.73) and having close friends or family with cancer (OR 1.98, 95% CI 0.99 - 3.96).

After adjusting for these other variables using logistic regression, exposure to the intervention leaflet was still associated with reduced expressed willingness to have the study screening test, but the association was no longer statistically significant (Table 84). Having had a Pap smear in the past was a significant predictor of intention to have screening. However, having more risk factors for cervical cancer was not related to screening intention. Repeating the logistic regression model with an interaction term between the intervention effect and level of risk showed no significant interaction (p=0.59).

Table 84: Results of logistic regression model assessing the factors associated with women's expressed intention to have the study screening test

Intention to have study screening test	Adjusted OR	(95% CI)	Level of significance
Exposure to intervention	0.60	(0.28 – 1.29)	0.191
Previous Pap smear within last 5 years	2.54	(1.03 – 6.21)	0.042
Regular dentist attendee	2.26	(0.96 – 5.29)	0.062
Having family/friends with cancer	1.99	(0.89 - 4.48)	0.096
Higher risk for cervical cancer	0.94	(0.44 - 2.02)	0.871

Overall 87.6% (240/274) thought the Government should set up a national screening programme, including 59% (n=26/44) of those who did not want to attend themselves. Those in the intervention group were less likely to think such a programme should be implemented compared with the control group, though the difference was not statistically significant (Table 85).

Table 85: Expressed willingness to attend, and support for national screening programme, in control and intervention groups

% Control (n = 136)	% Intervention (n = 138)	Difference (95% CI)	Unadjusted OR (95% CI)	P value
Expressed willingness to attend for screening				
88.2	79.0	9.2 (3.2 – 21.7)	0.50 (0.26 – 0.97)	0.039
Government should set up national screening programme				
89.8	85.4	4.38 (-0.35 – 12.2)	1.50 (0.72 – 3.11)	0.273

6.5 Discussion

Providing women with more information about the risks and uncertainties of screening, as well as the benefits, resulted in a small reduction in expressed willingness to attend for screening. However, even among women who were given more information, intended screening rates were nearly 80%. Furthermore, there was no evidence that providing women with more information adversely affected those at higher risk.

6.5.1 Strengths and weaknesses of the study

This is the first trial to assess the effect of giving evidence-based information on women's expressed willingness to attend for a screening test that is already well established. The 5-year coverage for screening within the study population was the same as that for Birmingham generally (80.6%)[240] and this, together with the high response rate suggests that the samples were fairly representative of the target group.

The study attempted to blind participants to what the study test was, and the condition to which screening referred. The aim was to limit interference with their current understanding and beliefs about the Pap smear. On the other hand, decisions may have differed had women known that we were referring to cervical screening. As in some other studies[349],[350] the principal outcome was expressed willingness to have screening, which may differ from actual attendance. This may partly explain the higher proportion of women who said they would attend, compared with those that currently have Pap smears. Knowledge could not be compared between the two groups, and could not directly infer that women in the intervention group had a better

understanding of the pros and cons of the test. Also, the sample size did not allow sufficient power to detect a difference in intended uptake of less than 15% between groups.

6.5.2 Findings in relation to other studies

A few studies have investigated the effects of offering different types of information on intended[350; 351] or actual uptake[352; 353] of screening. Providing more information increases knowledge and assists in decision-making[354], but has an unpredictable effect on uptake[355]. In three studies assessing the effect of information giving on decisions to undergo screening for prostate cancer, two found that intervention reduced uptake, whilst in the other there was no effect[354]. In a study to assess willingness to undergo screening for pancreatic cancer, participants who were given extended information were significantly less likely to accept the test compared with those given basic information[350]. However, in a trial of women at low to moderate risk of breast cancer, better information had no effect on wanting to have genetic screening[352]. Decisions on screening are not just influenced by the information provided, but also by other factors, such as values, cultural beliefs and personal experiences[355]. There was a tendency for women who had personal contact with someone with cancer to be more likely to want to undergo screening.

6.5.3 Implications

The GMC guidelines, the National Screening Committee and various researchers all emphasise the importance of informed decision making for people undergoing screening. In cervical screening where a programme is now well established, the

tension is between maintaining a high enough coverage, particularly among women at high risk, to have a population impact, and ensuring that women given informed consent. This study has shown that providing women with a more balanced and honest appraisal of the pros and cons of screening does not have a major impact on decisions to have the test. Furthermore, such information is not likely to differentially deter women at high risk. Fears that providing more information would make the programme unviable appear unfounded.

