UNIVERSITY OF BIRMINGHAM

AN EXPLORATION OF DETECTION AND MANAGEMENT PRACTICES FOR POSTPARTUM HAEMORRHAGE IN LOW- AND MIDDLE-INCOME COUNTRIES: A QUANTITATIVE SURVEY

by

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Abstract

Introduction As the leading cause of maternal mortality worldwide, postpartum haemorrhage (PPH) accounts for 27% of maternal deaths each year. With timely detection and management, the majority of PPH-related maternal deaths could be avoided or prevented. One method which could enable this is PPH-related clinical care bundles: a set of three to five discrete evidence-based clinical interventions delivered concurrently or in quick succession. The present study aimed to explore how primary PPH is currently detected and managed during vaginal birth at the E-MOTIVE trial facilities, to what extent the components of the new E-MOTIVE bundle are currently implemented within trial facilities, and what factors influence current PPH detection and management, and the implementation of the E-MOTIVE bundle.

Methods An electronic quantitative survey was conducted in health facilities across four countries: Kenya, Nigeria, South Africa and Tanzania, all of which were selected for participation in the E-MOTIVE trial. In total, 1,009 healthcare professionals completed the survey across 91 trial facilities. Data were analysed descriptively.

Results Visual estimation was the most commonly reported method of blood loss measurement by participants (*n*=885, 89.5%). Amongst those who indicated that detection of PPH was part of their clinical role, 21.8% (*n*=216) reported that they use an obstetric drape. Current performance of the E-MOTIVE bundle components varied, with 93.0% (*n*=929) of participants regularly performing uterine **M**assage, 92.7% (*n*=925) administering **O**xytocin, 47.8% (*n*=477) administering **T**ranexamic acid, 90.8% (*n*=907) administering **IV** fluids, and 55.6% (*n*=555) performing Examination of the genital tract in the delivery room. When exploring methods to improve the detection and management of

PPH, 96.0% (*n*=949) of participants agreed or strongly agreed that they intend to improve their knowledge of PPH. Participants indicated that improving team working (*n*=838, 90.4%), increasing the availability of supplies (*n*=757, 81.7%), having all the required supplies in one place (*n*=744, 80.3%), and more training (*n*=714, 77.1%), would make it easier to perform multiple PPH management interventions together in a bundle.

Conclusions This research outlines the current PPH detection and management practices of healthcare professionals working in the E-MOTIVE trial facilities. Differences between current practice and the target E-MOTIVE intervention were identified. Current barriers and enablers to the application of the intervention were discussed, and implementation strategies to support the E-MOTIVE bundle are suggested. Future research may further explore descriptive differences found at the country and cadre level.

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List of abbreviations

ACOG - American College of Obstetricians and Gynaecologists

BCW – Behaviour Change Wheel

BMI – Body Mass Index

COM-B – Capability, Opportunity, Motivation – Behaviour

EC – Eastern Cape

HELLP – Hemolysis, Elevated Liver enzymes and Low Platelets

ICSI – Intracytoplasmic sperm injection

IVF – In vitro fertilisation

KZN - KwaZulu-Natal

LGA – Large for gestational age

MEOWS - Modified Early Obstetric Warning System

MOH – Major obstetric haemorrhage

mL – Millilitres

MMR – Maternal Mortality Ratio

PPH – Postpartum haemorrhage

PROM - Premature rupture of membranes

RANZCOG - Royal Australian and New Zealand College of Obstetricians and Gynaecologists

RCOG - Royal College of Obstetricians and Gynaecologists

SOGC – Society of Obstetricians and Gynaecologists of Canada

TDF – Theoretical Domains Framework

VEBL – Visual estimation of blood loss

WC – Western Cape

WHO – World Health Organization

1.0 Introduction and Literature Review

Women's health issues are gaining increasing international recognition, with sex-based health disparities being brought to the forefront of our attention. Every two minutes somewhere across the world a woman dies during labour or childbirth (World Health Organization, 2019). In 2019, the World Health Organization (WHO) published a report on maternal health trends and identified that in 2017 alone, over 295,000 maternal deaths occurred globally, with a woman being at a 1 in 190 risk of dying during childbirth. A majority, 94%, of these maternal deaths occurred in low-income countries where health disparities are greatest, and most of these were considered preventable (World Health Organization, 2019).

Obstetric haemorrhage is the leading direct cause of maternal mortality worldwide accounting for over 27% of deaths of mothers each year, with more than two-thirds categorised as postpartum haemorrhage (Family Care International, 2014). In low- and middle-income settings this translates to a mother dying in childbirth every six minutes as a result of postpartum haemorrhage (PPH), often in the prime of her life, leaving a young child and family behind (Say et al., 2014). For the child that is left behind, the prospects are poor, with less than a 20% chance that the infant will survive beyond their first month of life (Family Care International, 2014). Women who survive a postpartum haemorrhage are at higher risk of severe maternal morbidities, such as shock and organ dysfunctions, and long-term disabilities, including renal failure, and lung and heart diseases (Souza et al., 2013, World Health Organization, 2012).

Although the number of global maternal deaths has dropped by 44% since 1990, the latest global estimates predicted that in 2015 alone, 303,000 women died during childbirth (Alkema et al., 2016). In 2017, 86% (254,000) of the estimated global maternal

deaths occurred in Sub-Saharan Africa and Southern Asia (World Health Organization, 2019). Data relating to global maternal deaths since this date is yet to be published, and as such we are not aware of changes to these figures over the last five years. The disparities between maternal deaths in low- and high-income countries can be observed through the maternal mortality ratios (MMR) reported in each of these classifications of nations. The WHO reported that in 2017, the MMR in low-income countries was 462 deaths per 100,000 live births, compared to 11 per 100,000 live births in high-income countries (World Health Organization, 2019).

For these reasons, addressing the challenge presented by PPH in low- and middle-income settings must be a priority for women's healthcare providers and researchers across the globe.

1.1 Defining postpartum haemorrhage

Major obstetric haemorrhage (MOH) is defined as any form of excessive bleeding experienced by a woman during pregnancy, childbirth or the postpartum period (Trikha and Singh, 2018). The most common type of major obstetric haemorrhage is PPH (Mavrides et al., 2016).

The traditional definition for PPH is a blood loss of greater than 500 mL following a vaginal delivery, or of more than 1000 mL following a caesarean section birth. When a woman loses more than 500 mL of blood from the genital tract within the first 24 hours of the birth of her baby this is a primary PPH (Mousa et al., 2014). When blood loss continues past the 24 hour threshold this is then classified as a secondary postpartum haemorrhage (Alexander et al., 2002). In cases where PPH is persistent despite medical and non-

medical-management, repair of lacerations, and manual removal of retained placental tissue, this is defined as refractory or intractable postpartum haemorrhage (Gülmezoglu, 2009).

Such definitions exist as a result of the meeting of a Technical Working Group at the WHO in Geneva, 1989, and have been accepted and adopted since that date. The working group recognised that the thresholds of 500 mL were arbitrary and may not always have clinical significance. However, a value of 500 mL was kept, as the group acknowledged that healthcare providers were unable to accurately visually estimate blood loss, and often underestimated the volume of blood that a woman had lost during and after childbirth (World Health Organization, 1990).

Twenty years later this was still the case, as identified in a systematic review by Schorn (2010) that reported that healthcare providers often define PPH subjectively based on estimating blood loss. The author argued it was and continued use in clinical practice was questionable. Average blood loss during birth often exceeds these thresholds, and symptoms of PPH can be hidden by pregnancy-related plasma volume increases (Schorn, 2010). In addition, these common thresholds are only applicable for women who are of normal body mass. Women with a higher or lower than average body mass index (BMI) have an increased risk of PPH, and as such, different thresholds of blood loss may be of greater clinical significance in such populations (Knight et al., 2014, Knight et al., 2019).

As a result of these and other factors, in more recent years, various authors have challenged these definitions and redefined PPH with terms and values with greater clinical significance (Rath, 2011, Kerr and Weeks, 2017). Doing so is of clear importance, as without clear and transparent evidence-based clinical definitions, healthcare professionals

and researchers will be unable to address or report the issue transparently or consistently. In a commentary, Kerr and Weeks (2017) proposed that it is time to move away from a universal definition of PPH, and that three distinct definitions for PPH are required for different purposes. The first should be as a trigger point to when to start treatment for PPH, the second should be about consistency for audit purposes, and the final definition should be used for reporting research outcomes.

In addition to blood loss volumes, evidence suggests that including clinical signs of cardiovascular parameters after delivery and shock index, defined as heart rate divided by systolic blood pressure, can aid more accurate diagnosis of PPH (Borovac-Pinheiro et al., 2018). Furthermore, careful monitoring of the woman's vital signs, such as temperature, heart rate, blood pressure, and respirations, immediate diagnosis of the cause of PPH, and laboratory tests (such as those for coagulation) would help to better define PPH and reduce maternal mortality and morbidity. Consensus is yet to be reached on acceptable definitions for clinical settings, audit, and research

For the purposes of this thesis, in line with the definitions of PPH adopted for the E-MOTIVE trial (Trial registration: ClinicalTrials.gov No.: NCT04341662), of which this work is part, PPH is defined as blood loss greater than or equal to 500 mL, and severe PPH as blood loss greater than or equal to 1000 mL (see https://www.birmingham.ac.uk/Documents/college-mds/trials/bctu/E-MOTIVE/E-MOTIVE%20protocol%20v2.0%20clean.pdf).

1.2 Aetiology and risk factors for postpartum haemorrhage

The most common aetiologies for PPH can be summarised using the mnemonic the "Four T's":

1. Tone,
2. Trauma,
3. Tissue, and
4. Thrombin (Anderson and Etches, 2007).

Uterine *tone* (atony), where the uterus fails to contract adequately after childbirth, is the most common cause of PPH. It has been suggested that uterine atony is responsible for at least half of reported cases of PPH, yet this might be an underestimate and could be the cause for up to 80% of reported cases (Deneux-Tharaux et al., 2014, Feduniw et al., 2020). *Trauma* to the genital tract is responsible for approximately 15-20% of cases of PPH (Sentilhes et al., 2016). Trauma can include lacerations and haematomas, as well as surgical interventions such as caesarean section and episiotomy (Anderson and Etches, 2007). *Tissue* refers to retained products of conception, which can include retained placenta, where there is a failure to deliver the placenta within 30 minutes after birth, and invasive placenta, where the placenta attaches too strongly or invades too deeply into the wall of the uterus. Retained products of conception such as these have been reported to increase the likelihood of PPH by 3.5 times (Sheiner et al., 2005). The final T, *thrombin*, is the rarest cause of PPH accounting for approximately 1% of cases. Most coagulopathies or coagulation disorders are identified in advance of delivery and so can be accounted for, and advance plans can be put in place to prevent PPH during birth. Such disorders include haemophilia, idiopathic thrombocytopenic purpura, von Willebrand's disease, and thrombotic thrombocytopenic purpura (Anderson and Etches, 2007).

Whilst all women are at risk of experiencing a PPH during childbirth, several factors can increase the likelihood of a PPH occurring. The most prevalent risk factor is a previous history of PPH (Feduniw et al., 2020). Despite PPH being more common in women who have previously experienced a PPH, it is important for clinicians to be prepared and equipped to detect and manage a case of PPH in any delivery, given that around 20% of reported cases occur in women who have no reported risk factors (Magann et al., 2005).

Risk factors for PPH can be categorised into maternal diseases, pregnancy-associated conditions, labour-related factors, and sociodemographic factors (see Table 1). All of these factors are associated with an increased likelihood of experiencing a PPH. Smoking is the only known factor which is associated with a decreased risk of PPH, despite the known negative influences that this can have on maternal and foetal outcomes both during and subsequent to pregnancy (Girault et al., 2018, Cnattingius, 2004).

1.3 Detecting postpartum haemorrhage

Real-world detection rates for PPH are low, with healthcare professionals often relying on visual estimation of blood loss to diagnose a PPH. Visual estimation of blood loss (VEBL) is a tool-free method where the attending healthcare professional visually inspects and judges the volume of blood a woman has lost during and after birth by eye. Measuring blood loss using visual estimation is inaccurate and unreliable, and can result in major delays to the initiation of treatment (Hancock et al., 2015). More specifically, data suggests that there is no correlation between measured and estimated blood loss at vaginal delivery, where underestimation could range between 46% and 75% (Brant, 1966, Brant, 1967,

Duthie et al., 1991, Razvi et al., 1996). When compared with spectrophotometry, visual estimation can underestimate blood loss after vaginal birth by between 33% and 50% (Al Kadri et al., 2011, Schorn, 2010, Rath, 2011). Although this method is inaccurate and therefore may be clinically of limited value, it is routinised by healthcare professionals across all birth settings, and as such tradition and ease appear to be the main factors which underpin sustained use (Schorn, 2010). Underestimation can have grave consequences and therefore where possible, other methods to estimate blood loss after vaginal birth should be used which have greater accuracy and associated outcomes.

Alternative methods of blood loss estimation include direct measurement, gravimetric, photometry, and miscellaneous methods (Schorn, 2010). These alternative methods to VEBL range in diagnostic accuracy. The most accurate methods for blood loss estimation are photometric methods which include the evaluation of haemoglobin concentration in venous blood, and spectrophotometry (Diaz et al., 2018). Although such methods enable greater quantification of blood loss, these are difficult to perform and are not available in most healthcare settings, particularly in low- and middle-income countries (Patel et al., 2006, Pacagnella et al., 2013).

Table 1 Risk factors for postpartum haemorrhage, adapted from Mavrides et al. (2016).

The four Ts	**Risk factors and notes**
Tone: abnormalities of uterine contraction	
Overdistension of uterus	Polyhydramnios, multiple gestation, macrosomia
Intra-amniotic infection	Fever, prolonged rupture of membranes
Functional/anatomic distortion of uterus	Rapid labour, prolonged labour, fibroids, placenta praevia, uterine anomalies
Uterine relaxants, e.g. magnesium and nifedipine	Terbutaline, halogenated anaesthetics, glyceryl trinitrate
Bladder distension	May prevent uterine contraction
Tissue: retained products of conception	
Retained cotyledon or succenturiate lobe	
Retained blood clots	
Trauma: genital tract injury	
Lacerations of the cervix, vagina or perineum	Precipitous delivery, operative delivery
Extensions, lacerations at caesarean section	Malposition, deep engagement
Uterine rupture	Previous uterine surgery
Uterine inversion	High parity with excessive cord traction
Thrombin: abnormalities of coagulation	
Pre-existing states	
Haemophilia A	History of hereditary coagulopathies or liver disease
Idiopathic thrombocytopenic purpura	Bruising
von Willebrand's disease	
History of previous PPH	
Acquired in pregnancy	
Gestational thrombocytopenic	Bruising
Pre-eclampsia with thrombocytopenia e.g. HELLP	Elevated blood pressure
Disseminated intravascular coagulation	
a) Gestational hypertensive disorder of pregnancy with adverse conditions	Coagulopathy
b) In utero fetal demise	Fetal demise
c) Severe infection	Fever, neutrophilia/neutropenia
d) Abruption	Antepartum haemorrhage
e) Amniotic fluid embolus	Sudden collapse
Therapeutic anticoagulation	History of thromboembolic disaease

Publications as early as 1919 indicate the use of direct methods of blood loss estimation during birth was established practice (Williams, 1919). Direct methods employ the use of a tool to enable healthcare professionals to visually gauge how much blood a woman has lost after birth. Tools that have been to directly measure blood loss include bed pans or a kidney basin placed in front of the external genitalia to catch loss (Ambardekar et al., 2014), a bucket with a funnel placed underneath a cholera bed (Strand et al., 2003), standardised cloth mats (Prata et al., 2005, Prata et al., 2012), a Kelly's pad with basin (Vanitha et al., 2019), and calibrated under-buttocks drapes (Zhang et al., 2010, Diaz et al., 2018). In some cases, these tools are utilised as they are available in the maternity setting, and so act as a convenient receptacle to collect the blood that has been lost. In other cases, a measurement line is added to the article at a predetermined volume, such as 500 mL, which can act as a call to action for the healthcare professional. It has been hypothesised that using direct methods of blood loss estimation can lead to improved PPH detection rates, improved accuracy of blood loss estimation, reduced likelihood of underestimation, as well as improved detection and management of postpartum haemorrhage as a whole (Schorn, 2010, Al Kadri et al., 2011). Unfortunately, most of these methods have not been validated against any gold standard measurement of blood loss such as peripartum haemoglobin levels, and as such their efficacy cannot be confirmed or denied (Atukunda et al., 2016).

Gravimetric methods to determine blood loss involve calculating the volume of blood lost by weight. As part of this method, healthcare professionals may collect blood in a basin, bucket, or drape as well as using absorbent materials such as gauze, swabs, pads, or mats, which are then weighed on a scale. The dry weight of any non-blood materials is noted before the procedure and subtracted from the weight given on the scale, with the

resultant weight indicating the volume of blood that has been lost by the woman. In 1955, Rains and colleagues reported two different methods of gravimetric blood loss estimation, the first weighed swabs and towels as soon as they were well blood-stained, and the second weighed the patient before and after the procedure to estimate the total loss of fluid and blood-loss (Rains, 1955). Of these two methods, weighing contaminated swabs, linens, towels, and pads is used more often than weighing the patient in modern obstetrics, as it can be performed continually throughout procedures, and can be easily taught and undertaken in practice. However, this technique does not account for other birth-related fluids such as urine and amniotic fluids and can be both time- and labour-intensive (Schorn, 2010). Weighted blood loss has poor sensitivity but high specificity when compared to photometric methods; where quantifiable cell-indices are unavailable gravimetric methods may be a reasonable technique to detect PPH (Atukunda et al., 2016).

A limited number of randomised trials have compared the use of these blood loss estimation methods. One conducted by Ambardekar and colleagues (2014), compared the use of a calibrated drape against indirect gravimetric techniques and reported that there was a significant difference in blood loss measurement between these methods. Significantly greater mean blood loss was recorded by the direct calibrated drape (253.9 mL) than by the indirect gravimetric technique (195.3 mL; difference = 58.6 mL (95% CI: 31.1–86.1); $p < 0.001$), with twice as many women in the direct group than in the indirect group measuring blood loss of greater than 500 mL (8.7% vs. 4.7%, $p = 0.02$) (Ambardekar et al., 2014). This data confirms the findings of Patel et al. (2006), who compared visual estimation (VEBL) with estimation using a blood collection drape in a district hospital in India. The findings of this study reported that the mean estimation of blood loss in the VEBL group was 33% lower than in the drape estimation of blood loss condition (203 mL

vs. 304 mL, respectively; difference = 101 mL, $p < 0.001$) and concluded that use of an obstetric drape was more accurate than VEBL and may be a low-cost solution to improve the accuracy of blood loss estimation in the developing world.

These factors highlight that early detection of PPH through accurate and timely estimation of blood loss is critical. At the current time, there is insufficient evidence to support the use of one method of estimating vaginal blood loss over another (Diaz et al., 2018). Using a combination of gravimetric and direct methods may be the most practical (Schorn, 2010), however, more research is required to establish a validated and reliable method which can be used across all healthcare settings.

1.4 Managing postpartum haemorrhage

Death and/or severe complications of PPH can be averted through early identification of bleeding and prompt management with evidence-based interventions (World Health Organization, 2012). This can include the prevention and/or management of hypotension, tachycardia, hypovolemia, and consequently organ failure and death as a result of tissue hypoxia (Atukunda et al., 2016).

National guidelines for PPH management vary by country, as identified in a descriptive analysis of guidelines from the American College of Obstetricians and Gynaecologists (ACOG), the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG), the Royal College of Obstetrician and Gynaecologists (RCOG), and the Society of Obstetricians and Gynaecologists of Canada (SOGC) by Dahlke and colleagues (2015). Active management of the third stage of labour, the time between the birth of the baby and the placenta, is recommended for primary prevention of

PPH by all organisations except the ACOG (Dahlke et al., 2015). For vaginal deliveries, all four organisations recommend oxytocin as the medication of choice for PPH prevention and discuss eight surgical techniques for the treatment of PPH namely: balloon tamponade, uterine packing, uterine artery ligation, uterine curettage, brace suture, arterial embolization, hypogastric artery ligation, and hysterectomy (Dahlke et al., 2015).

Variation in guidelines is reported despite the prior publication of recommendations by the WHO. In 2012, the WHO held a Technical Consultation focused on the Prevention and Treatment of Postpartum Haemorrhage, which was attended by international stakeholders including researchers, obstetricians, midwives, experts in research synthesis, experts in health care programmes, neonatologists and consumer representatives. This consultation resulted in the production of "Recommendations for the Prevention and Treatment of Postpartum Haemorrhage", which summarised and updated existing evidence-informed practices for the management of PPH (World Health Organization, 2012). As subsequently presented in the four national guidelines (Dahlke et al., 2015), WHO guidelines recommended the use of uterotonics with oxytocin as the first choice, and performance of uterine massage, and fluid resuscitation with isotonic crystalloids in all cases of PPH (World Health Organization, 2012). Where uterotonic drugs are unavailable or refractory bleeding has occurred, the use of an intrauterine balloon tamponade is recommended; in cases where persistent trauma-related, or refractory atonic bleeding, is detected the use of tranexamic acid (TXA) is advised (World Health Organization, 2012). In 2017, the WHO updated the guidelines to include recommendations for TXA for PPH treatment, in response to new evidence from the WOMAN trial (Vogel et al., 2018, Shakur et al., 2017). Temporising measures that are recommended for use until substantive care is

available are bimanual uterine compression, external aortic compression, and the use of non-pneumatic anti-shock garments (NASGs) (World Health Organization, 2012).