6.5.4 Unanswered questions and future research

The intervention leaflet offered evidence based information related to the topics emphasised by the GMC. However, it is not known whether this contained sufficient information for decision making and whether it included messages, that women who have been through the process themselves, would feel are important. Furthermore, although there is some evidence that the medium used to convey information has little effect on knowledge, understanding or decision making[355], little is known about the most effective form of presentation.

6.5.5 Conclusions

The findings suggest that providing women with a more balanced appraisal of the pros and cons of screening, as well as being more ethical, would not have a major impact on uptake and would not adversely affect women at higher risk.

7 Concluding Remarks

When considering screening, it is important to note that it is more than the application of a single test. Screening consists of a series of steps, from the identification of the population at risk, who are offered the initial test, through to the diagnosis of disease or its precursors in some individuals, and subsequent treatment. The principles[2; 3] that need to be considered before setting up such a programme were briefly discussed in the introduction to this thesis and those related to the programme are outlined in box 3. The studies reported here will now be discussed in relation to these principles and to issues that need to be considered by policy makers in Hong Kong before deciding on setting up a cervical screening programme.

Box 3: Principles to be considered for a screening programme[3]

- There should be evidence from high quality randomised controlled trials that the screening programme is effective in reducing mortality or morbidity.
- There should be evidence that the complete screening programme (test, diagnostic procedures, treatment/ intervention) is clinically, socially and ethically acceptable to health professionals and the public.
- The benefit from the screening programme should outweigh the physical and psychological harm (caused by the test, diagnostic procedures and treatment).
- The opportunity cost of the screening programme (including testing, diagnosis and treatment) should be economically balanced in relation to expenditure on medical care as a whole.
- There should be a plan for managing and monitoring the screening programme and an agreed set of quality assurance standards.
- Adequate staffing and facilities for testing, diagnosis, treatment and programme management should be available prior to the commencement of the screening programme.
- All other options for managing the condition should have been considered (e.g. improving treatment, providing other services).

7.1 Arguments for developing a screening programme

In chapter 1, the epidemiology of cervical cancer was discussed. Based on this information, it is known that cervical cancer is an important health problem, particularly given the higher incidence rates in Hong Kong relative to many other countries. The disease has a recognisable pre-invasive stage that can be identified through application of a relatively simple test (cervical smear test). Treatment of this early stage has been shown to prevent progression to invasive disease, and evidence from countries with screening programmes suggests that both incidence and mortality can be reduced. In chapter 2, it was found that screening is also effective in the Hong Kong population, particularly in relation to squamous cell carcinomas. Therefore, the levels of benefit observed in other countries with organised screening programmes are likely to occur in this population as well.

Uptake rates for screening in countries with an organised programme are high, suggesting that such a programme is acceptable to the population. However, in chapter 3 it showed that in Hong Kong a large proportion of women do not attend for cervical screening. Those who are being screened have lower risk, and are screened more frequently than necessary. Furthermore, the study reported in chapter 4 demonstrated that currently there is great diversity in the way screening is provided, managed and organised in Hong Kong. An organised centrally co-ordinated screening programme would require a uniform plan for programme management and based on the model developed in chapter 3, it would have been expected to prevent more deaths, at a lower cost. It therefore seems reasonable to consider setting up such a programme.

7.2 Some considerations against a programme

It is also important to consider the other principles suggested by Wilson and Jungner and the National Screening Committee in the UK. First, although much is known about the natural history of the disease, the nature of pre-invasive disease is not fully understood. The incidence of pre-invasive disease is far higher than expected, and the factors that result in progression and regression are not known. This has implications for how information is conveyed to participants in the screening programme. Many positive smears occur in women who, untreated, would not have progressed to developing invasive disease. This means that the programme generates unnecessary anxiety related to false positive results and there is a degree of waste in resources.

There have been no randomised controlled trials to assess the effectiveness of cervical screening. Although the weight of evidence from observational studies is strong and convincing, it is likely that the magnitude of benefit achievable by a programme will be lower[138]. This will need to be taken into account when considering the economic benefits of a screening programme.

It is also relevant that compared with other major health problems in the region – such as vascular disease, and cancers of the lung, breast and gastrointestinal system, the incidence of cervical cancer is relatively low. Therefore it is important to consider the opportunity cost of setting up a cervical screening programme against other interventions. From a public health perspective, screening is only one contributor to reducing cancer deaths in the population. A study of the likely contribution of various

preventive interventions to overall cancer mortality reduction in the USA[356], estimated that screening would contribute about 3% (Table 86).

Table 86: Estimated cancer death reduction (all cancers) in USA by the year 2000

Type of prevention	**Percentage reduction**
Diet	8
Smoking reduction	8 – 15
Improvements in treatment	10 – 26
Screening	3
Total	29 – 52

Source: reference[356]

Primary prevention measures should therefore be considered and implemented where possible. For example, given the important role of HPV in the aetiology of cervical cancer, effective health promotion interventions aimed at reducing other sexually transmitted diseases should contribute to reducing cancer incidence. Both active and passive smoking are also important risk factors for cervical cancer, particularly squamous carcinoma (as discussed in chapter 2). Smoking control and prevention interventions are therefore important for preventing this, as well as other smoking related diseases.

7.2.1 Challenges to setting up an organised screening programme in Hong Kong

7.2.2 Programme organisation

The study of practitioners reported in chapter 4, shows the great range of current providers for screening, as well as diversity of screening arrangements and follow-up.

The first challenge to setting up an organised programme would therefore be standardisation of the various components in the system. Unless there are set criteria and guidelines for quality assurance and programme delivery, the programme and its effectiveness cannot be monitored. This would require consensus being reached on defining the target population, specification of the screening interval and quality assurance standards.

There is no worldwide consensus on issues such as age at which screening should start and end or screening intervals[210]. In Hong Kong, the incidence of cervical cancer starts to rise from the mid-30's to a peak in the late 50's age group. However, incidence remains high well into the mid-70's. Given that pre-invasive lesions usually pre-date invasive disease by about 10 years, this suggests that screening should start in the 20's and continue at least to the late 60's. However, other considerations include the cost-effectiveness ratios of screening at different ages. For example, a study examining the effect of extending screening up to age 74 rather than 65, showed that this would result in a reduction in risk of death from cervical cancer by about 18 in 10,000 and increase life expectancy by 3 days. This would be achieved at a marginal cost per life year of £52,241[100].

Similarly, screening intervals suggested in different programmes vary from yearly to 5-yearly. In the UK, a review of the literature was undertaken to consider the effects of reducing the screening interval from 5- to 3-yearly[357]. The review concluded that the additional cost of 3-year policy would be £200,000 per year per 100,000 eligible women (1995 prices). This was equivalent to £143,000 per extra case prevented. In chapter 3, the effect of various policies on effectiveness and estimated efficiency are

discussed. In general, little would be gained by having a screening interval lower than 3-yearly, and a 5-yearly programme would result in similar benefit at much lower cost.

The telephone survey reported in chapter 3 suggests that women at highest risk of cervical cancer tend not to attend for screening. Lack of knowledge about screening was the main reason for non-attendance. Therefore another important challenge to setting up a screening programme is invitation of the target group for screening. In the absence of population registers and with the diversity of providers, this would require a combination of approaches including the use of the media and health care providers.

Although uptake rates for screening are high in many countries with organised programmes, this is achieved by conveying information that emphasises the benefits of screening to the public. In chapter 6, the ethics of informed consent in screening was discussed. The pilot trial reported here suggests that providing more full information on the benefits and harms of screening may deter some women. However, a larger trial would be needed to assess the full impact on uptake. Also, more research is needed on they type of information and method of delivery that would enable participants to make an informed choice about participation.

Another important consideration is the extent to which the current health care system would have the capacity to expand to allow a greater proportion of women to participate in the screening programme. Whilst facilities for screening may be found, resources required for analysing smears (timely reporting from laboratories), testing

and diagnosing those with abnormalities and treatment facilities should also be taken into account.

7.2.3 Screening methods and management of abnormal smears

The practitioner study also showed that there is no recognised basic training for smear takers, the equipment for taking smears varies and the type of labarotories involved in analysing smears are diverse. Standardisation of procedures with the introduction of guidelines is therefore an important aspect of an organised programme. Given that practitioners and laboratories are in both the public and private sector, it would be reasonable to set up a system of accreditation for providers eligible to participate in the organised programme.