To effectively manage a PPH, the whole multidisciplinary team needs to work in concert, engaging in multiple interventions (Gülmezoglu, 2009). On identification of a PPH, the first contact clinician must obtain the assistance of other care providers including obstetricians and anaesthetists, establish the cause of the haemorrhage, and most importantly begin resuscitative efforts. Timely diagnosis and treatment of PPH by a team of care providers can have a significant impact on sequelae and the chance of survival of both the woman and her child (Gülmezoglu, 2009).

Although the literature uses the terms ‘treatment’ and ‘management’ of PPH interchangeably, for the purposes of this thesis the term ‘management’ will be used to describe behaviours performed to remediate a detected postpartum haemorrhage.

1.4 Identifying PPH-related challenges

Despite the variety of detection and management strategies for PPH, it persists as the leading cause of maternal mortality and morbidity worldwide (Say et al., 2014), with the highest levels of mortality and morbidity reported in low- and middle-income settings. Several challenges relating to PPH detection and management need to be addressed before any real impact on PPH-related maternal outcomes is realised.

The first challenge is that PPH is often not detected early, if at all, which results in delays in the prompt initiation of life-saving treatment. The majority of PPH detection methods remain unadopted in low- and middle-income settings due to their complexity and cost. In settings where staff are willing to adopt a tool-based solution, supply or cost serve

as barriers to implementation at a hospital or state level (Schorn, 2010, Stewart et al., 2014). Data from healthcare facilities across Kenya, Nigeria, and Tanzania suggest that PPH is accurately detected in less than 2.5% of cases, with figures as low as 1.8% in some maternity settings (Alwy Al-beity et al., 2019, Sotunsa et al., 2019).

Even when a PPH is detected in these settings women will not necessarily receive the appropriate or recommended treatment. Analysis of data from 10 countries in the 'Carbetocin HAeMorrhage PreventION' (CHAMPION) trial highlighted that of 886 women who experienced blood loss of between 500 mL and 600 mL, only 26% (n=235) received the recommended uterotonic drug for PPH management (Widmer et al., 2018). When blood loss reached 1000 mL – 1100 mL, only 68 of 96 women (70%) received a uterotonic drug for the treatment of PPH, and less than 1% (25/2,670) of women received tranexamic acid (Widmer et al., 2018). This highlights the second challenge - delayed or inconsistent use of interventions.

A third challenge for PPH detection and management is the passive dissemination of guidelines. Despite national and international recommendations for the management of PPH, current data suggest that healthcare professional adherence to guidelines is low and presents a significant barrier to improving PPH management for women globally (Widmer et al., 2018). If healthcare professionals are failing to adhere to PPH detection and management guidelines, then developing an understanding of what it is that they choose to do instead, and what factors are contributing to low adherence to recommendations is warranted.

Behavioural research has identified that passive dissemination of new clinical guidelines is unlikely to impact the practices of healthcare professionals, and often results

in minimal, if any, uptake (Michie et al., 2011). Implementing new guidelines requires considerable behaviour change at the individual, organisation, and system levels (Francis et al., 2012). When this occurs, it requires healthcare professionals to change their behaviour by adopting new practices, replacing old ones, and sometimes abandoning old practices altogether. Understanding how healthcare professionals respond to change, and the perceived barriers and enablers to adopting new behaviours is vital for comprehending adaptation in healthcare

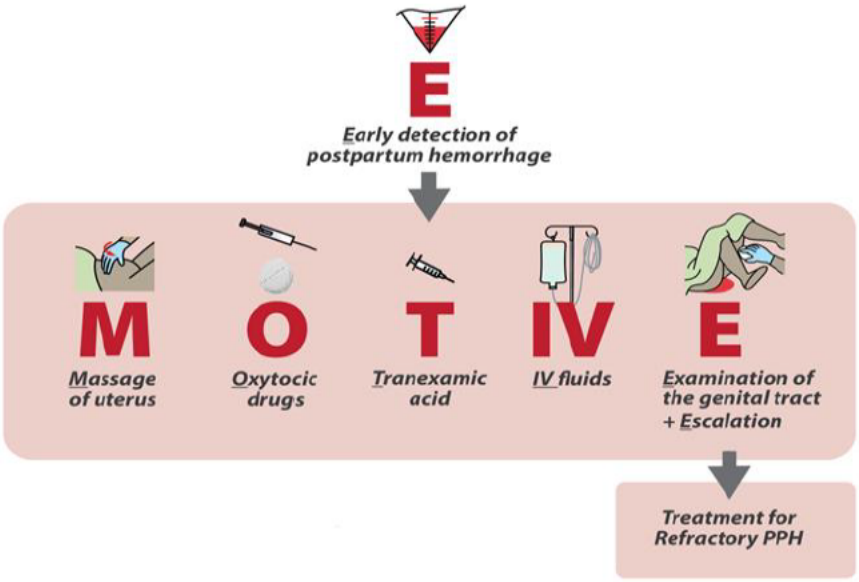
1.5 Addressing PPH-related challenges

The E-MOTIVE trial (Clinicaltrials.gov No.: NCT04341662) is a programme of research which aims to address the challenges related to PPH by improving the detection and management of primary PPH though the implementation of a clinical care bundle (https://www.birmingham.ac.uk/research/bctu/trials/womens/emotive/e-motive.aspx). Clinical care bundles are a complex intervention which aim to improve healthcare practice by integrating three to five discrete evidence-based clinical interventions which can be delivered concurrently or in quick succession (Althabe et al., 2020). When implemented in rapid succession, collectively, or concurrently, care bundles have been found to improve patient outcomes (Institue for Healthcare Improvement, 2012). All elements included in a care bundle should be evidence-based and within national guidelines (Borgert et al., 2015). Unless medically contraindicated, all elements of a bundle should be performed with all eligible patients, taking an all-or-none approach, which is a key strength of this intervention (Resar et al., 2012, Fulbrook and Mooney, 2003).

Care bundles have been proven to be an effective intervention across medical disciplines, including sepsis prevention and intensive care amongst others (Gaspar et al., 2023, Borgert et al., 2015, Avsar et al., 2022), and are also increasing in popularity within maternity care (Vogel et al., 2024). A retrospective cohort study of 463,630 births across 19 NHS Trusts in England identified that the use of the Saving Babies' Lives care bundle reduced the risk of stillbirth in England by 20%, from 4.2 to 3.4 per 1,000 births during the two-year period in which the bundle was implemented (Widdows et al., 2021). A further example of effective bundle use within maternity care is the FAST-M complex intervention which was used to detect and manage maternal sepsis in low-resource settings (Cheshire et al., 2021). Through the implementation of the FAST-M bundle, recognition of suspected maternal sepsis increased from 11.3% at baseline to 64.5% at the end of the 6-month intervention phase. Furthermore, sepsis management improved with 19.6% of women receiving all components of the bundle within one hour of recognition, vs 0% of women at baseline (Cheshire et al., 2021). This suggests that clinical care bundles may be an effective intervention within both low- and high-resource maternity settings.

The results of a WHO Technical Consultation conducted in 2017 recommended that a PPH first response care bundle should include the administration of uterotonics, isotonic crystalloids, tranexamic acid, and the performance of uterine massage (Althabe et al., 2020). The E-MOTIVE bundle contains each of these components: uterine **M**assage, **O**xytocic drugs, **T**ranexamic acid, **IV** fluids and **E**xamination of the genital tract, with the addition of a tool, the calibrated blood collection drape, to enable **E**arly detection of PPH (the first E in the E-MOTIVE acronym) (see **Error! Not a valid bookmark self-reference.**).

Figure 1 The E-MOTIVE care bundle for PPH detection and management



The E-MOTIVE trial consists of three phases: a formative phase, an intervention phase, and a post-intervention phase. In phase one, the formative phase, a mixed-methods research design aims to develop, adapt, and evaluate an implementation strategy to support behaviour change of health care professionals and uptake of performance of the E-MOTIVE bundle in their clinical practice. To achieve this aim, the formative phase of E-MOTIVE consists of four methodological components: in-depth qualitative interviews, a quantitative survey, a systematic review, and stakeholder consultation and design workshops. In this thesis, the administration of the quantitative survey is presented.

The formative phase is followed by a programme of work (intervention phase) consisting of a parallel cluster randomised trial with a baseline control phase, mixed-methods process evaluation, and a cost-effectiveness study. Should the intervention be effective, in the final post-intervention phase, clinical guidelines will be updated to reflect the findings of the trial.

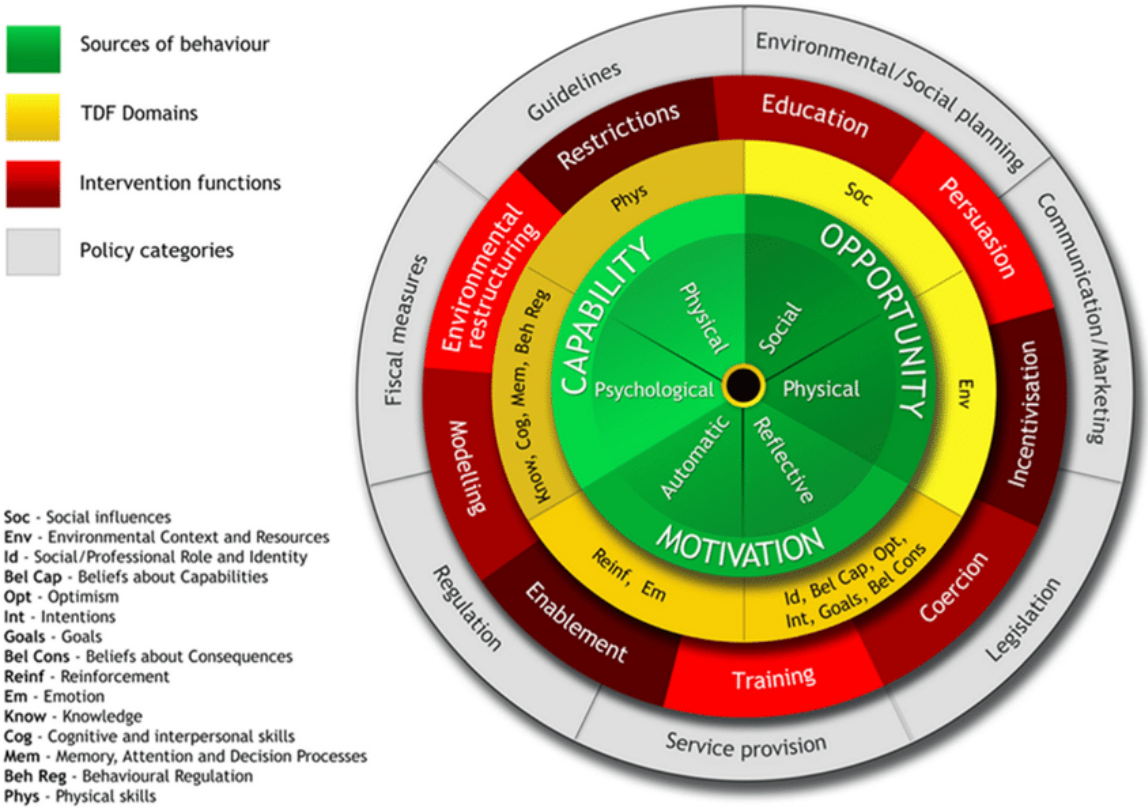
1.6 Rationale for the current body of research

The implementation of the E-MOTIVE bundle is conceptualised as a behaviour change intervention. As discussed, the passive dissemination of behavioural interventions is associated with poor uptake by their intended audience. Hence, understanding the factors that influence PPH practice, identifying potential barriers and enablers to uptake of the bundle, and addressing them is essential if the desired behaviours are to be adopted and sustained long term. Previous research in this field has focused on developing an in-depth understanding of healthcare professionals' PPH-related behaviours through interviews and focus groups (Alwy Al-beity et al., 2020, Flanagan et al., 2021, Mfinanga et al., 2009). Through 12 in-depth interviews and 7 focus group discussions with healthcare professionals in Tanzania, Alwy Al-beity and colleagues (2020) observed that healthcare professionals perceive their healthcare facility to have low readiness to provide any PPH-related care, citing poor communication, leadership, and referral practices as barriers. Flanagan et al. (2021) presented similar results from a study involving 47 in-depth interviews with healthcare professions from 19 facilities across Madagascar who reported that clinicians perceived that the risk of PPH is low for women in their care, that they received limited feedback on their practice, and that they operated in a context characterised by chronic scarcity of equipment, supplies, and support. Mfinanga and colleagues (2009) observed and interviewed hospital directors, pharmacists, and healthcare providers in 29 hospitals in Tanzania, and found that the correct practice of active management of the third stage of labour was performed in only 7% of 251 deliveries, despite the recommended drugs being available and correctly stored in nearly all facilities. The E-MOTIVE study attempts to address these barriers by establishing a standardised evidence-based approach to detecting and managing PPH through a care bundle and

supporting healthcare workers and management in low-resource maternity settings to improve communication, feedback and teamwork through a targeted implementation strategy.

Although these studies highlight that healthcare professionals both experience and exert challenges to accurate PPH detection and management practices, what is also evident is that the challenges they experience vary and may be context-specific. Moreover, it cannot be assumed that the experiences of these healthcare professionals are representative of the experience of all healthcare professionals working in LMICs and MICs and deserves further exploration. Although interviews can provide a depth of understanding, the context of maternal care can vary greatly by hospital, state, and country. Extrapolating the findings of qualitative studies exploring PPH detection and management across health facilities and countries may be inappropriate, and as such, collecting data from the present context will provide the best levels of understanding. To be able to adequately address the challenges around PPH detection and management in the study sites participating in the E-MOTIVE trial the perspectives of those experiencing bundle implementation on a daily basis must be captured and considered, which this research aims to do.

Figure 2 Integrated study conceptual frameworks: COM-B Model, Theoretical Domains Framework, and the Behaviour Change Wheel (Michie et al., 2014a).



Research from implementation science suggests that applying theories of behaviour change to research through exploring current practices, barriers, and enablers is advantageous. Although there is a wide range of theories which could be used, there is little guidance to advise researchers on their selection between potentially relevant theories (Davidoff et al., 2015). The COM-B model (Michie et al., 2011) and the associated Theoretical Domains Framework (TDF) (Cane et al., 2012) synthesise multiple behaviour change theories into one integrated, overarching theoretical model and framework. The COM-B model postulates that for any desired **B**ehaviour to occur, such as a new clinical practice like a care bundle, an individual must have the **C**apability, **O**pportunity, and **M**otivation to do so (Michie et al., 2011, Michie et al., 2014a) (Figure 2).

Capability is the physical and psychological capacity an individual has to perform the behaviour. This includes strength, skill, stamina, knowledge, and skills, as well as the capacity to comprehend and reason the benefits of performing the behaviour of interest. **O**pportunity encompasses all factors extrinsic to the individual that prompt or enable the enactment of the behaviour. These can be physical opportunities such as cues, time, financial resources, and access, as well as social opportunities created by the cultural environment. **M**otivation covers any process that directs or energises the behaviour. This can be reflective which involves the individual developing evaluations and plans, and/or automatic, which involves emotions and impulses developed as a result of innate dispositions and associative learning (Michie et al., 2014b). For an individual to perform a target behaviour, the strength of their motivation, frequency of opportunities, and depth of capabilities to engage in it need to be greater than the capability, opportunity, and motivations to perform or revert to competing and often ingrained behaviours.

The constructs of the COM-B model map onto the TDF framework. The TDF synthesises thirty-three behaviour change theories into fourteen domains representing cognitive, affective, social and environmental influences on behaviour (Cane et al., 2012). The COM-B and TDF are linked to the Behaviour Change Wheel (BCW), which facilitates systematic progress from the identification of barriers and enablers to the design of targeted implementation interventions (Michie et al., 2014a, Michie et al., 2011). The BCW presents nine intervention functions, including restrictions, education, persuasion, incentivisation, coercion, training, enablement, modelling, and environmental restructuring, which can address deficits in one or more of the COM-B constructs (Michie et al., 2011).

Both the COM-B and TDF have been used widely to explore barriers and enablers to changing clinical practice behaviours (Francis et al., 2012, Roberts et al., 2017, Gould et al., 2018). For these reasons, the COM-B model was used in the design of the tools used in this study, to capture each part of the behavioural system, and to be able to map barriers and enablers to effective implementation strategies to encourage uptake of the E-MOTIVE bundle.

1.7 Current body of work

To gain a wider understanding of the PPH-related behaviours adopted by practitioners working in the E-MOTIVE trial facilities, the work presented in this thesis sought to explore healthcare professionals' PPH detection and management behaviours across all health facilities participating in the E-MOTIVE trial. The specific objectives of this thesis are to:

1. Understand the current clinical management of primary PPH in the study facilities; and,
2. Explore healthcare providers' primary PPH detection and management in current practice including (a) how detection and treatment could be improved, and (b) potential barriers and enablers to implementation of the E-MOTIVE intervention in their practice.

More specifically, this quantitative survey aimed to answer the following research questions:

1. How is primary PPH during vaginal birth currently detected and managed at the study facilities?

2. To what extent are the components of the E-MOTIVE bundle currently implemented?
3. What are the factors that are influencing current PPH detection and management?; and,
4. What are the factors influencing the implementation of the E-MOTIVE bundle?

2.0 Methods

2.1 Study design and facilities

A quantitative survey was conducted in health facilities across four countries: Kenya, Nigeria, South Africa and Tanzania, all of which were selected for participation in the E-MOTIVE trial.

2.2 Participants

A cross-sectional, electronic survey was conducted in all E-MOTIVE study health facilities (n=91) across four countries: Kenya, Nigeria, South Africa, and Tanzania. To ensure that a wide range of opinions were obtained, engagement was sought from a diverse selection of participants. Eligible participants were required to work within the maternity wards of the health facility at the time of data collection and included midwives, nurses, junior doctors, medical officers, residents, consultant and specialist obstetricians, non-physician clinicians, anaesthetists, health managers, and student healthcare professionals. Participants were capable of reading and responding to the survey questions in English; there were no restrictions on other demographic characteristics of participants, including age, gender, race, ethnicity, or sexual orientation. No demographic information was collected from participants regarding these factors to best protect the anonymity of the participants. Individuals who were unable or unwilling to give informed consent to participate were not able to take part, and patients and family caregivers were not eligible to participate in this survey.

2.3 Training

Before data collection, a two-day formative training workshop was provided for each of the country hub teams, who assisted with participant recruitment and data collection. The country's principal investigators (PIs), data managers, qualitative leads, and research midwives were invited to attend. On day one of the workshop, information relating to the overall E-MOTIVE trial, the formative and mixed methods work, and the qualitative in-depth interviews (which are not part of this thesis) was shared. The second day of training covered content relating to the quantitative formative survey, which is presented in this thesis.

During the training session, information was provided about the format of the survey, how to navigate the SmartSurvey software as a participant, the content of the questions and response options, participant recruitment methods, the process and importance of informed consent, and participant withdrawal from the study. The hub teams in attendance at the training were invited to ask questions and provide feedback relating to the content of the survey to tailor the survey to each country's context before it went live for data collection. For example, some participants suggested adding a different detection method or training format to the response options that were unique to their country context. Following the training session, the trainees were invited to pilot and familiarise themselves with the survey using an offline version, which did not save or register responses.

2.4 Participant recruitment and sampling

At the time of recruitment, the country PIs and facility research coordinators contacted the healthcare providers and managers in each health facility. At each health facility, the

facility coordinator obtained a list of potential participants who met the eligibility criteria, which included the participants' names and email addresses. Individualised email links to complete the survey were sent by the lead researcher to each eligible participant, and reminders to complete the survey were sent weekly for two weeks. Participants were also invited to take part, if they had not already, at the health facility during visits by the country's principal investigators. Paticipants could access the survey using an internet-enabled tablet device provided by the trial team if they did not have a device of their own. Participants who completed the survey at the trial sites using the electronic tablet were not required to have an email address to participate. These methods of recruitment were chosen to facilitate the monitoring of responses and follow-up. Participants' names and email addresses were kept separate from the completed surveys to ensure that the research team were not able to link this information to protect participants' anonymity.

If participants were willing to take part when approached by email or at facility visits, they were asked to provide written consent via the online survey platform (SmartSurvey; https://www.smartsurvey.co.uk/) before completing the survey. The first page of the electronic survey was the participant information sheet. The second page of the electronic survey was the informed consent form, which included two tick box options: 'I consent to all of the above statements' or 'I do not consent to all of the above statements', which participants were required to complete before they could progress to the content of the survey. Participants were asked to complete the survey independently and encouraged to do so in a setting where they felt comfortable giving honest responses without fear of repercussions.

Maximum variation sampling was used to achieve a stratified sample without random selection and to ensure heterogeneity of research participants. This method used

pre-specified parameters to stratify the sample and encouraged recruitment and sampling based on diversity. In each of the study facilities, healthcare professionals were sampled based on their cadre. The type or designation of health care professionals was expected to vary by facility, but at the minimum would include obstetric specialists, medical officers, midwives, and nurses. A recruitment target of nine to ten participants per health facility was set, which included five midwives or nurses, three medical officers or junior doctors, and two obstetric specialists, for a minimum total *n* of 819-910 participants across all health facilities and countries.