Currently providers for screening services do not necessarily have a direct link with diagnostic and treatment services, to which women with abnormal smears would be referred. Most providers would be unaware of whether women identified with an abnormality actually attend for subsequent follow-up. Compliance is a key factor in determining the success of a screening programme, yet studies even in countries with organised programmes have shown that non-adherence following screening is not uncommon, and can be as high as 40%[17; 358; 359]. Therefore it is important to identify lines of responsibility to ensure follow-up and treatment of individuals identified with an abnormality through screening. There also needs to be an agreed policy on both the reporting of smear results, and the subsequent management plan.

7.2.4 Monitoring the programme and use of resources

In chapter 6, one approach to monitoring was discussed. Use of TQM techniques is useful for monitoring and improving an organised programme. However, this requires agreed data collection procedures and a system for collating and analysing such data. Standards and targets for the programme would also have to be agreed in advance. These have to be carefully thought through, so as to reflect the screening process and be good indicators of screening effectiveness. For example, a target for coverage set in many countries, may be inappropriate if the emphasis of the programme is to offer informed choice.

7.3 Conclusions

The current system of screening in Hong Kong achieves poor coverage, is inequitable, wastes resources unnecessarily and may be resulting in more harm as a result of over-screening low risk women. Introduction of an organised cervical screening programme could contribute to a reduction in mortality and morbidity from this important disease. However, this would be achieved at high initial and ongoing costs. Introducing such a programme would require commitment to adequate long term resources, and development of agreed policies for screening methods, programme organisation and monitoring.

Appendix 1: Questionnaires used for case control study and for cross-sectional study

Appendix 2: Calculation of potential number of cases prevented by screening

Firstly, information was obtained regarding the average number of incident cases of cervical cancer observed per year (O_a) in Hong Kong for each age group (a), based on a 5-year average (from latest available period 1988-1992). For each age group (a), the average proportion reduction (R_a) for cumulative incidence was calculated as:

$$R_a = \sum S_{ai} * R_i$$

where S_{ai} = the proportion of women screened at each interval

and R_i = the interval specific proportional reduction in incidence

(from Table 21, assuming this to be the same for all age groups)

For each age group, the number of new cases of cervical cancer expected if there were no screening (E_a) is then given by $E_a = O_a / (1 - R_a)$

The potential number of cases prevented for each age group (P_a) is then:

$$P_a = E_a - O_a$$

The total number of cases potentially prevented (P) is given by:

$$P = \sum P_a$$

For example, for a = 20 to 39 age group:

Screening interval (months) (i)	Proportion screened (S_{ai})	Expected proportional reduction (R_i)	Number of cases / year (1990-1994) (O_a)
0-11	0.280	0.935	72.5
12-23	0.147	0.925	
24-35	0.046	0.908	
36-47	0.022	0.871	
48-71	0.024	0.836	
72-119	0.014	0.713	
120	0.000	0.641	
120+	0.022	0.375	
Never	0.445	0	

$R_a = \sum S_{ai} * R_i = 0.497$

$E_a = O_a / (1 - R_a) = 146$

Therefore $P_a = E_a - O_a = 73$

For estimating the interval-specific screening coverage in each age group, those that were included only had at least two previous screening tests, or women who had only one test, but intended to return for further screening. Women, who had only one screening test and were not intending to have any more, were assumed to have the same benefit as those who were screened over 10 years ago.

Appendix 3: Questionnaire used for practitioner study

Appendix 4: Questionnaire used for practices with high or low inadequate smear rates

Appendix 5: Questionnaire used for randomised controlled trial (chapter 6)

First, we want to know something about your general health:

1. In the recent months, do you think your health is:

- ❑ Very good
- ❑ Good
- ❑ Poor
- ❑ Very poor

2. On average, how often do you visit your GP?

- ❑ Weekly
- ❑ Fortnightly
- ❑ Monthly
- ❑ Once every 3 months
- ❑ Twice yearly
- ❑ Yearly
- ❑ Other, please specify . . . . . .

3. Do you visit your Dentist regularly?

- ❑ Yes:
  - ❑ Every 6 months
  - ❑ Yearly
  - ❑ Other, please specify . . . . . .
- ❑ No

4. Do you smoke currently?

- ❑ Yes
- ❑ No

If no, have you ever smoked?

- ❑ Yes
- ❑ No

5. Have you had any major illnesses in the past 10 years or suffer from any chronic disease?

- ❑ Yes
- ❑ No

If yes, please would you say:

what the problem was/is . . . . . .

and approximately what year the problem first started . . . . . .

6. Has anyone in your family or among your close friends had any one of the following conditions?

- ❑ Diabetes
- ❑ Heart disease
- ❑ Psychiatric disorders
- ❑ Asthma
- ❑ Epilepsy
- ❑ Cancer, if so please specify what type . . . . . .

7. Have you ever had a smear (cervical smear) in your lifetime?

- ❑ Yes

  Please state when the last test you had was:
  - ❑ Within the last 3 years
  - ❑ Within the last 5 years
  - ❑ More than 5 years ago

- ❑ No

  Please state your main reason for not having the test:
  - ❑ I don't know what it's for
  - ❑ It's inconvenient to get to a clinic
  - ❑ The test is humiliating
  - ❑ The test will be painful
  - ❑ I don't have time to attend for a test
  - ❑ Other medical problems prevent me from going
  - ❑ I don't want to have a test
  - ❑ I'm scared of what the test will show
  - ❑ Other reason, please specify . . . . . .

8. Have you ever had a mammogram in your lifetime?

- ❑ Yes

  Please state when the last test you had was:
  - ❑ Within the last 5 years
  - ❑ More than 5 years ago

- ❑ No

  Please state your main reason for not having the test:
  - ❑ I'm too young to have one
  - ❑ I don't know what it's for
  - ❑ It's inconvenient to get to a clinic
  - ❑ The test will be humiliating
  - ❑ The test will be painful
  - ❑ I don't have time to attend for a test
  - ❑ Other medical problems prevent me from going
  - ❑ I don't want to have a test
  - ❑ I'm scared of what the test will show
  - ❑ Other reason, please specify . . . . . .

We would now like to give you some information about an important cancer in the UK, for which screening is possible.

We would now like to know;

9. Given this information, do you think the Government should implement a National Programme for this condition?

- ❑ Yes
- ❑ No
- ❑ Don't know

10. Would you have the screening test yourself?

- ❑ Yes
- ❑ No
- ❑ Don't know

Finally, we would like some personal information about you. We would be grateful if you would complete this last section of the questionnaire:

11. Please would you write down how old you are now

. . . . years old

12. What is your marital status?

- ❑ Single (never married)
- ❑ Married or living with a partner
- ❑ Separated or divorced
- ❑ Widowed

13. The main wage earner in the household is usually described as the head. From this list below, please describe the occupation of the head of your household. (If presently retired or unemployed, please give information about the last job, or choose the 'never worked' box)

Non-manual occupation:

- ❑ Professional occupations (e.g. doctor, lawyer)
- ❑ Managerial and lower professional (e.g. sales managers, teachers)
- ❑ Non-manual skilled occupations (e.g. clerk, shop assistant)

Manual occupations:

- ❑ Skilled manual occupations (e.g. bricklayer, engineering trades)
- ❑ Partly skilled manual occupations (e.g. farm worker, postman)
- ❑ Unskilled occupation (e.g. general labourer, cleaner)

Other:

- ❑ Member of armed forces
- ❑ Student
- ❑ Never worked
- ❑ Other: please briefly describe the occupation of the head of the household . . . .

14. Which ethnic group best describes you?

- ❑ White
- ❑ Asian (including Indian, Bangladeshi, Pakistani)
- ❑ Black (including Caribbean, African)
- ❑ Chinese
- ❑ Other, please specify . . . . . .

THANK YOU FOR YOUR HELP!
Please return this questionnaire to the receptionists before you leave the surgery.

Appendix 6: Information in intervention Leaflet

Cancer Screening Test

Introduction:

We would like to tell you about a test that is now available to detect the early signs of cancer. The sign that cancer may develop can be spotted in advance, and it can be prevented even before the cancer has started.

On average, around 10 out of every 100,000 (or 1500 women) die from this cancer in the UK each year. The risk is lower in younger women. Yet a quick, simple and painless test is available, that might have saved their lives. We would like to tell you more about this test.

What is the test?
The test can pick up abnormalities, which are the warning signs that cancer may develop if no treatment is given. As with all medical tests, this is not 100% perfect. *There is approximately 10% chance that the test report will be normal, even when there is an abnormality.* If you have any problems between tests, you should still consult your GP.

The test takes a few minutes and is painless, although slight discomfort may be felt occasionally. You could have the test at your GP surgery, or at a family planning clinic. You will be asked to undress from the waist down, and the test involves a vaginal examination.