2.5 Study Instruments

The study instrument was an online quantitative survey. The survey was developed alongside a team of social and behavioural scientists, obstetricians, and midwives to ensure clinical relevance and appropriate use of behaviour change frameworks. The survey was piloted before data collection, as part of the training of the research teams. The survey was expected to take the participants approximately fifteen to twenty minutes to complete, and participants were free to pause and return to participation as necessary. The overarching structure and content of the survey mirrored the qualitative interview guide used in the E-MOTIVE formative work, to facilitate triangulation between the two data collection methods and data sources. The survey covered the following domains:

1. Sociodemographic information (profession, years of experience, country and place of employment);

2. How PPH is detected and managed for vaginal births;

3. Factors influencing current practice for PPH management; and,

4. Potential barriers and enablers to implementing the E-MOTIVE bundle.

Response options were a combination of dichotomous (yes/no), Likert scales, and multi-option formats. The survey was made available in both web and mobile formats, to enable participants to take part on their own electronic devices.

2.6 Study procedures and follow-up

Participants were invited to take part in the survey using a custom web link provided by email or by the country PI during the facility visits. Participants were asked at the start of the survey if they would like to hear the results of the survey once they have been collated and interpreted and were given the option to provide a contact email if they chose. If they chose to share their contact email, their email address was stored separately from their survey responses to protect participant anonymity.

Once the surveys were completed, study participants may have had additional contact with the research team through two potential avenues. First, if the participant chose to share their contact email, the study results were shared with them. Second, if the participant was still employed at the health facility during the stakeholder consultation and design workshops or the subsequent trial, they may have been involved in research workshops, developing implementation strategies, etc. However, in no instance would they be identified as participants in the survey and their decision to participate or not in the survey will have no bearing on their future involvement in the trial.

2.7 Data management and quality assurance

All data collected through SmartSurvey is registered under the General Data Protection Regulation 2018. Secure Sockets Layer encryption was added to any survey,

which enables an encrypted link between a web server and a browser to be established. This ensures that all data passed between the web servers and the browsers remained private and integral. All data were stored and backed up on United Kingdom-based servers and were not accessed nor shared without prior permission.

Country PIs were in frequent communication with the E-MOTIVE formative research team to respond to any issues that arose during data collection. Halfway through data collection in each country, all data collected up to that point was reviewed to ensure data quality. Completion rates were monitored at multiple stages of the data collection process, non-respondents received a maximum of two reminder emails asking them to complete the survey. Country PIs also followed up with the health facilities to maximize response to the survey.

2.8 Data analysis plan

Quantitative survey data were summarised using descriptive statistics as appropriate. Cross-tabulation was used to describe practices for PPH detection and management, and perceptions of the E-MOTIVE intervention for PPH management. Results were cross-tabulated and filtered to allow comparison of results by demographic subgroup, including cadre and country. These data helped to establish a baseline of practices for PPH detection, management and perceptions of the E-MOTIVE intervention and implementation strategy, to allow comparison of practices and perceptions over the course of the E-MOTIVE trial, and post-trial, as well as to help evaluate future uptake, acceptability, and adherence of the MOTIVE bundle.

Although the survey was designed around the COM-B model to capture all elements of participants' behaviour, the tool was not validated therefore there can be no formal analysis against each of these domains.

3.0 Results

In total, 1,035 participants were recruited from 91 hospitals across Nigeria, Kenya, South Africa, and Tanzania between July 2020 and October 2021. Of these, 1,009 (97.5%) consented to participate in the survey: 463 (45.9%) were from Nigeria, 208 (20.6%) were from Tanzania, 186 (18.4%) were from Kenya, 152 (15.1%) were from South Africa.

3.1 Baseline characteristics

Table 2 presents an overview of demographic information about each health facility in the previous 12 months at the time of site assessment. This includes information relating to the total number of vaginal births and PPHs recorded. Table 3 presents an overview of the total number of staff working within the maternity unit of each facility recruited in the E-MOTIVE trial. This includes the total number of staff, and a breakdown of different types of staff, based on common job roles within obstetric teams. Missing data in Table 2 and

Table 3 were not provided by the facility or country hub teams at the point of data collection and are indicated by a dash symbol (-).

Table 4 presents the sociodemographic characteristics of survey participants. Of the 1,009 participants, the majority were nurse-midwives (*n*=345, 34.2%) or midwives (*n*=192, 19.2%). Additional information about participant cadres, years of experience, and clinical activeness, measured through the last time the participant helped with a vaginal birth and detected or managed a PPH, can also be seen in Table 4.

Table 2 Demographic information for the E-MOTIVE trial facilities

Facility name	Total births (vaginal and caesarean)	Total vaginal births (% of total births)	Treated for PPH (vaginal births) (% of vaginal births)	Blood transfusions for PPH (vaginal births) (% of vaginal births)	Laparotomies for PPH (vaginal births) (% of vaginal births)	Deaths from vaginal birth (% of vaginal births)	Main trial, adaptive cycle or formative site
Kenya							
Busia County Hospital	4462	3717 (83.3%)	154 (4.1%)	132 (3.6%)	16 (0.4%)	9 (0.2%)	Main trial
Embu Level 5 Hospital	5880	4450 (75.7%)	63 (1.4%)	63 (1.4%)	7 (0.2%)	9 (0.2%)	Main trial
Gatundu Level 5 Hospital	5862	4100 (69.9%)	65 (1.6%)	7 (0.2%)	4 (0.1%)	0 (0.0%)	Main trial
Iten Level 5 Hospital	2618	2035 (77.7%)	18 (0.9%)	12 (0.6%)	4 (0.2%)	2 (0.1%)	Main trial
JM Kariuki Memorial County Referral Hospital	3051	2312 (75.8%)	20 (0.9%)	~100 (~4.3%)	8 (0.3%)	8 (0.3%)	Main trial
Kakamega County Government Referral Hospital	5824	4335 (74.4%)	65 (1.5%)	100 (4.3%)	15 (0.3%)	2 (>0.1%)	Main trial
Kerugoya County Referral Hospital	2352	1929 (82.0%)	38 (2.0%)	20 (1.0%)	0 (0.0%)	0 (0.0%)	Main trial
Makindu Sub County Hospital	2370	1631 (68.8%)	58 (3.6%)	28 (1.7%)	5 (0.3%)	2 (0.1%)	Main trial
Malindi Sub County Hospital	4646	3516 (75.7%)	70 (2.0%)	100 (2.8%)	4 (0.1%)	2 (0.1%)	Main trial
Maragua Hospital	2845	1856 (65.2%)	152 (8.2%)	24 (1.3%)	16 (0.9%)	3 (0.2%)	Main trial
Meru Teaching and Referral Hospital	5540	3901 (70.4%)	30 (0.8%)	34 (0.9%)	6 (0.2%)	2 (0.1%)	Main trial
Moi County Referral Hospital - Voi	1589	1093 (68.8%)	49 (4.5%)	30 (2.7%)	0 (0.0%)	0 (0.0%)	Main trial
Msambweni County Hospital	2890	1986 (68.7%)	91 (4.6%)	80 (4.0%)	6 (0.3%)	4 (0.2%)	Main trial
Nyeri Level 5 Hospital	4976	3533 (71.0%)	69 (2.0%)	22 (0.6%)	2 (0.1%)	1 (>0.1%)	Main trial
Ruiru Sub County Hospital	5681	4828 (85.0%)	101 (2.1%)	60 (1.2%)	0 (0.0%)	0 (0.0%)	Main trial
Vihiga County Referral Hospital	2921	1906 (65.3%)	68 (3.6%)	49 (2.6%)	9 (0.5%)	3 (0.2%)	Main trial
Nigeria							
Abdullahi Wase Specialist Hospital	3945	3105 (78.7%)	173 (5.6%)	- (-)	- (-)	- (-)	Formative
ABU Zaria Teaching Hospital	1965	1217 (61.9%)	196 (16.1%)	204 (16.8%)	2 (0.2%)	4 (0.3%)	Main trial
Abubakar Tafawa Balewa University Teaching Hospital	3200	2228 (69.6%)	54 (2.4%)	120-144 (5.4-6.5%)	33 (1.5%)	- (-)	Adaptive cycle
Ahmad Sani Yariman Bakura Specialist Hospital	2000	1550 (77.5%)	200 (12.9%)	450 (29.0%)	8 (0.5%)	25 (1.6%)	Main trial
Aminu Kano Teaching Hospital	3283	2463 (75.0%)	12 (0.5%)	- (-)	3 (0.1%)	- (-)	Main trial

Facility name	Total births (vaginal and caesarean)	Total vaginal births (% of total births)	Treated for PPH (vaginal births) (% of vaginal births)	Blood transfusions for PPH (vaginal births) (% of vaginal births)	Laparotomies for PPH (vaginal births) (% of vaginal births)	Deaths from vaginal birth (% of vaginal births)	Main trial, adaptive cycle or formative site
Barau Dikko Teaching Hospital	2907	2416 (83.1%)	103 (4.3%)	103 (4.3%)	4 (0.2%)	10 (0.4%)	Main trial
Birnin Kudu General Hospital	2384	1975 (82.8%)	144 (7.3%)	960 (48.6%)	11 (0.6%)	30 (1.5%)	Main trial
Central Hospital Warri	3291	2320 (70.5%)	25 (1.1%)	- (-)	12 (0.5%)	1 (0.0%)	Main trial
Central Hospital, Benin City	2800	2204 (78.7%)	88 (4.0%)	47 (2.1%)	3 (0.1%)	2 (0.1%)	Main trial
Dutse General Hospital, Jigawa	4143	3742 (90.3%)	31 (0.8%)	- (-)	1 (>0.1%)	5 (0.1%)	Main trial
Federal Medical Center Azare	1659	1147 (69.1%)	69 (6.0%)	240 (20.9%)	6 (0.5%)	3 (0.3%)	Main trial
Federal Medical Centre Abuja	1952	1091 (55.9%)	10 (0.9%)	5 (0.5%)	5 (0.5%)	1 (0.1%)	Main trial
Federal Medical Centre Asaba, Delta State	1484	1108 (74.7%)	32 (2.9%)	25 (2.3%)	4 (0.4%)	1 (0.1%)	Main trial
Federal Medical Centre Birnin Kebbi	1601	1032 (64.5%)	22 (2.1%)	12 (1.2%)	4 (0.4%)	2 (0.2%)	Main trial
Federal Medical Centre Katsina	2230	1775 (79.6%)	7 (0.4%)	6 (0.3%)	4 (0.2%)	10 (0.6%)	Main trial
Federal Medical Centre Owerri	3231	1999 (61.9%)	21 (1.1%)	- (-)	7 (0.4%)	5 (0.3%)	Adaptive cycle
Federal Medical Centre, Yola, Adamawa State	1526	1065 (69.8%)	50 (4.7%)	50 (4.7%)	14 (1.3%)	6 (0.6%)	Main trial
Federal Medical Centre Gusau Zamfara State	2000	1400 (70.0%)	8 (0.6%)	15 (1.1%)	8 (0.6%)	3 (0.2%)	Main trial
Gambo Sawaba General Hospital	2259	2153 (95.3%)	101 (4.7%)	20 (0.9%)	0 (0.0%)	1 (>0.1%)	Main trial
General Hospital Gumel	5083	4835 (95.1%)	343 (7.1%)	343 (7.1%)	2 (>0.1%)	6 (0.1%)	Main trial
General Hospital Kazaure	3837	3509 (91.5%)	104 (3.0%)	102 (2.9%)	1 (>0.1%)	11 (0.3%)	Main trial
General Hospital Ringim	1898	1813 (95.5%)	94 (5.2%)	186 (10.3%)	0 (0.0%)	14 (0.8%)	Main trial
General Hospital Suleja	3333	2875 (86.3%)	115 (4.0%)	95 (3.3%)	3 (0.1%)	2 (0.1%)	Main trial
Gwarinpa General Hospital	1229	983 (80.0%)	25 (2.5%)	- (-)	3 (0.3%)	0 (0.0%)	Main trial
Jos University Teaching Hospital	1780	1246 (70.0%)	45 (3.6%)	13 (1.0%)	0 (0.0%)	0 (0.0%)	Main trial
Jummai Babangida Aliyu Maternal and Newborn Hospital	3104	2858 (92.1%)	480 (16.8%)	75 (2.6%)	81 (2.8%)	29 (1.0%)	Main trial
Kubwa General Hospital	2076	1830 (88.2%)	36 (2.0%)	- (-)	5 (0.3%)	2 (0.1%)	Main trial
Nyanya General Hospital	2239	1508 (67.4%)	20 (1.3%)	- (-)	3 (0.2%)	3 (0.2%)	Main trial
Rivers State University Teaching Hospital	2017	957 (47.4%)	33 (3.4%)	30+ (3.1%+)	6 (0.6%)	1 (0.1%)	Main trial
Sabo Bakin Zuwo Maternity Hospital	4181	3976 (95.1%)	43 (1.1%)	- (-)	- (-)	7 (0.2%)	Main trial

Facility name	Total births (vaginal and caesarean)	Total vaginal births (% of total births)	Treated for PPH (vaginal births) (% of vaginal births)	Blood transfusions for PPH (vaginal births) (% of vaginal births)	Laparotomies for PPH (vaginal births) (% of vaginal births)	Deaths from vaginal birth (% of vaginal births)	Main trial, adaptive cycle or formative site
Sir Muhammad Sunusi Specialist Hospital	2491	2322 (93.2%)	116 (5.0%)	104 (4.5%)	3 (0.1%)	2 (0.1%)	Main trial
Sir Yahya Memorial Hospital	1540	1322 (85.8%)	193 (14.6%)	216 (16.3%)	21 (1.6%)	13 (1.0%)	Main trial
Specialist Hospital Sokoto	5130	4602 (89.7%)	411 (8.9%)	401 (8.7%)	2 (>0.1%)	13 (0.3%)	Main trial
Turai Yaradua Maternity Center	5692	4800 (84.3%)	56 (1.2%)	56 (1.2%)	31 (0.6%)	54 (1.1%)	Main trial
University of Medical Sciences Teaching Hospital	2183	1458 (66.8%)	36 (2.5%)	70 (4.8%)	6 (0.4%)	28 (1.9%)	Main trial
University of Benin Teaching Hospital	2530	1280 (50.6%)	34 (2.7%)	29 (2.3%)	19 (1.5%)	7 (0.5%)	Main trial
University of Ilorin Teaching Hospital	1858	1293 (69.6%)	59 (4.6%)	14 (1.1%)	9 (0.7%)	1 (0.1%)	Main trial
University of Maiduguri Teaching Hospital	4279	3447 (80.6%)	47 (1.4%)	41 (1.2%)	5 (0.1%)	3 (0.1%)	Main trial
Usmanu Danfodiyo University Teaching Hospital	3181	2619 (82.3%)	18 (0.7%)	18 (0.7%)	11 (0.4%)	12 (0.5%)	Main trial
Waziri Gidado Hospital	2367	2318 (97.9%)	33 (1.4%)	33 (1.4%)	1 (>0.1%)	3 (0.1%)	Main trial
Yusuf Dantsoho Memorial Hospital	2218	1895 (85.4%)	58 (3.1%)	58 (3.1%)	0 (0.0%)	7 (0.4%)	Main trial
South Africa							
Benedictine District Hospital (KZN)	4236	3167 (74.8%)	60 (1.9%)	30 (0.9%)	3 (0.1%)	0 (0.0%)	Main trial
Butterworth Hospital (EC)	3500	2421 (69.2%)	- (-)	- (-)	1 (>0.1%)	- (-)	Main trial
Frere Hospital (EC)	4570	2550 (55.8%)	23 (0.9%)	- (-)	- (-)	- (-)	Main trial
Karl Bremer Hospital (WC)	5928	3847 (64.9%)	150 (3.9%)	- (-)	4 (0.1%)	- (-)	Main trial
Khayelitsha Hospital (WC)	4056	2232 (55.0%)	24 (1.1%)	- (-)	0 (0.0%)	- (-)	Main trial
Knysna Hospital (WC)	1741	1361 (78.2%)	15 (1.1%)	- (-)	0 (0.0%)	0 (0.0%)	Main trial
Madwaleni District Hospital (EC)	1398	1122 (80.3%)	25 (2.2%)	20 (1.8%)	0 (0.0%)	0 (0.0%)	Main trial
Mitchells Plain Hospital (WC)	3204	1922 (60.0%)	38 (2.0%)	- (-)	20 (1.0%)	- (-)	Main trial
Mthatha General Hospital (EC)	5899	3807 (64.5%)	66 (1.7%)	46 (1.2%)	33 (0.9%)	0 (0.0%)	Main trial
Northdale Hospital (KZN)	6000	4000 (66.7%)	96 (2.4%)	15 (0.4%)	0 (0.0%)	1 (>0.1%)	Main trial
Osindisweni Hospital (KZN)	3167	2174 (68.6%)	108 (5.0%)	60 (2.8%)	0 (0.0%)	2 (0.1%)	Main trial
Paarl Hospital (WC)	5802	4156 (71.6%)	65 (1.6%)	50 (1.2%)	15 (0.4%)	0 (0.0%)	Adaptive cycle
Provincial Hospital Worcester (WC)	2762	1700 (61.5%)	48 (2.8%)	104-156 (6.1-9.2%)	12 (0.7%)	6 (0.4%)	Main trial

Facility name	Total births (vaginal and caesarean)	Total vaginal births (% of total births)	Treated for PPH (vaginal births) (% of vaginal births)	Blood transfusions for PPH (vaginal births) (% of vaginal births)	Laparotomies for PPH (vaginal births) (% of vaginal births)	Deaths from vaginal birth (% of vaginal births)	Main trial, adaptive cycle or formative site
St Elizabeth Hospital (EC)	4707	3426 (72.8%)	19 (0.6%)	19 (0.6%)	0 (0.0%)	0 (0.0%)	Main trial
Vredenburg Hospital (WC)	1620	1116 (68.9%)	- (-)	- (-)	- (-)	- (-)	Main trial
Vryheid Hospital (KZN)	5000	3900 (78.0%)	60 (1.5%)	22 (0.6%)	- (-)	0 (0.0%)	Adaptive cycle
Zithulele Hospital (EC)	2257	1514 (67.1%)	69 (4.6%)	14 (0.9%)	0 (0.0%)	0 (0.0%)	Adaptive cycle
Tanzania							
Bagamoyo District Hospital	2562	1994 (77.8%)	68 (3.4%)	70 (3.5%)	4 (0.2%)	3 (0.2%)	Adaptive cycle
Bariadi Town Council Hospital	2243	1863 (83.1%)	84 (4.5%)	- (-)	1 (0.1%)	- (-)	Main trial
Buzuruga Hospital	3122	3120 (99.9%)	70 (2.2%)	120 (3.8%)	0 (0.0%)	2 (0.1%)	Main trial
Kharumwa Health Centre	1672	1521 (91.0%)	95 (6.2%)	50 (3.3%)	1 (0.1%)	1 (0.1%)	Main trial
Kisarawe District Hospital	1564	1004 (64.2%)	20 (2.0%)	20 (2.0%)	4 (0.4%)	5 (0.5%)	Main trial
Magu District Hospital	3164	2884 (91.2%)	38 (1.3%)	- (-)	3 (0.1%)	- (-)	Main trial
Malampaka Health Centre	1402	1232 (87.9%)	34 (2.8%)	26 (2.1%)	4 (0.3%)	0 (0.0%)	Adaptive cycle
Masumbwe Health Centre	3279	3144 (95.9%)	68 (2.2%)	34 (1.1%)	19 (0.6%)	8 (0.3%)	Main trial
Maswa District Hospital	2900	2637 (90.9%)	32 (1.2%)	- (-)	0 (0.0%)	- (-)	Main trial
Meatu District Hospital	2466	2203 (89.3%)	58 (2.6%)	20 (0.9%)	3 (0.1%)	4 (0.2%)	Main trial
Misasi Health Centre	1930	1786 (92.5%)	24 (1.3%)	22 (1.2%)	3 (0.2%)	1 (0.1%)	Main trial
Misungwi District Hospital	3120	2856 (91.5%)	6 (0.2%)	2 (0.1%)	16 (0.6%)	0 (0.0%)	Main trial
Mkoani Health Centre	3993	3619 (90.6%)	59 (1.6%)	32 (0.9%)	0 (0.0%)	3 (0.1%)	Main trial
Mkuranga District Hospital	4399	3570 (81.2%)	153 (4.3%)	101 (2.8%)	3 (0.1%)	6 (0.2%)	Main trial
Ngudu District Hospital (Mtengwa Dm)	2173	1903 (87.6%)	29 (1.5%)	48 (2.5%)	3 (0.2%)	2 (0.1%)	Main trial
Sumve Hospital	2141	1911 (89.3%)	21 (1.1%)	- (-)	2 (0.1%)	- (-)	Adaptive cycle
Uyovu Health Centre	4004	3668 (91.6%)	46 (1.3%)	25 (0.7%)	2 (0.1%)	0 (0.0%)	Main trial

Missing data were not provided by the facility or country hub teams at the time of data collection and are indicated by a '-'. All data in this table were collected in the previous 12 months at the time of site assessment for the E-MOTIVE trial. Provinces for South African facilities are given in brackets following the facility name: EC = Eastern Cape, WC = Western Cape, KZN = KwaZulu-Natal.

Table 3 Total number of staff working within the maternity unit of each facility recruited in the E-MOTIVE trial

Facility name	Clinical officers	Consultants	Doctors in training and medical officers	Nurses	Midwives	Nurse-midwives	Medical students	Nurse/ midwifery students	Other healthcare professionals	Total staff
Kenya										
Busia County Hospital	0	1	3	0	0	14	0	0	1	19
Embu Level 5 Hospital	7	3	5	0	0	17	0	0	3	35
Gatundu Level 5 Hospital	2	2	6	0	0	13	5	15	6	49
Iten Level 5 Hospital	-	1	-	-	-	-	-	-	-	1
JM Kariuki Memorial County Referral Hospital	5	2	7	0	0	20	0	6	0	40
Kakamega County Government Referral Hospital	4	2	8	7	0	10	29	0	0	60
Kerugoya County Referral Hospital	0	1	3	28	0	9	1	11	1	54
Makindu Sub County Hospital	3	1	3	0	0	18	5	10	0	40
Malindi Sub County Hospital	0	3	4	0	0	18	3	10	3	41
Maragua Hospital	0	1	2	15	4	6	0	0	1	29
Meru Teaching and Referral Hospital	1	2	6	21	0	0	0	20	1	51
Moi County Referral Hospital - Voi	2	2	4	0	0	21	2	2	4	37
Msambweni County Hospital	0	2	7	11	0	2	0	13	3	38
Nyeri Level 5 Hospital	0	2	9	10	0	20	7	20	0	68
Ruiru Sub County Hospital	0	2	4	0	0	21	0	0	4	31
Vihiga County Referral Hospital	9	2	3	7	0	7	0	14	0	42
Nigeria										
Abdullahi Wase Specialist Hospital	0	6	20	20	21	0	0	0	0	67
ABU Zaria Teaching Hospital	0	27	45	0	47	0	52	30	0	201

Facility name	Clinical officers	Consultants	Doctors in training and medical officers	Nurses	Midwives	Nurse-midwives	Medical students	Nurse/ midwifery students	Other healthcare professionals	Total staff
Abubakar Tafawa Balewa University Teaching Hospital	40	10	20	80	50	8	90	100	0	398
Ahmad Sani Yariman Bakura Specialist Hospital	5	5	12	4	12	0	0	8	2	48
Aminu Kano Teaching Hospital	8	19	30	0	55	20	58	1	8	199
Barau Dikko Teaching Hospital	16	6	13	53	3	22	25	0	9	147
Birnin Kudu General Hospital	-	-	-	1	15	-	-	-	-	16
Central Hospital Warri	76	4	12	27	11	0	56	40	0	226
Central Hospital, Benin City	0	8	7	30	15	0	25	15	0	100
Dutse General Hospital, Jigawa	0	2	0	6	10	0	0	0	2	20
Federal Medical Center Azare	40	10	15	60	30	4	0	0	0	159
Federal Medical Centre Abuja	0	9	41	20	1	0	0	0	0	71
Federal Medical Centre Asaba, Delta State	5	11	51	100	71	0	0	0	13	251
Federal Medical Centre Birnin Kebbi	0	6	20	7	57	0	0	0	0	90
Federal Medical Centre Katsina	0	10	26	0	11	11	0	8	3	69
Federal Medical Centre, Owerri	0	11	40	143	0	38	43	8	11	294
Federal Medical Centre, Yola, Adamawa State	30	12	19	29	40	0	8	36	0	174
Federal Medical Centre Gusau Zamfara State	0	5	18	5	0	12	0	15	10	65
Gambo Sawaba General Hospital	5	1	5	1	4	9	0	10	0	35
General Hospital Gumel	0	1	6	3	15	1	0	5	0	31
General Hospital Kazaure	0	5	5	7	20	3	0	0	5	45
General Hospital Ringim	0	5	0	0	14	3	0	0	0	22

Facility name	Clinical officers	Consultants	Doctors in training and medical officers	Nurses	Midwives	Nurse-midwives	Medical students	Nurse/ midwifery students	Other healthcare professionals	Total staff
General Hospital Suleja	4	2	0	3	13	0	0	0	0	22
Gwarinpa General Hospital	0	3	12	4	37	0	0	2	8	66
Jos University Teaching Hospital	0	19	44	78	78	0	138	4	0	361
Jummai Babangida Aliyu Maternal and Newborn Hospital	0	4	9	10	17	0	0	55	0	95
Kubwa General Hospital	12	2	5	28	15	0	5	0	4	71
Nyanya General Hospital	0	2	1	40	5	0	0	0	0	48
Rivers State University Teaching Hospital	2	10	36	15	15	16	25	20	0	139
Sabo Bakin Zuwo Maternity Hospital	0	1	2	7	7	2	0	3	2	24
Sir Muhammad Sunusi Specialist Hospital	2	1	2	1	8	5	3	10	5	37
Sir Yahya Memorial Hospital	-	-	-	-	-	-	-	-	-	0
Specialist Hospital Sokoto	0	3	9	33	60	19	4	12	0	140
Turai Yaradua Maternity Center	0	4	8	12	21	3	0	0	0	48
University of Medical Sciences Teaching Hospital	0	7	10	7	37	0	18	20	0	99
University of Benin Teaching Hospital	0	14	27	8	58	0	69	47	0	223
University of Ilorin Teaching Hospital	20	16	29	88	18	14	163	35	0	383
University of Maiduguri Teaching Hospital	5	13	32	15	59	23	110	20	5	282
Usmanu Danfodiyo University Teaching Hospital	0	14	34	37	65	15	38	50	14	267

Facility name	Clinical officers	Consultants	Doctors in training and medical officers	Nurses	Midwives	Nurse-midwives	Medical students	Nurse/ midwifery students	Other healthcare professionals	Total staff
Waziri Gidado Hospital	0	1	0	2	6	0	0	0	2	11
Yusuf Dantsoho Memorial Hospital	-	-	-	-	-	-	-	-	-	0
South Africa										
Benedictine District Hospital (KZN)	3	0	4	26	9	7	0	0	21	70
Butterworth Hospital (EC)	0	4	16	1	20	11	0	0	12	64
Frere Hospital (EC)	8	4	11	14	10	14	5	4	10	80
Karl Bremer Hospital (WC)	9	2	4	47	20	0	0	0	1	83
Khayelitsha Hospital (WC)	2	5	0	11	18	8	1	0	8	53
Knysna Hospital (WC)	-	-	-	-	-	-	-	-	-	0
Madwaleni District Hospital (EC)	2	1	15	8	11	3	2	0	0	42
Mitchells Plain Hospital (WC)	0	2	6	8	11	0	10	0	10	47
Mthatha General Hospital (EC)	0	3	13	54	18	0	0	0	0	88
Northdale Hospital (KZN)	0	0	9	0	46	0	15	16	21	107
Osindisweni Hospital (KZN)	0	1	5	14	23	0	1	2	2	48
Paarl Hospital (WC)	2	4	12	17	32	0	0	0	0	67
Provincial Hospital Worcester (WC)	0	3	8	28	17	0	3	0	5	64
St Elizabeth Hospital (EC)	0	0	12	3	11	5	0	0	7	38
Vredenburg Hospital (WC)	0	0	7	-	-	-	-	-	6	13
Vryheid Hospital (KZN)	0	0	4	22	16	0	0	0	0	42
Zithulele Hospital (EC)	0	1	10	10	25	0	10	0	11	67
Tanzania										
Bagamoyo District Hospital	0	0	3	0	7	7	0	0	7	24
Bariadi Town Council Hospital	2	1	5	7	2	8	2	0	3	30
Buzuruga Hospital	0	0	3	14	14	**0**	0	0	7	38
Kharumwa Health Centre	0	0	4	8	8	**0**	0	0	0	20

Facility name	Clinical officers	Consultants	Doctors in training and medical officers	Nurses	Midwives	Nurse-midwives	Medical students	Nurse/ midwifery students	Other healthcare professionals	Total staff
Kisarawe District Hospital	2	3	3	0	0	13	0	0	2	23
Magu District Hospital	4	2	4	7	0	13	1	0	1	32
Malampaka Health Centre	0	0	1	0	0	5	0	0	0	6
Masumbwe Health Centre	2	0	3	4	6	3	0	0	3	21
Maswa District Hospital	0	0	4	3	0	10	0	0	3	20
Meatu District Hospital	1	1	4	0	0	16	0	0	0	22
Misasi Health Centre	0	0	2	7	0	0	0	0	3	12
Misungwi District Hospital	0	0	2	0	0	18	0	0	4	24
Mkoani Health Centre	0	0	3	5	1	3	0	0	7	19
Mkuranga District Hospital	2	1	4	0	0	19	0	0	13	39
Ngudu District Hospital (Mtengwa Dm)	2	1	1	5	1	5	0	0	2	17
Sumve Hospital	4	0	0	9	0	0	0	0	0	13
Uyovu Health Centre	0	0	3	5	1	6	0	0	2	17
Total	**348**	**357**	**924**	**1420**	**1352**	**598**	**1032**	**697**	**301**	**7029**

Missing data were not provided by the facility or country hub teams at the time of data collection and are indicated by a '-'. All data in this table were collected in the previous 12 months at the time of site assessment for the E-MOTIVE trial. Provinces for South African facilities are given in brackets following the facility name: EC = Eastern Cape, WC = Western Cape, KZN = KwaZulu-Nata

3.2 Current practices: PPH detection after vaginal birth

The first section of the survey focused on current practices of PPH detection after vaginal birth. Of 1,009 participants, 98.0% (*n*=989) indicated that detecting PPH is part of their usual clinical role. These 989 participants made up the sub-sample that was surveyed on the following items relating to PPH detection.

Table 5 depicts the current practices of PPH detection after vaginal birth by country, and Table 6 depicts the current practices of PPH detection by cadre. Of 989 participants, 885 (89.5%) reported including visual estimation as part of their usual approach to detecting PPH, which was consistent by cadre and across Nigeria (*n*=431/463, 94.5%) and South Africa (*n*=134/152, 93.1%), with lower levels of visual estimation reported in Tanzania (*n*=159/208, 76.4%) and Kenya (*n*=161/181, 89.0%). Visual estimation was the most common approach for estimating blood loss (*n*=885, 89.5%), but was often coupled with other approaches to PPH detection. Approximately two-thirds of participants used vital signs (blood pressure, pulse, heart rate, respiration) to help them detect a PPH (*n*=680/989, 68.8%).

Data relating to the detection of PPH were also analysed by cadre (Table 6). Of 643 midwives or nurses who reported that detecting PPH was part of their clinical role, most (n=561, 87.3%) indicated that they would use the visual estimation of blood loss to detect a PPH. A greater percentage of doctors than midwives reported that they would use the visual estimation of blood loss to detect a PPH. Of 306 doctors who indicated that detecting PPH was part of their clinical role, 93.5% (*n*=286) reported that they would use visual estimation to detect a PPH. Furthermore, 95.0% (*n*=38) of the 40 healthcare providers from other cadres who reported that detecting PPH is part of their clinical role indicated that they would use visual estimation to detect a PPH.

The percentage of participants who reported using a tool to measure blood loss, such as a kidney basin, bedpan, counting or weighing soaked swabs, or Kelly's pad with basin, was 39.9% (*n*=395). Tanzania had the highest percentage of participants who reported collecting and measuring blood using a tool (69.7%, *n*=145/208) when compared to Kenya (40.9%, *n*=74/186), Nigeria (32.5%, *n*=148/463) and South Africa (19.4%, *n*=28/152). See Table 5 for additional data relating to the detection of PPH by country.

Fewer doctors than midwives or nurses reported that they would use a tool to collect and measure blood loss, with 47.3% (*n*=304/643) of nurses, 23.2% (*n*=71/306) of doctors, and 50.0% (*n*=20/40) of other cadres of healthcare professional reporting using a tool. See Table 6 for additional data relating to the detection of PPH by cadre.

Of participants who indicated that they use a tool to collect blood loss after vaginal birth and detect a PPH (*n*=395), 216 participants indicated that they use an obstetric drape. This equates to 54.7% of participants who indicated that they use a tool to detect a PPH, and 21.8% of participants who indicated that detecting PPH is part of their clinical role.

Table 4 Sociodemographic characteristics of survey participants

	Kenya (*n*=186)	**Nigeria** (*n*=463)	**South Africa** (*n*=152)	**Tanzania** (*n*=208)	**Total** (*n*=1,009)
Current role	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Consultant or specialist	12 (6.5%)	41 (8.9%)	10 (6.6%)	1 (0.5%)	64 (6.3%)
Medical doctor	20 (10.8%)	52 (11.2%)	32 (21.1%)	36 (17.3%)	140 (13.9%)
Medical doctor in training	1 (0.5%)	98 (21.2%)	5 (3.3%)	1 (0.5%)	105 (10.4%)
Non-physician clinician	5 (2.7%)	1 (0.2%)	0 (0.0%)	4 (1.9%)	10 (1.0%)
Nurse-midwife	72 (38.7%)	148 (32.0%)	16 (10.5%)	109 (52.4%)	345 (34.2%)
Midwife	24 (12.9%)	87 (18.8%)	73 (48.0%)	10 (4.8%)	194 (19.2%)
Nurse	48 (25.8%)	21 (4.5%)	4 (2.6%)	31 (14.9%)	104 (10.3%)
Other[a]	4 (2.2%)	15 (3.2%)	12 (7.9%)	16 (7.7%)	47 (4.7%)
Years of experience (total)					
0-4	93 (50.0%)	189 (40.8%)	59 (38.8%)	93 (44.7%)	434 (43.0%)
5-9	47 (25.3%)	147 (31.8%)	40 (26.3%)	76 (36.5%)	310 (30.7%)
10+	46 (24.7%)	127 (27.4%)	53 (34.9%)	39 (18.8%)	265 (26.3%)
Years of experience in current hospital					*(n=1007)*[b]
0-4	119 (64.3%)	243 (52.6%)	88 (57.9%)	111 (53.4%)	561 (55.7%)
5-9	43 (23.2%)	142 (30.7%)	32 (21.1%)	66 (31.7%)	283 (28.1%)
10+	23 (12.4%)[b]	77 (16.7%)[b]	32 (21.1%)	31 (14.9%)	163 (16.2%)[b]
Last time helped with a vaginal birth					
In the last week	113 (60.8%)	385 (83.2%)	121 (79.6%)	176 (84.6%)	795 (78.8%)
In the last month	41 (22.0%)	49 (10.6%)	13 (8.6%)	19 (9.1%)	122 (12.1%)
In the last 3-6 months	25 (13.4%)	19 (4.1%)	14 (9.2%)	10 (4.8%)	68 (6.7%)
Over 6 months ago	6 (3.2%)	9 (1.9%)	4 (2.6%)	3 (1.4%)	22 (2.2%)
Never helped with a vaginal birth	1 (0.5%)	1 (0.2%)	0 (0.0%)	0 (0.0%)	2 (0.2%)
Last time detected or managed PPH					
In the last week	74 (39.8%)	280 (60.5%)	66 (43.4%)	117 (56.3%)	537 (53.2%)
In the last month	68 (36.6%)	127 (27.4%)	61 (40.1%)	66 (31.7%)	322 (31.9%)
In the last 3-6 months	35 (18.8%)	37 (8.0%)	20 (13.2%)	19 (9.1%)	111 (11.0%)
Over 6 months ago	9 (4.8%)	18 (3.9%)	4 (2.6%)	6 (2.9%)	37 (3.7%)
Never detected or managed a PPH	0 (0.0%)	1 (0.2%)	1 (0.7%)	0 (0.0%)	2 (0.2%)

[a] Includes student midwives and student nurses

[b] One data point was excluded in Kenya and one in Nigeria, because they were deemed to be an outlier as a result of an incorrect value entered incorrectly by the participant, giving a total of 1,007 participants reported in 'years of experience at current hospital'

Table 5 Current PPH detection and management practices after vaginal birth, **by country**

	Kenya (*n*=186)	**Nigeria** (*n*=463)	**South Africa** (*n*=152)	**Tanzania** (*n*=208)	**Total** (*n*=1,009)
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
How is PPH typically detected? [c] (Among *n*=989 who reported that detecting PPH is part of their clinical role)	*(n=181)*	*(n=456)*	*(n=144)*	*(n=208)*	*(n=989)*
Visual estimation of blood loss	161 (89.0%)	431 (94.5%)	134 (93.1%)	159 (76.4%)	885 (89.5%)
Using vital signs (blood pressure, pulse, heart rate, respirations)	122 (67.4%)	335 (73.5%)	97 (67.4%)	126 (60.6%)	680 (68.8%)
Using uterine tone and size	96 (53.0%)	265 (58.1%)	73 (50.7%)	83 (39.9%)	517 (52.3%)
Collecting and measuring blood using a tool[d]	74 (40.9%)	148 (32.5%)	28 (19.4%)	145 (69.7%)	395 (39.9%)
Other	4 (2.2%)	20 (4.4%)	3 (2.1%)	12 (5.8%)	39 (3.9%)
Initial management response for PPH (Among *n*=999 who reported that managing PPH is part of their clinical role)	*(n=185)*	*(n=458)*	*(n=150)*	*(n=206)*	*(n=999)*
Uterine massage[Error! Bookmark not defined]	174 (94.1%)	421 (91.9%)	143 (95.3%)	191 (92.7%)	929 (93.0%)
Administer oxytocinError! Bookmark not defined.	161 (87.0%)	430 (93.9%)	143 (95.3%)	192 (93.2%)	926 (92.7%)
Administer IV fluids[d]	169 (91.4%)	411 (89.7%)	138 (92.0%)	189 (91.8%)	907 (90.8%)
Blood pressure and pulse checkError! Bookmark not defined.	152 (82.2%)	406 (88.7%)	137 (91.3%)	155 (75.2%)	850 (85.1%)
Administer misoprostol	107 (57.8%)	399 (87.1%)	97 (64.7%)	105 (51.0%)	708 (70.9%)
Internal examination in delivery room[d]	109 (58.9%)	261 (57.0%)	87 (58.0%)	98 (47.6%)	555 (55.6%)
Administer tranexamic acid (TXA)[d]	119 (64.3%)	183 (40.0%)	89 (59.3%)	86 (41.8%)	477 (47.8%)
Administer carbetocin	9 (4.9%)	64 (14.0%)	5 (3.3%)	2 (1.0%)	80 (8.0%)
Administer carboprost	5 (2.7%)	21 (4.6%)	5 (3.3%)	4 (1.9%)	35 (3.5%)
Other	9 (4.9%)	38 (8.3%)	13 (8.7%)	11 (5.3%)	71 (7.1%)

[c] Indicates a multiple-choice question where participants were able to select more than one response option

[d] Indicates a component of E-MOTIVE bundle

Table 6 Current PPH detection and management practices after vaginal birth, **by cadre**

	Doctor[e] (n=319)	**Nurse/midwife**[f] (n=648)	**Other** (n=42)	**Total (n=1,009)**
	n (%)	*n* (%)	*n* (%)	*n* (%)
How is PPH typically detected? [g] (Among *n*=989 who reported that detecting PPH is part of their clinical role)	*(n=306)*	*(n=643)*	*(n=40)*	*(n=989)*
Visual estimation of blood loss	286 (93.5%)	561 (87.3%)	38 (95.0%)	885 (89.5%)
Using vital signs (blood pressure, pulse, heart rate, respirations)	243 (79.4%)	403 (62.7%)	34 (85.0%)	680 (68.8%)
Using uterine tone and size	176 (57.5%)	319 (49.6%)	22 (55.0%)	517 (52.3%)
Collecting and measuring blood using a tool[h]	71 (23.2%)	304 (47.3%)	20 (50.0%)	395 (39.9%)
Other	5 (1.6%)	28 (4.4%)	6 (15.0%)	39 (3.9%)
Initial management response for PPH [g] (Among *n*=999 who reported that managing PPH is part of their clinical role)	*(n=316)*	*(n=642)*	*(n=41)*	*(n=999)*
Uterine massage[h]	297 (94.0%)	594 (92.5%)	38 (92.7%)	929 (93.0%)
Administer oxytocin[h]	291 (92.1%)	597 (93.0%)	38 (92.7%)	926 (92.7%)
Administer IV fluids[h]	287 (90.8%)	583 (90.8%)	37 (90.2%)	907 (90.8%)
Blood pressure and pulse check[h]	274 (86.7%)	539 (84.0%)	37 (90.2%)	850 (85.1%)
Administer misoprostol	226 (71.5%)	450 (70.1%)	32 (78.1%)	708 (70.9%)
Internal examination in delivery room[h]	174 (55.1%)	352 (54.8%)	29 (70.8%)	555 (55.6%)
Administer tranexamic acid (TXA)[h]	161 (51.0%)	294 (45.8%)	22 (53.7%)	477 (47.8%)
Administer carbetocin	36 (11.4%)	37 (5.8%)	7 (17.1%)	80 (8.0%)

[e] Includes consultant or specialist obstetricians, medical doctors, medical doctors in training, and non-physician clinician
[f] Includes student midwives and student nurses
[g] Indicates a multiple-choice question where participants were able to select more than one response option
[h] Indicates a component of E-MOTIVE bundle

3.3 Current practices: PPH management after vaginal birth

To understand how participants managed PPH after vaginal birth a series of questions were asked to capture what healthcare professionals' typical initial management response would be when they have detected a PPH. For this study, the focus was on first responses to primary vaginal PPH, not refractory or secondary PPH, and this was made clear to participants throughout the survey.

Almost all participants reported that managing PPH is part of their usual clinical role (*n*=999/1,009, 99.0%). These 999 participants made up the sub-sample that was surveyed on the following items relating to PPH management. Table 5 depicts the current practices of PPH management after vaginal birth by country, and Table 6 depicts the current practices of PPH management by cadre. First response management for PPH after vaginal birth was most commonly uterine massage (*n*=929/999, 93.0%), administration of oxytocin (*n*=926, 92.7%), and administration of IV fluids (*n*=907/999, 90.8%), which was comparable across countries and cadres.