What happens next?
After the test you will be told how, where and approximately when you will get the results. *Each time you have a test, there is a bout 7% chance that you will be called back for further tests.* This may be because the test didn't show up clearly and another test is needed. *In 3% of tests, slight changes are detected in the cells that were tested. In this case, the test result is abnormal.*

What happens if I have an abnormal result?
You may be asked to have another test. Sometimes the abnormal changes return to normal by themselves. But if the repeat test still shows abnormal cells, you may need to have more extensive tests. You will be asked to go to a hospital for a closer examination and treatment. The treatment is a minor procedure done on an out-patient basis.

Not all people with abnormal results actually have any disease – in fact about 2000 women will be recalled for further tests for every 1 woman who has early cancer.

How often would I be tested?
You are recommended to have the test at least once every 5 years, from when you are 20 years old. *If you have the test regularly, the risk of you having this cancer will reduce to 1 per 100,000.*

What is the cost of this test?
Each time you have a test, this will cost the NHS about £35.

In summary, what are the benefits and possible problems of having this test for me?
Your risk of dying from this cancer without the test is about 10 in a 100,000. Your risk is lower if you are younger (below 45 years old). By having the test regularly (at least every 5 years), you could reduce your chances of dying from this cancer to 1 in 100,000.

However, every time you have a test, you have 7% chance of being called back, and 3% chance that the test shows an abnormality that needs more extensive assessment. To put it another way, if you have 7 tests in your lifetime, you have a 1 in 2 chance that you will be called back, and 1 in 5 chance that you will need more tests at least once. If you are called back and need more tests, there is 1 in 2000 chance that you actually have serious disease that needed treatment.

On the other hand, even if your test result is normal, you have 1 in 10 chance that you have an abnormality that wasn't spotted by the test.

Sections in italics are additional information that was not in the control leaflet.

Appendix 7: CONSORT details

Paper section and topic	Item	Description
TITLE & ABSTRACT	1	One of us (PA) prepared a computer-generated list of random numbers, which was used to sequence questionnaires to contain either the control or intervention leaflet.
INTRODUCTION Background	2	Scientific background and explanation of rationale- see paragraphs 1 and 2.
METHODS Participants	3	Eligibility – women aged 20 to 64 (based on NHS cervical screening programme age criteria) who visited their GPs during a one-month period. Setting – 3 general practices in Birmingham
Interventions	4	Information in the control and intervention leaflets is attached Leaflets given out at randomisation within general practices, and read at the practice
Objectives	5	Specific objectives: to assess the effects of giving additional information on the pros and cons of screening on intended uptake
Outcomes	6	Outcome measures: - Primary – "expressed willingness to have screening test"
Sample size	7	How sample size was determined - Based on detecting a difference in intended uptake between groups of 15% or more
Randomisation Sequence generation	8	Method used to generate the random allocation sequence – computer generated list of random numbers
Allocation concealment	9	Questionnaires were previously stacked in random sequence, and distributed in order, without researcher's knowledge of which had been assigned
Implementation	10	The main author generated the allocation sequence, and the 3 last authors enrolled and assigned participants to their groups.
Blinding (masking)	11	Participants and those administering questionnaires were blinded to group assignment.
Statistical methods	12	Analysis: Bivariate analysis was used to compare intended screening in relation to other factors. Any characteristic that was associated with intended uptake at a level of significance of 10% or less was entered in a logistic regression model, to obtain an adjusted odds ratio for the intervention compared with the control group. All statistical analyses were performed with SPSS (version 10).
RESULTS Participant flow	13	Flow of participants through each stage – Figure 27
Recruitment	14	Dates defining the periods of recruitment – April to May 2001
Baseline data	15	Baseline demographic and clinical characteristics of each group. The two groups did not differ significantly in terms of sociodemographic factors (except ethnicity), past cervical screening history, smoking status and dentist visits.
Numbers analysed	16	Number of participants (denominator) in each group included in each analysis See report
Outcomes and estimation	17	Odds ratios and 95% confidence intervals are stated where relevant.
Ancillary analyses	18	Subgroup analyses – none reported.
Adverse events	19	Adverse events – not relevant.
DISCUSSION Interpretation	20	Interpretation of the results, taking into account study hypotheses, sources of potential bias or imprecision: final two paragraphs.
Generalizability	21	Generalizability (external validity) of the trial findings: The 5-year coverage for screening within the study population was the same as that for Birmingham generally. However, the trial was based on women attending their GPs and would not be representative of those who do not visit their practice.
Overall evidence	22	General interpretation of the results in the context of current evidence: final two paragraphs.

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