Blood pressure and pulse checks (*n*=850/999, 85.1%) were also consistently reported across cadres but varied across countries ranging from 75.2% (*n*=155/206) in Tanzania to 91.3% (*n*=137/150) in South Africa. Similarly, administration of misoprostol was common (*n*=708/999, 70.9%), and consistent across cadres, but with substantial variation across countries ranging from 51.0% of participants reporting using this method (*n*=105/206) in Tanzania to 87.1% (*n*=399/458) in Nigeria. Tranexamic acid was reported as part of the first response to PPH by less than half of the participants (*n*=477/999, 47.8%), with substantial variation across countries (Nigeria: *n*=183/458, 40.0%; Tanzania: *n*=86/206, 41.8%; South Africa: *n*=89/150, 59.3%; Kenya: *n*= 119/185, 64.3%).

3.4 PPH training

Of 1,009 participants, 815 reported that they had received training focused on PPH detection and/or management (80.8%). Less than half of the participants who said they had received training reported that they had received this training within the last year (*n*=370/818, 45.2%). The training participants received was provided by several outlets. Specifically, 47.2% (*n*=385/816) of participants received training from their health facility, 22.7% (*n*=185/816) received training from another organisation such as a Non-Governmental Organisation, 10.4% (*n*=85/816) received training from a regional or district team, and 9.1% (*n*=74/816) received training from their country's Ministry of Health. Over half of the participants reported that their training included a presentation (56.1%, *n*=458/816). Conversely, less than a quarter of participants indicated that their training involved any form of simulation or practical element (23.7%, *n*=193/816). Additional information about PPH-training-related questions, by cadre and country can be found in Table 7 and Table 8.

To gain an understanding of how participants perceived the training they received, a series of Likert-style scales were employed. Firstly, participants were asked whether they thought that the PPH-related training they had received was useful. Of 970 participants, 47.4% (*n*=460) strongly agreed that their past training was useful, with a further 33.8% (*n*=328) agreeing that the training that they had received was useful. In addition, 37.6% (*n*=365/970) of participants strongly agreed that they have been adequately trained to detect PPH after vaginal birth, with 43.5% (*n*=422) participants also agreeing with this statement. With regards to managing PPH after vaginal birth, 38.5% (*n*=373) of participants strongly agreed that they had been adequately trained to do so, with a further 44.1% (428/970) agreeing that they had been adequately trained to manage a PPH after

vaginal birth. Further data relating to these questions, by country and cadre, can be found in Table 9 and Table 10.

3.5 PPH guidelines

Participants were asked about the clinical guidelines used to detect and manage PPH at their hospital. Of 1,009 participants, 87.9% (*n*=887) reported that there are clinical guidelines at their facility, and of these participants, 81.0% (*n*=719/888) indicated that the guidelines are on display.

Of those who reported that guidelines are on display, 98.8% (*n*=710/719) of participants reported that clinical guidelines are on display in the labour and/or delivery rooms. Few participants indicated that guidelines are on display in other locations in their health facility, with only 6.4% (*n*=46/719) of participants specifying that guidelines are on display in a meeting room for clinical staff, 2.4% (*n*=17/719) indicating that guidelines are on display in the tea or break rooms, and 4.7% (*n*=34/719) reporting that guidelines are on display in another location (see Table 11 for additional data by country and Table 12 by cadre).

Following these questions, participants were asked a series of Likert-style questions, which covered belief statements relating to clinical guidelines for PPH. Of 887 participants, 94.0% (*n*=836) strongly agreed or agreed that they are aware of recommendations and guidelines for the management and detection of PPH. The majority of participants (91.2%, *n*=810/887), agreed or strongly agreed that they use clinical guidelines when they are detecting and/or managing a PPH. In addition, 93.2% of participants (*n*=826/887) agreed or strongly agreed that they find recommendations and

guidelines for detecting and managing PPH useful for their clinical practice. Finally, 80.6% of participants (*n*=715/887) agreed or strongly agreed that they can easily access a copy of clinical guidelines for detecting and managing PPH within their health facility. For a further breakdown of these questions by country see Table 13 and by cadre see Table 14.

Table 7 Participant responses to training-related questions, **by country**

	Kenya (*n*=186)	**Nigeria** (*n*=463)	**South Africa** (*n*=152)	**Tanzania** (*n*=208)	**Total (*n*=1,009)**
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Have you received training on PPH detection and management?	*(n=186)*	*(n=463)*	*(n=152)*	*(n=208)*	*(n=1,009)*
Yes - Both detection and management of PPH training	129 (69.4%)	338 (73.0%)	129 (84.9%)	102 (49.0%)	698 (69.2%)
Yes - Management of PPH training only	25 (13.4%)	33 (7.1%)	7 (4.6%)	20 (9.6%)	85 (8.4%)
Yes - Detection of PPH training only	8 (4.3%)	7 (1.5%)	7 (4.6%)	10 (4.8%)	32 (3.2%)
No - No PPH training	23 (12.4%)	75 (16.2%)	7 (4.6%)	74 (35.6%)	179 (17.7%)
Unsure	1 (0.5%)	10 (2.2%)	2 (1.3%)	2 (1.0%)	15 (1.5%)
Recency of PPH training (amongst *n* who have received PPH-related training)	*(n=162)*	*(n=380)*	*(n=143)*	*(n=133)*	*(n=818)*
Less than one year ago	75 (46.3%)	177 (46.6%)	75 (52.5%)	43 (32.3%)	370 (45.2%)
1-2 years ago	47 (29.0%)	88 (23.2%)	39 (27.3%)	39 (29.3%)	213 (26.0%)
3-5 years ago	22 (13.6%)	64 (16.8%)	20 (14.0%)	34 (25.6%)	140 (17.1%)
Over 5 years ago	18 (11.1%)	51 (13.4%)	9 (6.3%)	17 (12.8%)	95 (11.6%)
Provider of PPH-related training (amongst *n* who have received PPH-related training)	*(n=162)*	*(n=379)*	*(n=143)*	*(n=132)*	*(n=816)*
Trainers from participants' hospital	69 (42.6%)	203 (53.6%)	67 (46.9%)	46 (34.9%)	385 (47.2%)
Trainers from the district or regional team	14 (8.6%)	11 (2.9%)	35 (24.5%)	25 (18.9%)	85 (10.4%)
Trainers from another organisation e.g. a Non-Governmental Organisation (NGO)	48 (29.6%)	91 (24.0%)	11 (7.7%)	35 (26.5%)	185 (22.7%)
Trainers from the Ministry of Health	17 (10.5%)	32 (8.4%)	8 (5.6%)	17 (12.9%)	74 (9.1%)
Unsure	2 (1.2%)	6 (1.6%)	1 (0.7%)	3 (2.3%)	12 (1.5%)
Other	12 (7.4%)	36 (9.5%)	21 (14.7%)	6 (4.6%)	75 (9.2%)
Format of the training (amongst *n* who have received PPH-related training)[i]	*(n=162)*	*(n=379)*	*(n=143)*	*(n=132)*	*(n=816)*
Workshop	57 (35.2%)	123 (32.5%)	38 (26.6%)	33 (25.0%)	251 (30.8%)
Presentation	100 (61.7%)	211 (55.7%)	68 (47.6%)	79 (59.9%)	458 (56.1%)
Simulation	48 (29.6%)	44 (11.6%)	55 (38.5%)	46 (34.9%)	193 (23.7%)
Case based	35 (21.6%)	86 (22.7%)	42 (29.4%)	40 (30.3%)	203 (24.9%)
Lectures	49 (30.3%)	124 (32.7%)	33 (23.1%)	51 (38.6%)	257 (31.5%)
Textbook	12 (7.4%)	45 (11.9%)	8 (5.6%)	20 (15.2%)	85 (10.4%)
Other	4 (2.5%)	16 (4.2%)	6 (4.2%)	2 (1.5%)	28 (3.4%)

[i] Multiple choice, multiple response question – participants could choose multiple training formats in their answer, to reflect the varied and combined nature of some training

Table 8 Participant responses to training-related questions, **by cadre**

	Doctor[j] (n=319)	**Nurse/Midwife[k]** (n=647)	**Other** (n=43)	**Total (n=1,009)**
	n (%)	*n* (%)	*n* (%)	*n* (%)
Have you received training on PPH detection and management?	*(n=319)*	*(n=647)*	*(n=43)*	*(n=1,009)*
Yes - Both detection and management of PPH training	258 (80.9%)	414 (64.0%)	26 (60.5%)	698 (69.2%)
Yes - Management of PPH training only	14 (4.4%)	66 (10.2%)	5 (11.6%)	85 (8.4%)
Yes - Detection of PPH training only	8 (2.5%)	24 (3.7%)	0 (0.0%)	32 (3.2%)
No - No PPH training	34 (10.7%)	133 (20.6%)	12 (27.9%)	179 (17.7%)
Unsure	5 (1.6%)	10 (1.6%)	0 (0.0%)	15 (1.5%)
Recency of PPH training (amongst those who had received PPH-related training)	*(n=283)*	*(n=504)*	*(n=31)*	*(n=818)*
Less than one year ago	148 (52.3%)	209 (41.5%)	13 (41.9%)	370 (45.2%)
1-2 years ago	68 (24.0%)	140 (27.8%)	5 (16.1%)	213 (26.0%)
3-5 years ago	41 (14.5%)	95 (18.9%)	4 (12.9%)	140 (17.1%)
Over 5 years ago	26 (9.2%)	60 (11.9%)	9 (29.0%)	95 (11.6%)
Provider of PPH-related training (amongst *n* who have received PPH-related training)	*(n=281)*	*(n=504)*	*(n=31)*	*(n=816)*
Trainers from participants' hospital	166 (59.1%)	210 (41.7%)	9 (29.0%)	385 (47.2%)
Trainers from the district or regional team	26 (9.3%)	54 (10.7%)	5 (16.1%)	85 (10.4%)
Trainers from another organisation e.g. a Non-Governmental Organisation (NGO)	53 (18.9%)	127 (25.2%)	5 (16.1%)	185 (22.7%)
Trainers from the Ministry of Health	12 (4.3%)	56 (11.1%)	6 (19.4%)	74 (9.1%)
Unsure	3 (1.1%)	9 (1.8%)	0 (0.0%)	12 (1.5%)
Other	21 (7.5%)	48 (9.5%)	6 (19.4%)	75 (9.2%)
Format of the training (amongst *n* who have received PPH-related training)[l]	*(n=281)*	*(n=504)*	*(n=31)*	*(n=816)*
Workshop	80 (28.5%)	159 (31.6%)	12 (38.7%)	251 (30.8%)
Presentation	175 (62.3%)	265 (52.6%)	18 (58.1%)	458 (56.1%)
Simulation	71 (25.3%)	113 (22.4%)	9 (29.0%)	193 (23.7%)
Case based	95 (33.8%)	97 (19.3%)	11 (35.5%)	203 (24.9%)
Lectures	81 (28.8%)	167 (33.1%)	9 (29.0%)	257 (31.5%)
Textbook	38 (13.5%)	43 (8.5%)	4 (12.9%)	85 (10.4%)
Other	6 (2.1%)	14 (2.8%)	8 (25.8%)	28 (3.4%)

[j] Includes consultant or specialist obstetricians, medical doctors, medical doctors in training, and non-physician clinician

[k] Includes student nurses and student midwives

[l] Multiple choice, multiple response question – participants could choose multiple training formats in their answer, to reflect the varied and combined nature of some training

Table 9 Participant responses to training-related belief statements, **by country**

To what extent do you agree with the following statements…	**Kenya** *n* (%) (n=186)	**Nigeria** *n* (%) (n=463)	**South Africa** *n* (%) (n=152)	**Tanzania** *n* (%) (n=208)	**Total *n* (%) (n=1,009)**
I think that the PPH training I received was useful	*(n=186)*	*(n=424)*	*(n=152)*	*(n=208)*	*(n=970)*
Strongly agree – agree	152 (81.7%)	368 (86.8%)	4 (2.6%)	10 (4.8%)	788 (81.2%)
Neither agree nor disagree	1 (0.5%)	1 (0.2%)	1 (0.7%)	4 (1.9%)	7 (0.7%)
Disagree – strongly disagree	15 (8.1%)	21 (5.0%)	140 (92.1%)	128 (61.5%)	50 (5.2%)
I have not received training	18 (9.7%)	34 (8.0%)	7 (4.6%)	66 (31.7%)	125 (12.9%)
I have been adequately trained how to detect PPH after a vaginal birth	*(n=186)*	*(n=424)*	*(n=152)*	*(n=208)*	*(n=970)*
Strongly agree – agree	153 (82.3%)	368 (86.8%)	3 (2.0%)	129 (62.0%)	787 (81.1%)
Neither agree nor disagree	7 (3.8%)	4 (0.9%)	5 (3.3%)	7 (3.4%)	23 (2.4%)
Disagree – strongly disagree	11 (5.9%)	22 (5.2%)	137 (90.1%)	11 (5.3%)	47 (4.8%)
I have not received training	15 (8.1%)	30 (7.1%)	7 (4.6%)	61 (29.3%)	113 (11.7%)
I have been adequately trained how to manage PPH after a vaginal birth	*(n=186)*	*(n=424)*	*(n=152)*	*(n=208)*	*(n=970)*
Strongly agree – agree	157 (84.4%)	371 (87.5%)	141 (92.8%)	132 (63.5%)	801 (82.6%)
Neither agree nor disagree	4 (2.2%)	6 (1.4%)	2 (1.3%)	10 (4.8%)	22 (2.3%)
Disagree – strongly disagree	10 (5.4%)	21 (5.0%)	3 (2.0%)	12 (5.8%)	46 (4.7%)
I have not received training	15 (8.1%)	26 (6.1%)	6 (4.0%)	54 (26.0%)	101 (10.4%)

Table 10 Participant responses to training-related belief statements, **by job role**

To what extent do you agree with the following statements…	**Doctor[m]** *n* (%) (n=319)	**Nurse/Midwife[n]** *n* (%) (n=647)	**Other** *n* (%) (n=43)	**Total** ***n* (%)** **(n=1,009)**
I think that the PPH training I received was useful	*(n=315)*	*(n=612)*	*(n=43)*	*(n=970)*
Strongly agree – agree	270 (85.7%)	485 (79.2%)	33 (76.7%)	788 (81.2%)
Neither agree nor disagree	4 (1.3%)	2 (0.3%)	1 (2.3%)	7 (0.7%)
Disagree – strongly disagree	14 (4.5%)	36 (5.9%)	0 (0.0%)	50 (5.2%)
I have not received training	27 (8.6%)	89 (14.5%)	9 (20.9%)	125 (12.9%)
I have been adequately trained how to detect PPH after a vaginal birth	*(n=315)*	*(n=612)*	*(n=43)*	*(n=970)*
Strongly agree – agree	265 (84.1%)	488 (79.7%)	34 (79.1%)	787 (81.1%)
Neither agree nor disagree	10 (3.2%)	13 (2.1%)	0 (0.0%)	23 (2.4%)
Disagree – strongly disagree	15 (4.8%)	30 (5.1%)	2 (4.7%)	47 (4.8%)
I have not received training	25 (7.9%)	81 (13.2%)	7 (16.3%)	113 (11.7%)
I have been adequately trained how to manage PPH after a vaginal birth	*(n=315)*	*(n=612)*	*(n=43)*	*(n=970)*
Strongly agree – agree	274 (87.0%)	494 (80.7%)	33 (76.7%)	801 (82.6%)
Neither agree nor disagree	7 (2.2%)	15 (2.5%)	0 (0.0%)	22 (2.3%)
Disagree – strongly disagree	12 (3.8%)	31 (5.1%)	3 (7.0%)	46 (4.7%)
I have not received training	22 (7.0%)	72 (11.8%)	7 (16.3%)	101 (0.4%)

[m] Includes consultant or specialist obstetricians, medical doctors, medical doctors in training, and non-physician clinician
[n] Includes student nurses and student midwives

Table 11 Clinical guidelines for PPH **by country**

	Kenya *n* (%) (n=186)	**Nigeria** *n* (%) (n=463)	**South Africa** *n* (%) (n=152)	**Tanzania** *n* (%) (n=208)	**Total *n* (%) (n=1,009)**
Are there clinical guidelines used in your facility to detect and manage PPH?	*(n=186)*	*(n=463)*	*(n=152)*	*(n=208)*	*(n=1,009)*
Yes	164 (88.2%)	394 (85.1%)	145 (95.4%)	184 (88.5%)	887 (87.9%)
No	22 (11.8%)	69 (14.9%)	7 (4.6%)	24 (11.5%)	122 (12.1%)
Are these clinical practice guidelines on display? (Amongst *n* who reported that there are clinical guidelines)	*(n=165)*	*(n=394)*	*(n=145)*	*(n=184)*	*(n=888)*
Yes	152 (92.1%)	299 (75.9%)	115 (79.3%)	153 (83.2%)	719 (81.0%)
No	13 (7.9%)	95 (24.1%)	30 (20.7%)	31 (16.8%)	169 (19.0%)
Where are the PPH detection and management guidelines on display? (Amongst *n* who reported that guidelines were on display)°	*(n=152)*	*(n=299)*	*(n=115)*	*(n=153)*	*(n=719)*
Labour and/or delivery rooms	151 (99.3%)	295 (98.7%)	112 (97.4%)	152 (99.4%)	710 (98.8%)
Tea/break room	5 (3.3%)	1 (0.3%)	3 (2.6%)	8 (5.2%)	17 (2.4%)
Meeting room for clinical staff	5 (3.3%)	25 (9.4%)	8 (7.0%)	8 (5.2%)	46 (6.4%)
Other	3 (2.0%)	19 (6.4%)	10 (8.7%)	2 (1.3%)	34 (4.7%)

° Multiple choice, multiple response question – participants could choose multiple locations when answering this question, as guidelines may be on display in multiple locations within the health facilities

Table 12 Clinical guidelines for PPH **by cadre**

	Doctor[p] *n* (%) (n=319)	**Nurse/Midwife[q]** *n* (%) (n=647)	**Other** *n* (%) (n=43)	**Total** ***n* (%)** **(n=1,009)**
Are there clinical guidelines used in your facility to detect and manage PPH?	*(n=319)*	*(n=647)*	*(n=43)*	*(n=1,009)*
Yes	265 (83.1%)	590 (91.2%)	32 (74.4%)	887 (87.9%)
No	54 (16.9%)	57 (8.8%)	11 (25.6%)	122 (12.1%)
Are these clinical practice guidelines on display? (Amongst *n* participants who reported that there are clinical guidelines)	*(n=265)*	*(n=590)*	*(n=33)*	*(n=888)*
Yes	191 (72.1%)	505 (85.6%)	23 (69.7%)	719 (81.0%)
No	74 (27.9%)	85 (14.4%)	10 (30.3%)	169 (19.0%)
Where are the PPH detection and management guidelines on display? (Amongst *n* who reported that guidelines were on display)?[r]	*(n=191)*	*(n=505)*	*(n=23)*	*(n=719)*
Labour and/or delivery rooms	189 (99.0%)	499 (98.8%)	22 (95.7%)	710 (98.8%)
Tea/break room	5 (2.6%)	11 (2.2%)	1 (4.4%)	17 (2.4%)
Meeting room for clinical staff	11 (5.8%)	34 (6.7%)	1 (4.4%)	46 (6.4%)
Other	14 (7.3%)	17 (3.4%)	3 (13.0%)	34 (4.7%)

[p] Includes consultant or specialist obstetricians, medical doctors, medical doctors in training, and non-physician clinician
[q] Includes student nurses and student midwives
[r] Multiple choice, multiple response question – participants could choose multiple locations when answering this question, as guidelines may be on display in multiple locations within the health facilities

Table 13 Participant responses to guideline-related belief statements, **by country**

To what extent do you agree with the following statements…	**Kenya** *n* (%) (n=186)	**Nigeria** *n* (%) (n=463)	**South Africa** *n* (%) (n=152)	**Tanzania** *n* (%) (n=208)	**Total** ***n* (%) (n=1,009)**
I am aware of recommendations and guidelines for the management and detection of PPH	*(n=164)*	*(n=394)*	*(n=145)*	*(n=184)*	*(n=887)*
Strongly agree – agree	151 (92.1%)	376 (95.4%)	141 (97.2%)	168 (91.3%)	836 (94.3%)
Neither agree nor disagree	2 (1.2%)	4 (1.0%)	1 (0.7%)	8 (4.4%)	15 (1.7%)
Disagree – strongly disagree	11 (6.7%)	14 (3.6%)	3 (2.1%)	8 (4.4%)	36 (4.1%)
I use clinical guidelines when I am detecting and managing a PPH	*(n=164)*	*(n=394)*	*(n=145)*	*(n=184)*	*(n=887)*
Strongly agree – agree	143 (87.2%)	371 (94.2%)	137 (94.5%)	159 (86.4%)	810 (91.3%)
Neither agree nor disagree	6 (3.7%)	10 (2.5%)	3 (2.1%)	14 (7.6%)	33 (3.7%)
Disagree – strongly disagree	15 (9.2%)	13 (3.3%)	5 (3.5%)	11 (6.0%)	44 (5.0%)
I find recommendations and guidelines for detecting and managing PPH useful for my clinical practice	*(n=164)*	*(n=394)*	*(n=145)*	*(n=184)*	*(n=887)*
Strongly agree – agree	146 (89.0%)	377 (95.7%)	140 (96.6%)	163 (88.6%)	826 (93.1%)
Neither agree nor disagree	5 (3.1%)	2 (0.5%)	3 (2.1%)	8 (4.4%)	18 (2.0%)
Disagree – strongly disagree	13 (7.9%)	15 (3.8%)	2 (1.4%)	13 (7.1%)	43 (4.9%)
I can easily access a copy of clinical guidelines for detecting and managing PPH in my hospital	*(n=164)*	*(n=394)*	*(n=145)*	*(n=184)*	*(n=887)*
Strongly agree – agree	123 (75.0%)	320 (81.2%)	128 (88.3%)	144 (78.3%)	715 (80.6%)
Neither agree nor disagree	15 (9.1%)	29 (7.4%)	8 (5.5%)	22 (12.0%)	74 (8.3%)
Disagree – strongly disagree	26 (15.9%)	45 (11.4%)	9 (6.2%)	18 (9.8%)	98 (11.1%)

Table 14 Participant responses to guideline-related belief statements, **by cadre**

To what extent do you agree with the following statements…	**Doctor**[s] *n* (%) (n=319)	**Nurse/Midwife**[t] *n* (%) (n=647)	**Other** *n* (%) (n=43)	**Total** ***n* (%)** **(n=1,009)**
I am aware of recommendations and guidelines for the management and detection of PPH	*(n=265)*	*(n=590)*	*(n=32)*	*(n=887)*
Strongly agree – agree	256 (96.6%)	549 (93.1%)	31 (96.9%)	836 (94.3%)
Neither agree nor disagree	1 (0.4%)	14 (2.4%)	0 (0.0%)	15 (1.7%)
Disagree – strongly disagree	8 (3.0%)	27 (4.6%)	1 (3.1%)	36 (4.1%)
I use clinical guidelines when I am detecting and managing a PPH	*(n=265)*	*(n=590)*	*(n=32)*	*(n=887)*
Strongly agree – agree	245 (92.5%)	535 (90.7%)	30 (93.7%)	810 (91.3%)
Neither agree nor disagree	10 (3.8%)	21 (3.6%)	2 (6.3%)	33 (3.7%)
Disagree – strongly disagree	10 (3.8%)	34 (5.8%)	0 (0.0%)	44 (5.0%)
I find recommendations and guidelines for detecting and managing PPH useful for my clinical practice	*(n=265)*	*(n=590)*	*(n=32)*	*(n=887)*
Strongly agree – agree	256 (96.6%)	541 (91.7%)	29 (90.6%)	826 (93.1%)
Neither agree nor disagree	2 (0.8%)	15 (2.5%)	1 (3.1%)	18 (2.0%)
Disagree – strongly disagree	7 (2.6%)	34 (5.8%)	2 (6.3%)	43 (4.9%)
I can easily access a copy of clinical guidelines for detecting and managing PPH in my hospital	*(n=265)*	*(n=590)*	*(n=32)*	*(n=887)*
Strongly agree – agree	206 (77.7%)	480 (81.4%)	29 (90.6%)	715 (80.6%)
Neither agree nor disagree	32 (12.1%)	40 (6.8%)	2 (6.3%)	74 (8.3%)
Disagree – strongly disagree	27 (10.2%)	70 (11.9%)	1 (3.1%)	98 (11.1%)

[s]

[t] Includes student nurses and student midwives

3.6 Performing multiple interventions: barriers and enablers to performing a care bundle

Participants were asked to rate their level of agreement with a series of Likert-type scales relating to the use of a PPH care bundle, like E-MOTIVE. The scale ranged from 1 to 5, where 1 = strongly disagree and 5 = strongly agree. In total, 927 participants responded to these questions and are included in the following analysis.

Over half of the participants agreed that performing multiple interventions for PPH in a care bundle **would be easy to remember to do** (55.1%, *n*=511/927), with a further 20.1% (*n*=186/927) strongly agreeing with this statement. Of 927 participants, 46.8% (*n*=434/927) strongly agreed and a further 42.8% (*n*=397/927) agreed that performing multiple interventions in a care bundle **would help to improve the management of PPH for vaginal births**. When asked if a care bundle for PPH would be **more effective than how PPH is currently managed at their hospital**, 45.4% (*n*=421) agreed, and a further 22.1% (*n*=205/927) strongly agreed with this statement.

However, some participants also agreed with negative beliefs about potentially using a care bundle for PPH management, which may present barriers to the uptake of the E-MOTIVE bundle. Approximately one-third of participants agreed or strongly agreed that **it would be burdensome for them to perform a PPH care bundle** (32.8%, *n*=304/927**),** and almost two-thirds of participants agreed or strongly agreed that **performing a PPH care bundle would be too much for <u>one</u> person to do alone** (68.6%, 633/927) (see

Table 15).

Table 15 Beliefs about performing multiple interventions together in a care bundle, like E-MOTIVE (*n*=927)

If you were asked to perform multiple interventions in the shortest possible time frame, to what extent does/would this…	**Strongly disagree** *n* (%)	**Disagree** *n* (%)	**Neither agree nor disagree** *n* (%)	**Agree** *n* (%)	**Strongly agree** *n* (%)	**I don't know** *n* (%)
Be burdensome for me to do	98 (10.6%)	397 (42.8%)	114 (12.3%)	226 (24.4%)	78 (8.4%)	14 (1.5%)
Be easy to remember to do	22 (2.4%)	126 (13.6%)	72 (7.8%)	511 (55.1%)	186 (20.1%)	10 (1.1%)
Be more effective than how PPH is currently managed for vaginal births at our hospital	31 (3.3%)	141 (15.2%)	112 (12.1%)	421 (45.4%)	205 (22.1%)	17 (1.8%)
Be too much for a team to do	256 (27.6%)	475 (51.2%)	38 (4.1%)	94 (10.1%)	58 (6.3%)	6 (0.7%)
Be too much for one person to do	46 (5.0%)	179 (19.3%)	62 (6.7%)	412 (44.4%)	221 (24.2%)	4 (0.4%)
Help to improve the management of PPH for vaginal births	30 (3.2%)	39 (4.2%)	25 (2.7%)	397 (42.8%)	434 (46.8%)	2 (0.2%)
Make sense to me	38 (4.1%)	123 (13.3%)	68 (7.3%)	384 (41.4%)	287 (31.0%)	27 (2.9%)
Require us to change how we work as a team	64 (6.9%)	261 (28.2%)	85 (9.2%)	361 (38.9%)	141 (15.2%)	15 (1.6%)

3.7 Addressing barriers and utilising enablers to changing PPH practice

To be able to appropriately address the barriers and enablers to performing multiple interventions together, participants were then asked what interventions could make it easier to perform a care bundle. The majority of participants indicated that **improving team working** would make it easier to perform multiple interventions together (90.4%, *n*=838/926). Of 926 participants, 81.7% (*n*=757) also indicated that **increasing the availability of PPH-related supplies** at their hospital would also help them to perform multiple PPH interventions together in a care bundle. In addition to this, 80.3% (*n*=744/926) of participants indicated that **putting all of the required supplies in one place**, like a box or trolley, would assist them in performing multiple interventions together. Other interventions that participants perceived would make it easier to perform multiple PPH-related interventions together in a care bundle can be found in Table 17.

Participants were asked what assistance they would need to perform the PPH management methods in the E-MOTIVE bundle. This was a multiple-selection question, where participants could choose as many forms of assistance as they thought they would need to be able to perform the target behaviours. Over half of the participants indicated that they would not need any assistance to be able to perform a blood pressure and pulse check (61.7%, *n*=682), perform uterine massage (60.1%, *n*=671), administer IV fluids (57.1%, *n*=630), or administer oxytocin (54.9%, *n*=623). Around one-third of participants indicated that they would not need any assistance to perform an internal examination in the delivery room (35.6%, *n*=444) or administer tranexamic acid (TXA) (34.0%, *n*=416).

When asked what assistance they would need to administer TXA, 28.7% of participants (*n*=352) said that they would need more supplies, and 20.1% of participants (*n*=247) said that they would need more training. Regarding performing an internal

examination in the delivery room, 21.9% of participants (n=273) said that they would need more training, and 18.9% of participants (n=235) said that they would need more supervision. Some participants also disclosed that they would need other forms of assistance to perform each of these behaviours, which can be seen in Table 16.

Table 16 Assistance that participants indicated they would need to perform the PPH management strategies in the E-MOTIVE bundle

	More training	More supervision	More supplies	More time	No assistance	Not able to do
	N (%)	*N (%)*	*N (%)*	*N (%)*	*N (%)*	*N (%)*
Blood pressure and pulse check	72 (6.5%)	71 (6.4%)	188 (17.0%)	87 (7.9%)	682 (61.7%)	5 (0.5%)
Uterine massage	164 (14.7%)	125 (11.2%)	68 (6.1%)	84 (7.5%)	671 (60.1%)	4 (0.4%)
Administer oxytocin	100 (8.8%)	71 (6.3%)	290 (25.6%)	48 (4.2%)	623 (54.9%)	3 (0.3%)
Administer tranexamic acid (TXA)	247 (20.2%)	135 (11.0%)	352 (28.7%)	43 (3.5%)	416 (34.0%)	32 (2.6%)
Administer IV fluids	81 (7.3%)	55 (5.0%)	293 (26.6%)	40 (3.6%)	630 (57.1%)	4 (0.4%)
Internal examination in delivery room	273 (21.9%)	235 (18.9%)	137 (11.0%)	126 (10.1%)	444 (35.6%)	31 (2.5%)

Participants were asked about what interventions to improve PPH-related practice currently exist in their hospital. The most reported strategy was having **guidelines and protocols on display**, which was selected by 67.9% (n=628/925) of participants. In addition to guidelines and protocols, participants also reported that there are **visual reminders and posters** of procedures and policies on display within the maternity and delivery wards (63.8%, n=590/925). Of the 925 participants who responded to this question, only 66 (7.1%) reported that they were not aware of any current strategies to improve PPH-related practice at their facility (see Table 17).

Table 17 Existing and proposed interventions to assist in changing PPH-related practice

	***n* (%)**
What interventions would make it easier to perform multiple interventions together?	*(n=926)*
Improving team working	838 (90.4%)
Increasing the availability of supplies	757 (81.7%)
Having all of the required supplies in one place e.g., in a box or trolley	744 (80.3%)
More training	714 (77.1%)
Having plans, protocols, or guidelines in place	710 (76.6%)
Having opportunities to practice	595 (64.2%)
Having reminders	483 (52.1%)
Other	22 (2.4%)
What strategies to improve PPH-related practice are currently in place at your health facility?	*(n=925)*
Guidelines and protocols on display	628 (67.9%)
Visual reminders and posters	590 (63.8%)
Efforts to improve ease of access to supplies	463 (50.1%)
Feedback on current practice	408 (44.1%)
Peer support system	392 (42.4%)
Decision aids	303 (32.8%)
Local PPH champions and leads	234 (25.3%)
No strategies are in place	66 (7.1%)
Other	7 (0.8%)

3.8 Beliefs about Capability, Opportunity, and Motivation around PPH detection

To establish an understanding of their capabilities, opportunities, and motivations around performing PPH detection and management-related behaviours, participants were asked to rate their agreement with several statements on a 5-point Likert-type scale, where 1 indicated a strong disagreement and 5 indicated a strong agreement with the statement. These Likert-type questions were modelled on previous research (Huijg et al., 2014) which developed a generic questionnaire assessing the 14 domains of behavioural determinants from the revised TDF (Cane et al., 2012). These generic questions can be tailored to suit different target behaviours, actions, and contexts relative to implementation science research. Although it was possible to map the behaviours and actions of interest: those relating to the detection and management of PPH, and context: the healthcare providers'

hospital, these items did not capture the full range of behaviours this research aimed to explore. For this reason, items were added to encapsulate all behaviours of interest. For this reason, and that the current questionnaire was not validated, the results of this study cannot be analysed against the COM-B model and claims cannot be made about the healthcare providers' overall capability, opportunity, and motivation as whole constructs.

When asked about their agreement with PPH detection-related statements, of 989 participants, 96.0% (n=949) agreed or strongly agreed that they intend to improve their knowledge of PPH detection during vaginal birth, 95.8% (n=947) agreed or strongly agreed that they know what to do to detect PPH after vaginal birth. The majority of participants also agreed or strongly agreed that they want to improve how they detect PPH during a vaginal birth (95.1%, n=941), and that they have the skills to detect a PPH after vaginal birth (94.3%, n=933). In total, 880 of 989 participants (89.0%) agreed or strongly agreed that they are confident that they can detect a PPH after a vaginal birth even when there is little time, 822 of 989 participants (83.1%) agreed or strongly agreed that it is easy to distinguish between normal blood loss and PPH after vaginal birth, and 511 of 989 participants (51.7%) agreed or strongly agreed that it is easy to accurately estimate the volume of blood that is lost after vaginal birth.

Regarding emotions around PPH detection, 929 of 989 participants (93.9%) agreed or strongly agreed that they feel good if they successfully detect a PPH during a vaginal birth, 651 of 989 participants (65.9%) disagreed or strongly disagreed that their emotional state affects how they detect a PPH after a vaginal birth, and 629 participants (63.6%) disagreed or strongly disagreed that their emotions are negatively affected by detecting a PPH after a vaginal birth. Of 989 participants, 65.8% (n=650) disagreed or strongly

disagreed that fear of repercussions from the patient and their family affect how they detect a PPH after vaginal birth.

When asked to rate their agreement with statements concerning the social aspects of PPH detection, 922 of 989 participants (93.2%) agreed or strongly agreed that if they need help detecting a PPH after vaginal birth they can easily get the support or assistance they need from their team. In total, 583 of 989 participants (58.9%) reported that in the past they have needed assistance when detecting a PPH after vaginal birth, as they did not have the competency required to do so, furthermore, 628 of 989 participants (63.5%) disagreed or strongly disagreed that improving PPH detection is not discussed in regular meetings at their health facility.

Regarding feedback, commendation, and punishment around PPH detection, of 989 participants, 62.2% (n=615) agreed or strongly agreed that they get feedback on their performance relative to PPH detection after vaginal birth, and 63.3% (n=626/989) agreed or strongly agreed that they get sufficient feedback about their performance when detecting a PPH after vaginal birth. Of 989 participants, 506 (51.2%) agreed or strongly agreed that their team is disciplined for failing to detect a PPH during a vaginal birth, and 501 (50.7%) agreed or strongly agreed that they are commended if they successfully detect a PPH during a vaginal birth at their health facility. See Table 18 for additional data relating to each of these statements.

Table 18 Participant agreement with PPH detection-related statements (n=989)

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
	N (%)	*N (%)*	*N (%)*	*N (%)*	*N (%)*
Fear of repercussions from the patient and their family affect how I detect a PPH after a vaginal birth	222 (22.5%)	428 (43.3%)	142 (14.4%)	153 (15.5%)	44 (4.5%)
I am confident that I can detect a postpartum haemorrhage after a vaginal birth, even when there is little time	14 (1.4%)	38 (3.8%)	57 (5.8%)	619 (62.6%)	261 (26.4%)
I feel good if I successfully detect a PPH during a vaginal birth	23 (2.3%)	6 (0.6%)	31 (3.1%)	437 (44.2%)	492 (49.8%)
I get sufficient feedback about my performance when I detect a PPH during a vaginal birth	38 (3.8%)	185 (18.7%)	140 (14.2%)	506 (51.2%)	120 (12.1%)
I have the skills to detect postpartum haemorrhage after vaginal birth	12 (1.2%)	12 (1.2%	32 (3.2%)	584 (59.1%)	349 (35.3%)
I intend to improve my knowledge of PPH detection during vaginal birth	14 (1.4%)	8 (0.8%)	18 (1.8%)	483 (48.8%)	466 (47.1%)
I know what I need to do to detect a postpartum haemorrhage after a vaginal birth	13 (1.3%)	9 (0.9%)	20 (2.0%)	594 (60.1%)	353 (35.7%)
I want to improve how I detect PPH during a vaginal birth	23 (2.3%)	10 (1.0%)	15 (1.5%)	425 (43.0%)	516 (52.2%)
If I need help detecting a postpartum haemorrhage after a vaginal birth, I can easily get the support or assistance I need from my team	25 (2.5%)	17 (1.7%)	25 (2.5%)	477 (48.2%)	445 (45.0%)
If I successfully detect a PPH after a vaginal birth at my health facility I am commended	58 (5.9%)	222 (22.5%)	208 (21.0%)	413 (41.8%)	88 (8.9%)
Improving PPH detection is not discussed in regular meetings at my facility	161 (16.3%)	467 (47.2%)	85 (8.6%)	224 (22.7%)	52 (5.3%)
In the past, I have needed assistance when detecting a postpartum haemorrhage after a vaginal birth, as I did not have the competency required	75 (7.6%)	240 (24.3%)	91 (9.2%)	491 (49.7%)	92 (9.3%)
It is easy to accurately estimate the volume of blood lost after a vaginal birth	51 (5.2%)	312 (31.6%)	115 (11.6%)	405 (41.0%)	106 (10.7%)
It is easy to distinguish between normal blood loss and a postpartum haemorrhage after a vaginal birth	20 (2.0%)	82 (8.3%)	65 (6.6%)	545 (55.1%)	277 (28.0%)
My emotional state affects how I detect a PPH after a vaginal birth	228 (23.1%)	423 (42.8%)	102 (10.3%)	188 (19.0%)	48 (4.9%)
My emotions are negatively affected by detecting a PPH after a vaginal birth	165 (16.7%)	464 (46.9%)	134 (13.6%)	184 (18.6%)	42 (4.3%)
My team is disciplined for failing to detect a PPH during a vaginal birth	71 (7.2%)	207 (20.9%)	205 (20.7%)	384 (38.8%)	122 (12.3%)
When I detect a PPH during a vaginal birth I receive feedback on my performance	48 (4.9%)	176 (17.8%)	150 (15.2%)	492 (49.8%)	123 (12.4%)

Table 19 Participant agreement with PPH management-related statements (*n*=989)

	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
	N (%)	*N (%)*	*N (%)*	*N (%)*	*N (%)*
Fear of repercussions from the patient and their family affect how I manage a PPH after vaginal birth	193 (21.0%)	412 (44.8%)	128 (13.9%)	133 (14.5%)	53 (5.8%)
I am confident that I can manage a postpartum haemorrhage after a vaginal birth, even when there is little time	8 (0.9%)	21 (2.3%)	60 (6.5%)	545 (59.3%)	285 (31.0%)
I feel good if I successfully manage a PPH during a vaginal birth	7 (0.8%	1 (0.1%)	18 (2.0%)	388 (42.2%)	505 (55.0%)
I get sufficient feedback about my performance when I manage a PPH after vaginal birth	34 (3.7%)	174 (18.9%)	164 (17.9%)	427 (46.5%)	120 (13.1%)
I have the skills to manage a postpartum haemorrhage after a vaginal birth	6 (0.7%)	7 (0.8%)	31 (3.4%)	576 (62.7%)	299 (32.5%)
I intend to improve my knowledge of PPH management	8 (0.9%)	5 (0.5%)	10 (1.1%)	453 (49.3%)	443 (48.2%)
I know what I need to do to manage a postpartum haemorrhage after a vaginal birth	7 (0.8%)	5 (0.5%)	19 (2.1%)	580 (63.1%)	308 (33.5%)
I want to improve how I manage PPH during a vaginal birth	12 (1.3%)	12 (1.3%)	11 (1.2%)	420 (45.7%)	464 (50.5%)
If I need help managing a postpartum haemorrhage after a vaginal birth, I can easily get the support or assistance I need from my team	12 (1.3%)	8 (0.9%)	23 (2.5%)	439 (7.8%)	437 (47.6%)
If I successfully manage a PPH after vaginal birth at my health facility I am commended	38 (4.1%)	178 (19.4%)	185 (20.1%)	416 (45.3%)	102 (11.1%)
Improving PPH management is not discussed in regular meetings at my facility	138 (15.0%)	427 (46.5%)	93 (10.1%)	206 (22.4%)	55 (6.0%)
In the past, I have needed assistance when managing a postpartum haemorrhage after a vaginal birth, as I did not have the competency required	39 (4.2%)	153 (16.7%)	85 (9.3%)	519 (56.5%)	123 (13.4%)
My emotional state affects how I manage a PPH after vaginal birth	171 (18.6%)	447 (48.6%)	110 (12.0%)	140 (15.2%)	51 (5.6%)
My emotions are negatively affected by managing a PPH after vaginal birth	156 (17.0%)	421 (45.8%)	137 (14.9%)	158 (17.2%)	47 (5.1%)
My team is disciplined for failing to manage a PPH during a vaginal birth	54 (5.9%)	215 (23.4%)	186 (20.2%)	344 (37.4%)	120 (13.1%)
When I manage a PPH after vaginal birth I receive feedback on my performance	36 (3.9%)	162 (17.6%)	170 (18.5%)	442 (48.1%)	109 (11.9%)

3.9 Beliefs about Capability, Opportunity, and Motivation around PPH management

When asked about their agreement with PPH management-related statements, of 989 participants, 90.6% (*n*=896) agreed or strongly agreed that they intend to improve their knowledge of PPH management during vaginal birth, and 89.8% (*n*=888) agreed or strongly agreed that they know what they need to do to manage PPH after vaginal birth. The majority of participants also agreed or strongly agreed that they want to improve how they manage PPH during a vaginal birth (89.4%, *n*=884), and that they have the skills to detect a PPH after vaginal birth (88.5%, *n*=875). In total, 830 of 989 participants (83.9%) agreed or strongly agreed that they are confident that they can manage a PPH after a vaginal birth even when there is little time.

Regarding emotions around PPH management, 893 of 989 participants (90.3%) agreed or strongly agreed that they feel good if they successfully manage a PPH during vaginal birth, 618 of 989 participants (67.2%) disagreed or strongly disagreed that their emotional state affects how they manage a PPH after vaginal birth, and 577 of 989 participants (62.8%) disagreed or strongly disagreed that their emotions are negatively affected by managing a PPH after vaginal birth. Of 989 participants, 65.8% (*n*=605) disagreed or strongly disagreed that fear of repercussions from the patient and their family affect how they manage a PPH after vaginal birth.

When asked to rate their agreement with statements concerning the social aspects of PPH management, 876 of 989 participants (88.6%) agreed or strongly agreed that if they need help managing a PPH after vaginal birth they can easily get the support or assistance they need from their team. In total, 642 of 989 participants (64.9%) reported that in the past they have needed assistance when managing a PPH after vaginal birth, as they did not have the competency required to do so, furthermore, 565 of 989 participants (61.5%)

disagreed or strongly disagreed that improving PPH management is not discussed in regular meetings at their health facility.

Regarding feedback, commendation, and punishment around PPH detection, of 989 participants, 55.7% (*n*=551) agreed or strongly agreed that they get feedback on their performance relative to PPH management after vaginal birth, and 55.3% (*n*=547/989) agreed or strongly agreed that they get sufficient feedback about their performance when managing a PPH after vaginal birth. Of 989 participants, 464 (46.9%) agreed or strongly agreed that their team is disciplined for failing to manage a PPH during vaginal birth, and 518 (52.4%) agreed or strongly agreed that they are commended if they successfully manage a PPH during vaginal birth at their health facility. For further data see Table 19.

3.10 Beliefs about Capability, Opportunity, and Motivation around PPH

Participants were asked to rate their agreement with a series of statements relating to the detection and management of PPH as a whole. This rating was on a scale of 1 to 5, where 1 = strongly disagree and 5 = strongly agree, some scales also offered participants the option to select that they were unsure as to their level of agreement with the statement if relevant. Of 929 participants, 92.9% (*n*=963) agreed or strongly agreed that PPH is something that concerns them, and 53.9% (*n*=500) disagreed or strongly disagreed that they find detecting and managing PPH stressful. Of 926 participants, 84.8% (*n*=785) agreed or strongly agreed that PPH management after vaginal birth needs to improve at their hospital, and 83.8% (*n*=765) agreed or strongly agreed that PPH detection needs to improve at their hospital.

Table 20 Participant agreement with PPH detection and management-related statements

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Unsure
	N (%)	*N (%)*	*N (%)*	*N (%)*	*N (%)*	*N (%)*
I find detecting and managing postpartum haemorrhage stressful[u]	85 (9.2%)	415 (44.7%)	115 (12.4%)	220 (23.7%)	87 (9.4%)	7 (0.8%)
Postpartum haemorrhage detection after vaginal birth needs to improve at my hospital[v]	24 (2.6%)	69 (7.5%)	57 (6.2%)	521 (56.3%)	255 (27.5%)	-
Postpartum haemorrhage is a priority compared to my other clinical responsibilities in my current role[u]	14 (1.5%)	46 (5.0%)	94 (10.1%)	431 (46.4%)	334 (36.0%)	10 (1.1%)
Postpartum haemorrhage is a problem for women giving birth vaginally in my hospital[u]	37 (4.0%)	171 (18.4%)	102 (11.0%)	407 (43.8%)	202 (21.7%)	10 (1.1%)
Postpartum haemorrhage is something that concerns me[u]	15 (1.6%)	20 (2.2%)	27 (2.9%)	433 (46.6%)	430 (46.3%)	4 (0.4%)
Postpartum haemorrhage management after vaginal birth needs to improve at my hospital[v]	27 (2.9%)	57 (6.2%)	57 (6.2%)	508 (54.9%)	277 (29.9%)	-

[u] n=929
[v] n=926

Approximately two-thirds of participants agreed or strongly agreed that PPH is a problem for women giving birth in their hospital (65.6%, *n*=609/929). Of 929 participants, 82.3% (*n*=765) agreed or strongly agreed that PPH is a priority compared to other clinical responsibilities in their current role.

3.11 Perceived importance of PPH detection and management practices

To understand how important participants feel that a variety of PPH detection and management practices are, they were asked to rate each method on a scale of 1 to 5, where 1 = 'not at all important' and 5 = 'extremely important'.

Of 989 participants, 49.1% (*n*=486) agreed that using vital signs, including blood pressure, pulse, heart rate, and respirations is extremely important in helping them to detect a PPH. One-third of participants (33.3%, *n*=329/989) agreed that using uterine tone and size is extremely important when detecting a PPH. 32.1% of participants (*n*=317/989) agreed that collecting and measuring blood using a tool was extremely important when detecting a PPH, however, 15.7% (*n*=155/989) had never used a tool to detect a PPH. Visual estimation of blood loss was reported as an extremely important method of PPH detection by 27.4% of participants (*n*=271/989). The Modified Early Obstetric Warning System (MEOWS) was seen to be an extremely important method of detecting PPH by 21.7% of participants (*n*=215/989), in addition, 30.7% of participants had never used MEOWS to help detect a PPH. Over half of the participants had never used a CRADLE device (58.0%, *n*=574/989), with only 6.4% of participants (*n*=64/989) indicating that this is an extremely important tool in helping them to detect a PPH (see

Table 21).

Participants were then asked to rate their perceived importance of PPH management strategies and methods, which included medications and actions that they may employ after they have diagnosed a PPH. The management strategies included in the E-MOTIVE bundle were amongst the methods participants were asked to rate. Administering oxytocin was reported to be extremely important by the greatest number of participants (67.5%, *n*=621/920), followed by administering IV fluids which was rated as extremely important by 61.6% of participants (*n*=567/920). In addition, 61.5% of participants (*n*=566/920) indicated that they feel that performing a blood pressure and pulse check is extremely important when managing a PPH. 58.9% of participants (*n*=542/920) indicated that they felt that repairing high vaginal or cervical tears is extremely important when managing a PPH. Of 920 participants, 492 (53.5%) indicated that uterine massage is extremely important, with a further 355 (38.6%) rating internal exploration in the delivery room as extremely important in their PPH management practices. Less than one-third of participants agreed that administering tranexamic acid (TXA) is extremely important when managing a PPH (29.6%, *n*=272/919). Other PPH management practices which are not included in the E-MOTIVE bundle can be seen in Table 22.

Table 21 Participants' perceived importance of PPH detection methods (*N*=989)

	Not at all important	**Slightly important**	**Moderately important**	**Very important**	**Extremely important**	**Never used method**
	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Using vital signs, including blood pressure, pulse, heart rate, respirations	3 (0.3%)	20 (2.0%)	50 (5.1%)	423 (42.8%)	486 (49.1%)	7 (0.7%)
Using uterine tone and size	11 (1.1%)	35 (3.5%)	105 (10.6%)	431 (43.6%)	329 (33.3%)	78 (7.9%)
Collecting and measuring blood using a tool[w]	5 (0.5%)	27 (2.7%)	68 (6.9%)	417 (42.2%)	317 (32.1%)	155 (15.7%)
Visual estimation of blood loss	12 (1.2%)	66 (6.7%)	160 (16.2%)	475 (48.0%)	271 (27.4%)	5 (0.5%)
Modified Early Obstetric Warning System (MEOWS)	17 (1.7%)	20 (2.0%)	80 (8.1%)	353 (35.7%)	215 (21.7%)	304 (30.7%)
CRADLE device	30 (3.0%)	60 (6.1%)	91 (9.2%)	170 (17.2%)	64 (6.5%)	574 (58.0%)

[w] A component of the E-MOTIVE bundle

Table 22 Participants' perceived importance of PPH management methods and interventions

	Not at all important	**Slightly important**	**Moderately important**	**Very important**	**Extremely important**
	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Administer oxytocin[xy]	2 (0.2%)	4 (0.4%)	4 (0.4%)	289 (31.4%)	621 (67.5%)
Administer IV fluids[xy]	1 (0.1%)	6 (0.7%)	20 (2.2%)	326 (35.4%)	567 (61.6%)
Blood pressure and pulse check[x]	2 (0.2%)	6 (0.7%)	20 (2.2%)	326 (35.4%)	566 (61.5%)
Repair of high vaginal or cervical tears[x]	3 (0.3%)	5 (0.5%)	19 (2.1%)	351 (38.2%)	542 (58.9%)
Uterine massage[xy]	1 (0.1%)	7 (0.8%)	41 (4.5%)	379 (41.2%)	492 (53.5%)
Manual removal of placenta[z]	7 (0.8%)	13 (1.4%)	43 (4.7%)	416 (45.3%)	440 (47.9%)
Administer misoprostol[x]	18 (2.0%)	21 (2.3%)	75 (8.2%)	392 (42.6%)	414 (45.0%)
Internal examination in delivery room[zy]	18 (2.0%)	31 (3.4%)	73 (7.9%)	442 (48.1%)	355 (38.6%)
Administer tranexamic acid (TXA)[zy]	40 (4.4%)	56 (6.1%)	138 (15.0%)	413 (44.9%)	272 (29.6%)
Bimanual compression[z]	12 (1.3%)	57 (6.2%)	134 (14.6%)	467 (50.8%)	249 (27.1%)
Internal uterine exploration in theatre[z]	42 (4.6%)	84 (9.1%)	158 (17.2%)	418 (45.5%)	217 (23.6%)
Non-pneumatic anti-shock garment (NASG)[z]	92 (10.0%)	98 (10.7%)	166 (18.1%)	357 (38.9%)	206 (22.4%)
Uterine balloon tamponade[z]	57 (6.2%)	82 (8.9%)	172 (18.7%)	412 (44.8%)	196 (21.3%)
Administer ergometrine[x]	100 (10.9%)	101 (11.0%)	181 (19.7%)	368 (40.0%)	170 (18.5%)
Admission to ICU[z]	132 (14.4%)	150 (16.3%)	224 (24.4%)	323 (35.2%)	90 (9.8%)
Administer carbetocin[z]	128 (13.9%)	163 (17.7%)	236 (25.7%)	309 (33.6%)	83 (9.0%)
Administer carboprost[z]	135 (14.7%)	178 (19.4%)	270 (29.4%)	256 (27.9%)	80 (8.7%)

[x] n=920
[y] A component of the E-MOTIVE bundle
[z] n=919

3.12 Current availability of detection and management methods

Participants were asked to rate the availability of supplies used to manage PPH within their health facility. First, participants were asked to rate on a scale of 1 to 5, where 1 = never available, 2 = rarely available, 3 = sometimes available, 4 = often available, and 5 = always available. If participants indicated that the method was never, rarely, or sometimes available they were then asked a follow-up question to gather information about why there is limited availability of this method and understand what barriers exist around performing these behaviours.

Participants were asked about the availability of several detection and management methods in their health facility. Of 928 participants, 58.3% (*n*=541) indicated that tools to measure the volume of blood loss were never, rarely, or sometimes available. When questioned as to the reasons for this, 66.4% (360/541) reported that tools to measure blood loss are not routinely stocked, 39.9% (216/541) reported that it was because supplies of tools are inconsistent, and 16.1% (87/541) reported that tools to measure blood loss are not easily located when needed. Additional reasons for the lack of availability of tools to measure the volume of blood lost can be found in Table 23.

Next, participants were asked about the availability of oxytocin. Of 928 participants, 94.9% indicated that uterotonic drugs, including oxytocin, are often or always available. Of the 47 participants (5.1%) who indicated that uterotonics were never, rarely, or sometimes available, 59.6% (28/47) indicated that this was because there are inconsistent supplies and 53.2% (25/47) reported that it was because uterotonics are not routinely stocked at their facility. Other reasons for the lack of availability of uterotonics including oxytocin can be seen in Table 24.

Table 23 Reasons why tools to measure blood loss, tranexamic acid, and IV fluids are never, rarely or sometimes available in participants' health facilities

	Not routinely stocked	Inconsistent supplies	Incorrect supplies	Not easily located when needed	Lack of storage space	No refrigeration	Inadequate or untrained staff	Other
	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Tools to measure the volume of blood lost[aa]	360 (66.4%)	216 (39.9%)	56 (10.3%)	87 (16.1%)	24 (4.4%)	-	95 (17.5%)	41 (7.6%)
Tranexamic acid (TXA)[bb]	248 (64.9%)	150 (39.3%)	29 (7.6%)	62 (16.2%)	10 (2.6%)	-	56 (14.7%)	23 (6.0%)
IV fluids[cc]	27 (42.2%)	51 (79.7%)	16 (25.0%)	21 (32.8%)	7 (10.9%)	-	1 (1.6%)	5 (7.8%)

Table 24 Reasons why uterotonic drugs are never, rarely or sometimes available in participants' health facilities

	Not routinely stocked	Inconsistent supplies	Incorrect supplies	Not easily located when needed	Lack of storage space	No refrigeration	Inadequate or untrained staff	Other
	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Uterotonic drugs (e.g., oxytocin)[dd]	25 (53.2%)	28 (59.6%)	15 (31.9%)	14 (29.8%)	6 (12.8%)	10 (21.3%)	5 (10.6%)	2 (4.3%)

[aa] Amongst 541 participants who indicated that tools to measure the volume of blood lost are never, rarely or sometimes available
[bb] Amongst 382 participants who indicated that tranexamic acid is never, rarely or sometimes available
[cc] Amongst 64 participants who indicated that IV fluids are never, rarely or sometimes available
[dd] Amongst 47 participants who indicated that uterotonic drugs (e.g., oxytocin) are never, rarely or sometimes available

Table 25 Reasons why blood transfusions are never, rarely or sometimes available in participants' health facilities

	Not routinely stocked	Inconsistent supplies	Incorrect supplies	Lack of storage space	Inadequate or untrained staff	Time constraints with preparing blood	Other
	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Blood transfusions[ee]	38 (30.7%)	84 (67.7%)	9 (7.3%)	10 (8.1%)	1 (0.8%)	30 (24.2%)	13 (10.5%)

Table 26 Reasons why surgical theatre for laparotomy are never, rarely or sometimes available in participants' health facilities

	No surgical theatre at hospital	No dedicated obstetric theatre at hospital	Surgical theatre is too busy	Inconsistent supplies in theatre	Incorrect supplies in theatre	Inadequate staffing - no anaesthetist	Inadequate staffing – no trained surgeon	Other
	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Surgical theatre for laparotomy[ff]	4 (5.6%)	17 (23.6%)	17 (23.6%)	16 (22.2%)	8 (11.1%)	10 (13.9%)	26 (36.1%)	8 (11.1%)

[ee] Amongst 124 participants who indicated that blood transfusions are never, rarely or sometimes available
[ff] Amongst 72 participants who indicated that surgical theatres for laparotomy are never, rarely or sometimes available

When asked about the availability of IV fluids within their health facility, 93.1% of participants (*n*=864/928) indicated that IV fluids are often or always available. Amongst the 64 participants who indicated that IV fluids are never, rarely, or sometimes available, 79.7% (*n*=51/64) indicated that this was due to inconsistent supplies, 42.2% (*n*=27/64) indicated that this was due to IV fluids not being routinely stocked, and 32.8% (*n*=21/64) indicated that this was because IV fluids are not easily located when needed. Other reasons for the lack of availability of IV fluids can be found in Table 23.

Of 928 participants, 58.8% (*n*=546) reported that tranexamic acid is often or always available. The remaining 41.2% (*n*=382) participants indicated that tranexamic acid is never, rarely or sometimes available. Of these 382 participants, 64.9% (*n*=248) reported that tranexamic acid is not available at their health facility because it is not routinely stocked, and 39.3% (*n*=150/382) reported that supplies of TXA at their health facility are inconsistent. Other reasons participants gave for the lack of routine availability of TXA can be found in Table 23.

Blood transfusions were reported to be often or always available by 86.6% (*n*=804/928) of participants. Amongst the 124 (13.4%) participants who indicated that blood transfusions are never, rarely or sometimes available, 67.7% (*n*=84/124) indicated that supplies for blood transfusions are inconsistent, 30.7% (*n*=38/124) said that supplied for blood transfusions are not routinely stocked, and 24.2% (*n*=30/124) gave time constraints with preparing blood as a reason for blood transfusions not always or often being available. See Table 25 for more reasons why participants reported that blood transfusions are not often or always available.

Laparotomy was reported to be often or always available by 92.2% of 928 participants (*n*=856). Of the 72 participants who reported that surgical theatre for laparotomy was never, rarely or sometimes available, 36.1% (*n*=26) reported that this was due to inadequate staffing due to no trained surgeon, 23.6% (*n*=17) reported that the surgical theatre is too busy, and that there is no dedicated obstetric theatre at the hospital. Other reasons given by participants for the poor availability of surgical theatre for laparotomy can be seen in Table 26.

3.13 COVID-19

To understand the impact of the COVID-19 pandemic on PPH detection and management, participants were asked to respond to a series of Likert-type scales relating to COVID-19 and PPH.

Of 924 participants, 85.5% (*n*=790) reported that there had been no change in their PPH detection and management practices as a result of the COVID-19 pandemic. A total of 99 participants (10.7%) indicated that how they detect and manage PPH had changed as a result of the COVID-19 pandemic, with a further 19 participants (2.1%) stating that only how they manage PPH had changed, and 16 participants (1.7%) reporting that only how they detect PPH had changed.

Amongst participants who reported that their PPH-related practice had changed as a result of the COVID-19 pandemic, 66.1% (*n*=88/134) agreed or strongly agreed that there are fewer staff available to monitor women pre-birth, 64.2% (*n*=85/134) agreed or strongly agreed that patients were coming to hospital less, 47.3% (*n*=67/134) agreed or strongly agreed that women were choosing to have home births instead of coming to the hospital to

give birth, and 59.4% (*n*=79/134) agreed or strongly agreed that there are new policies and guidelines to follow. On the other hand, most participants disagreed or strongly disagreed that their maternity wards had been converted to a COVID-19 ward (86.5%, *n*=86.5%), and most also disagreed or strongly disagreed that they had less time to detect and manage PPH (55.6%, *n*=74/134). Additional data relating to beliefs about the impact of the COVID-19 pandemic can be seen in Table 27.

Table 27 Changes to PPH detection and management practices as a result of the COVID-19 pandemic (*n*=99)

	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
	n (%)	*n (%)*	*n (%)*	*n (%)*	*n (%)*
Patients are coming to hospital less	10 (7.5%)	28 (21.1%)	10 (7.5%)	62 (46.6%)	23 (17.3%)
There are less staff available to monitor women pre-birth	7 (5.4%)	29 (21.8%)	9 (6.8%)	66 (49.6%)	22 (16.5%)
More women are choosing to have home births than come into the hospital	14 (10.5%)	27 (20.3%)	25 (18.8%)	47 (35.3%)	20 (15.0%)
There are less staff available to monitor women post-birth	6 (4.5%)	27 (20.3%)	11 (8.3%)	69 (51.9%)	20 (15.0%)
There are new policies and guidelines to follow	3 (2.3%)	27 (20.3%)	24 (18.1%)	69 (51.9%)	10 (7.5%)
We have more equipment and supplies to detect and manage PPH	21 (15.8%)	70 (52.6%)	17 (12.8%)	17 (12.8%)	8 (6.0%)
It is more difficult to access medications to manage PPH	12 (9.0%)	67 (50.4%)	14 (10.5%)	34 (25.6%)	6 (4.5%)
There is less access to routine tests for PPH	6 (4.5%)	47 (35.3%)	19 (14.3%)	55 (41.4%)	6 (4.5%)
Non-COVID maternal care has been deprioritised	8 (6.0%)	39 (29.3%)	27 (20.3%)	54 (40.6%)	5 (3.8%)
I have less time to detect and manage PPH	10 (7.5%)	64 (48.1%)	30 (22.6%)	25 (18.8%)	4 (3.0%)
The maternity ward has been converted to a COVID-19 ward	42 (31.6%)	73 (54.9%)	5 (3.8%)	9 (6.8%)	4 (3.0%)

4.0 Discussion

The objectives of this research were to understand the current clinical management of primary PPH in the E-MOTIVE study facilities, and to explore healthcare providers' primary PPH detection and management in current practice including (a) how detection and treatment could be improved, and (b) potential barriers and enablers to implementation of the E-MOTIVE intervention in their practice. More specifically, this survey aimed to identify how primary PPH is currently detected and managed during vaginal birth at the study facilities, to explore the extent to which the components of the E-MOTIVE bundle are currently implemented, to identify what factors influence current PPH detection and management, and to identify what factors influence the implementation of the E-MOTIVE bundle.

Participants in the study reported that the most common way they detect a primary PPH during vaginal birth is by using visual estimation of blood loss. This finding is in agreement with previous research, which suggests that despite inaccuracy and unreliability, visual estimation of blood loss remains the most popular method of PPH detection across countries and cadres (Hancock et al., 2015, Schorn, 2010, Rath, 2011). This finding shows the importance of the E-MOTIVE trial in validating an alternative, more accurate practice to measure blood loss and enable early detection of PPH. This also highlights how widespread VEBL is across the trial facilities, which may bring challenges to behaviour change due to the engrained nature of the practice.

In this study, approximately a fifth of participants reported that they currently use an obstetric drape, which will be used as the tool to enable **E**arly detection of PPH in the E-MOTIVE trial, to measure blood loss and detect a PPH. This indicates that for the

majority of participants, the E-MOTIVE trial may be the first instance where they use a calibrated or uncalibrated blood collection drape in their obstetric practices. For this reason, it is essential that adequate information and training are provided around the use of the drape with all staff, to ensure that they are comfortable and confident with using this new tool.

Amongst participants surveyed, the vast majority currently perform **M**assage of the uterus, administer **O**xytocin, and administer **IV** fluids to manage cases of PPH after a woman has given birth vaginally. As healthcare professionals are already performing these management behaviours, this may be an enabler which encourages the performance of these behaviours within the trial. Dosages, routes, and methods of performing these three interventions were not explored in the present study and expected practices in the trial may vary from participants' current practices. Considering this, identification of possible differences and changes in practice, and clarity around what changes need to be made to bring these in line with the practices of the E-MOTIVE bundle will be essential to ensure the correct performance of the intervention both within and beyond the trial. Such checks are also imperative to ensuring the validity and reliability of participants' behaviours within and across trial sites.

Administration of **T**ranexamic acid, and **E**xamination of the genital tract are the remaining two management components of the E-MOTIVE intervention. This study identified that approximately half of the study participants are consistently performing either of these behaviours when managing a PPH. This identifies a potential barrier to performing these behaviours within the E-MOTIVE trial, as they may be unfamiliar or non-routine for 1 in 2 participants working at the trial facilities. Participants were not asked why they do not examine the genital tract in the delivery room, which prevents the

identification of specific barriers to the performance of this behaviour. However, participants identified that the main reasons they do not administer TXA are most commonly due to the fact it is not routinely stocked at their hospital, and supplies are inconsistent. These were the most common factors that influence current PPH detection and management across management strategies. These barriers are addressed for the duration of the trial, as stocks of certain drugs like TXA and oxytocin are provided by and quality checked by the trial teams, however, this is something which could impact the dissemination of the bundle outside of the trial setting, should the trial produce significant results. Lack of routine stock and inconsistent supplies were identified to be the two major factors influencing the performance of these interventions.

Participants indicated that improving team-working, increasing the availability of supplies, having all the supplies required in one place – like a box or trolley, and more training, would make it easier for them to perform a care bundle for PPH, and multiple PPH management interventions together. The importance of these factors has been evidenced in literature: effective teamwork, clear roles, and identified leadership are essential for high performance in maternity care, and more specifically in the detection and management of PPH (Brazil et al., 2022). In addition, PPH carts and medication kits can optimise a team's ability to effectively manage a PPH, by reducing the amount of time and distance required to obtain necessary materials (Kogutt et al., 2022). Ongoing training is essential for effective medical practice. For PPH, multi-professional scenario-based, simulation and team training exercises have been found to significantly improve PPH management amongst both clinically experienced community and consultant-led hospital teams (Marshall et al., 2015, Egenberg et al., 2017). The desires and needs of participants within this study converge with recent evidence for the effectiveness of these techniques.

As a result, these implementation strategies have been employed within the E-MOTIVE trial: ongoing multi-disciplinary, simulation-based training will be provided for all clinicians in the experimental condition, and toolkits and trolleys will be implemented and tailored to each hospital setting.

Whilst differences in PPH detection and management practices were identified between countries and cadres within this research, statistical conclusions could not be drawn around the significance of these differences due to the exploratory nature and aims of the study. Despite this, a key conclusion which can be drawn is that differences in practice do exist and should be considered when implementing both the current E-MOTIVE bundle, as well as future global women's health interventions. Such contextual differences at country, hospital, and staff levels may have a significant impact on the success of trials like E-MOTIVE, and as such, adaptations to accommodate context-specific barriers and enablers should be considered where possible.

Despite the vast majority of participants indicating that they know what to do to detect PPH, a greater number indicated that they intend to improve their knowledge in this area. This theme was consistent across each area of the survey: participants felt that they had the knowledge or skills they needed, but still wanted to improve in these areas. This could be a positive and enabling factor for the E-MOTIVE trial, as a desire to improve and gain additional information would be key to acquiring a new skill and behaviour like the implementation of the E-MOTIVE bundle.

Overall, participants responded positively to the idea of using a bundle of care for E-MOTIVE, with a consensus across cadres and countries that this would help to improve the management of PPH compared to their usual care, that it would be more effective at

managing PPH, and would be easy to remember to do. Such beliefs highlight the potential success and positive impression that the bundle has in the eyes of healthcare professionals in countries where the PPH burden is the highest. There was some uncertainty around the bundle, particularly around the volume of work that implementing such a practice would involve – in that, it would be burdensome and would be too much for one person to do. With this in mind, it is important that when presenting the bundle to healthcare workers there is an emphasis on the collaborative nature of the E-MOTIVE bundle, and there is no expectation that it is to be performed alone nor is it the sole responsibility of one healthcare professional. By doing this, we would be able to address these concerns, and hopefully maximise uptake and buy-in of the E-MOTIVE care bundle for the detection and management of PPH.

Overall, it was observed that participants reported lower levels of agreement with statements relating to PPH management than for PPH detection. Due to the nature of the survey, we cannot ask participants why this is, nor assume the reasons for this observation. During subsequent phases of the trial, it would be important for the team to observe and understand why this may be the case and address any observations around these differences in agreement and confidence when implementing the bundle with healthcare workers in the future. The benefit of the E-MOTIVE bundle is that it has a large focus on the management of PPH, this may help to address participants' lower levels of confidence around PPH management abilities, knowledge, and skills. Future research in the E-MOTIVE programme of work aims to conduct a process evaluation in which these survey questions will be asked again in both the control and intervention health facilities. It would be interesting to focus on whether there has been any shift in participants' ratings on these Likert-style scales around their capability, motivation and opportunity as a result of using

the bundle and identify whether this has improved participants' beliefs around both PPH detection and management.

A limitation of this research is that at the point of data collection, the study facilities had been recruited into the trial but had not been allocated to the control or experimental group. Participants may have been biased to respond in ways that would make their facility look desirable or to secure trial participation or allocation to the experimental condition, which would not have been possible based on participation in the survey. A further limitation was that the survey was provided in English, and native language versions were not available to participants. This may have limited who could have completed the survey, particularly those who did not read or comprehend English beyond a basic level.

The quantitative nature of this work has generated some questions which cannot be answered with the data it has produced. Data from this study suggests that despite participants indicating that they know what to do to detect and manage PPH, and have received appropriate training to do so, they are not consistently performing some of the bundle components in their current practice. Establishing why this is occurring has not been possible through quantitative data, and may limit the current work. It is important that the results of this study are considered with the qualitative data collected from study sites simultaneously as part of the E-MOTIVE mixed methods programme.

This survey, along with the wider body of E-MOTIVE mixed methods work has been able to identify which implementation strategies could support the use of the E-MOTIVE bundle across study sites in Nigeria, Tanzania, Kenya, and South Africa. Data from this survey was brought to a series of stakeholder consultation workshops, which

consisted of maternity care providers, key stakeholders, and members of the E-MOTIVE research team (Bohren et al., 2021). These workshops provided a space for participants in both this quantitative survey, and the wider formative work of the E-MOTIVE trial, to expand on challenges they face within their maternity setting and enabled the identification of possible solutions to address these challenges within the E-MOTIVE trial. As a result, training, PPH champions, audit, and feedback were identified as useful strategies to support the implementation of the E-MOTIVE bundle. These strategies were subsequently developed and tested in a separate body of research for acceptability, feasibility, and fidelity within adaptive cycles across the trial countries prior to utilisation within the implementation phase of the E-MOTIVE trial (Bohren et al., 2021).

A key advantage of this research was the scale and volume of participants who completed this survey. Although statistical conclusions could not be drawn, it was valuable to observe a consensus between participants at both a cadre and country level in such a wide range of individuals. Few demographic details were collected about participants, like their gender or age, and although there may be interesting differences at these levels, allowing participants to be fully anonymous within their facility may have allowed us to elicit more truthful and reliable data, as they knew there was no fear of personal identification by the research team.

This research identified how primary PPH during vaginal birth is currently detected and managed at the study facilities of the E-MOTIVE trial, the extent to which the components of the E-MOTIVE bundle currently implemented at the trial facilities, the factors that are influencing current PPH detection and management, and the factors influencing implementation of the E-MOTIVE bundle. Although this was a large body of work, there were some details that it would have been beneficial to explore which were

missed in this survey. Future research would benefit from exploring the specific details of management strategies that are used by healthcare professionals, such as route, dosage, and quality of drugs like TXA or oxytocin, and how this varies from the details and desired behaviours related to these factors in the trial. Future research would benefit from targeted hypothesis testing and statistical analysis, to identify where statistical differences lie between the countries and cadres included in this research. In future components of the E-MOTIVE trial, process evaluation surveys will be conducted utilising questions in this research, to allow comparison between behaviours performed before and after implementation of the E-MOTIVE bundle. In these surveys, it would be advantageous to make the aforementioned changes to the provision of the survey in the survey software and to make specific hypothetical predictions to enable formal statistical comparisons and conclusions to be drawn.

In combination with other modalities of research, this study has contributed to the identification of implementation strategies to support the E-MOTIVE trial. Through this work, it was identified that more training, steady provision of drug stocks, and adequate supply of consumables and equipment were key to ensuring delivery of the E-MOTIVE bundle. These findings, and this body of work in general, emphasise the importance of speaking with the individuals who work in the target environments. Understanding their needs and challenges will best help to identify barriers and enablers from current practice to maximise the potential for effective change and improvement in this and other areas of global women's health research and beyond.

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6.0 Appendix

6.1 Participant information sheet and consent form

UNIVERSITY OF BIRMINGHAM

WHO Collaborating Centre for Global Women's Health Research

Understanding perceptions and practices in the detection and management of postpartum haemorrhage (PPH)

Introduction
We would like to invite you to take part in a study that aims to explore perceptions and practices in the detection and management of postpartum haemorrhage.

Before you decide if you want to take part, please read the following information carefully and ask us if there is anything that is not clear or if you would like more information.

What is the purpose of the study?
We are interested in understanding current perceptions of and practices used for the detection and management of postpartum haemorrhage (PPH), with the aim of improving how PPH is detected and managed in maternity settings.

Why have I been chosen?
We are inviting people who currently work in maternity settings to take part in this study. The facility where you work has been chosen to participate in the 'E-MOTIVE' trial, which will explore the effectiveness of the implementation of a PPH initial response bundle. In order to maximise the effectiveness of this intervention we are looking to explore current perceptions of, and practices surrounding the detection and management of PPH in the facility in which you work, to allow us to appropriately tailor the intervention to your setting.

Do I have to take part?
It is up to you to decide whether or not to take part. If you would like to take part please read the rest of this information, before pressing the 'Next' button at the bottom of the page, where you will be asked to complete a consent form. If you decide part way through the survey that you do not want to carry on you do not have to. To withdraw from the survey you should close the web page and the browser window.

The survey will not ask for any identifying information such as your name, email address or IP address. As all data collected is anonymous you will not be able to withdraw your data once the survey has been submitted. At the end of the survey we will confirm that you are happy to submit your data, once you have progressed past this page you will be unable to withdraw your data.

What do I have to do?
If you choose to take part, you will be asked to complete an online survey. The online survey will take approximately 15-20 minutes to complete and can be completed at a time and place of your choosing. All responses will be recorded electronically. Anything

we publish will not identify you or anyone else by name.

What are the possible disadvantages or risks of taking part?
We expect that there will be minimal disadvantages or risks of taking part. Taking part in this study can take part in your normal working day at a time that best suits you.

What are the possible benefits of taking part in this study?
The information you share during this survey will help us to develop intervention strategies to improve the detection and management of PPH in maternity facilities.

Confidentiality
All the information we obtain will be treated as confidential. Only the research team will have access to your personal data, and this will not be passed onto any outside bodies. Any information stored on a computer will be password protected. Your name, email address, or other identifying information will not be recorded in the survey.

In case of concerns:
If you are concerned about any aspect of the research you can contact the team using the details below. If you wish to complain, or have any concerns about any aspect of the way you have been approached or treated during the course of this study, and you feel unable to discuss this with the research team then you may contact the University of Birmingham Research Ethics Team on +44 (0)121 414 8825 or by email ethics-queries@contacts.bham.ac.uk.

What will happen to the results of this study?
We intend to use the anonymised information we have collected in this study to help develop an intervention strategy for a PPH initial response bundle as part of the E-MOTIVE clinical trial. This information will be shared with relevant health organisations, including the World Health Organization (WHO), at academic meetings, and will be published in medical journals. The results will also be used to design new materials specific for maternity settings. You will not be identified in any report/publication. We will send you the results of the study if you request this. Data used in this research project may also be used in future projects that are closely related to this project, or in the same general area of research as this project. All data of this project will be held under the provisions of the 2018 Data Protection Act including the General Data Protection Regulation (GDPR) which sets a standard for participant rights regarding their data. Data will be stored in manual and/or electronic files in a secure format for up to 5 years. Furthermore, for the purpose of future research, the research data will be stored for up to five years after the last publication of findings is released.

Who is organising and funding this research?
The study is being organised and run by the University of Birmingham. This research is funded by the Bill and Melinda Gates Foundation.

Who has reviewed this study?
The University of Birmingham's Research Ethics Review Committee, The University of Melbourne Human Ethics Advisory Group and Human Ethics Sub-Committee, and local ethical review boards from each participating country: Kenya, Nigeria, South Africa, Tanzania, Sri Lanka, and Pakistan.

Who can I contact if I have any concerns about the project?
We hope that this information sheet answers all of the questions you might have. If you

have any further questions please contact the research team who will do their best to answer them:

Dr Meghan Bohren Senior Lecturer; University of Melbourne; Email: [redacted]; Phone: [redacted]

Dr Fabiana Lorencatto Research Lead; University College London; Email: [redacted]; Phone: [redacted]

This project is managed by the University of Birmingham, and this research project has been approved by the University of Birmingham Science, Technology, Engineering and Mathematics (STEM) ethics committee as the primary approving committee. This research project has also been approved by the Human Research Ethics Committee of The University of Melbourne. If you have any concerns or complaints about the conduct of this research project, which you do not wish to discuss with the research team, you should contact the following ethics committees:

University of Birmingham Email: ethics-queries@contacts.bham.ac.uk; Phone: +44 (0)121 415 8011

The Manager, Human Research Ethics, Research Ethics and Integrity, University of Melbourne, VIC 3010. Tel: +61 3 8344 2073 or Email: HumanEthics-complaints@unimelb.edu.au. All complaints will be treated confidentially. In any correspondence please provide the name of the research team or the name or ethics ID number of the research project.

Thank you for taking time to consider taking part in this research, please keep hold of a copy of this information sheet for your records.

Consent Form

In order to continue, please indicate your consent to participate in the E-MOTIVE study by agreeing to each of the following statements.

I confirm that I have read and understood the participant information sheet for the above study. I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily.

I understand that participating in this study is voluntary, and that I am free to withdraw at any point during the survey without giving a reason, and that this will not affect my legal rights.

I understand that I will be asked to take part in a single online survey.

I understand that electronic data from this online survey will be stored, and that I will not be identifiable by name on this electronic record.

I understand that data collected about me for this project will be held under the provisions of the 1998 Data Protection Act and will be stored in manual and/or

electronic files in a secure format for a minimum of five years.

I agree that the anonymised information gathered about me can be stored by the research team for possible use in future projects. The research data will be stored for a minimum of five years after the last publication of findings has been released.

I agree to the use of my anonymous responses being used in reports and publications from the study.

I agree to take part in the "Understanding perceptions and practices in the detection and management of postpartum haemorrhage (PPH)" survey.
*

- [ ] I consent to all of the above statements
- [ ] I do not consent to all of the above statements

Would you like to know the outcomes of the research?

- [ ] No, I would not like to know the outcomes of the research.
- [ ] Yes, I would like to know the outcomes of the research.

Please provide your email address in the box below to hear about the outcomes of the research. Your email address will not be linked to your responses.

By clicking the '*Next Page*' button at the bottom of this page you are agreeing to participate in the E-MOTIVE Formative Survey, in full knowledge of the information provided in the participant information sheet.

If you wish to withdraw participation at any stage of the survey, this can be done by exiting the page and closing your browser window.

If you consent to participate, please press the '*Next Page*' button where you will be taken to the first page of the survey.

Thank you for taking part in this research.

E-MOTIVE Formative Survey

Country Selection

Please select the country you are based in: *

- [ ] Kenya
- [ ] Nigeria
- [ ] South Africa – Eastern Cape
- [ ] South Africa – Western Cape
- [ ] South Africa – KwaZulu-Natal
- [ ] Sri Lanka
- [ ] Tanzania

Local Contact Details (Kenya)

The E-MOTIVE Principal Investigator in Kenya is [redacted]
The E-MOTIVE study co-ordinator in Kenya is [redacted]

If you have any problems and need help completing this survey please contact one of the above.

What is the name of the facility you currently work at? *

Local Contact Details (Nigeria)

The E-MOTIVE Principal Investigator in Nigeria is [redacted]
The E-MOTIVE Trial Coordinator in Nigeria is [redacted]

If you have any problems and need help completing this survey please contact one of the above.

What is the name of the facility you currently work at? *

Local Contact Details (South Africa - Eastern Cape)

The E-MOTIVE Principal Investigator in South Africa is [redacted]
The E-MOTIVE Trial Coordinator in South Africa (Eastern Cape) is [redacted]

If you have any problems and need help completing this survey please contact one of the above.

What is the name of the facility you currently work at?

Local Contact Details (South Africa - Western Cape)

The E-MOTIVE Principal Investigator in South Africa is [redacted]
The E-MOTIVE Co-Principal Investigator in South Africa (Western Cape) is [redacted]
The E-MOTIVE Trial Coordinator in South Africa (Western Cape) is [redacted]

If you have any problems and need help completing this survey please contact one of the above.

What is the name of the facility you currently work at?

Local Contact Details (South Africa - KwaZulu-Natal)

The E-MOTIVE Principal Investigator in South Africa is [redacted]
The E-MOTIVE Trial Coordinators in South Africa (KwaZulu-Natal) are [redacted] and [redacted]

If you have any problems and need help completing this survey please contact one of the above.

What is the name of the facility you currently work at? *

Local Contact Details (Sri Lanka)

The E-MOTIVE Principal Investigator in Sri Lanka is [redacted]
The E-MOTIVE Trial Coordinator in Sri Lanka is [redacted]

If you have any problems and need help completing this survey please contact one of the above.

What is the name of the facility you currently work at? *

Local Contact Details (Tanzania)

The E-MOTIVE Principal Investigator in Tanzania is [redacted]
The E-MOTIVE Trial Coordinators in Tanzania are [redacted] and [redacted]

If you have any problems and need help completing this survey please contact one of the above.

What is the name of the facility you currently work at? *

Demographics

For the purpose of this survey we will be focusing on the **detection and management** of postpartum haemorrhage after vaginal births in your hospital. By detection we are referring to the

initial diagnosis of postpartum haemorrhage. This survey is not focused on the prevention of postpartum haemorrhage.

There are no right or wrong answers to any of the questions asked in this survey, we are simply interested in exploring your personal experience and beliefs surrounding postpartum haemorrhage. We want to reassure you that the answers you give will not be able to be linked back to you, and will remain anonymous and confidential.

We would like to start with a few questions about your role in your current job, and the facility where you work. Please work through the questions on this page before progressing on to the next section of questions.

What is your current position? *

- [ ] Consultant (or specialist doctor)
- [ ] Medical doctor
- [ ] Medical doctor in training - resident
- [ ] Medical doctor in training - house officer
- [ ] Medical student
- [ ] Clinical/medical officer (non-physician clinician)
- [ ] Nurse
- [ ] Nursing student
- [ ] Midwife
- [ ] Midwifery student
- [ ] Nurse-Midwife
- [ ] Nurse-Midwifery student
- [ ] Other (please specify):

How long, in years, have you worked in this position at this hospital? *

How long, in years, have you worked in this position in total? Note: The answer you provide must be equal or greater than your answer to the previous question *

When did you last perform or assist with a vaginal delivery? *

- [ ] In the last week
- [ ] In the last month
- [ ] In the last 3 months
- [ ] In the last 6 months
- [ ] Over 6 months ago

- [ ] I have never performed or assisted with a vaginal delivery

When was the last time you detected and/or managed a case of postpartum haemorrhage? *

- [ ] In the last week
- [ ] In the last month
- [ ] In the last 3 months
- [ ] In the last 6 months
- [ ] Over 6 months ago
- [ ] I have never detected and/or managed a case of postpartum haemorrhage

Training

Next, we would like to focus on the training you have received around detecting and managing postpartum haemorrhage.

Have you received any training about postpartum haemorrhage detection and/or management? * *[Capability, Physical]*

- [ ] Yes - **detection** of postpartum haemorrhage training only
- [ ] Yes - **management** of postpartum haemorrhage training only
- [ ] Yes - postpartum haemorrhage **detection and management** training
- [ ] No postpartum haemorrhage training
- [ ] Unsure

How long ago did you receive your most recent training? * *[Capability, Physical]*

- [ ] Less than one year ago
- [ ] 1-2 years ago
- [ ] 3-5 years ago
- [ ] Over 5 years ago

Please think back to your most recent postpartum haemorrhage training.

Was your most recent postpartum haemorrhage training given by...? * *[Capability, Physical]*

- [ ] Trainers from your own hospital
- [ ] Trainers from the district or regional team
- [ ] Trainers from another organisation e.g. a Non-Governmental Organisation (NGO)
- [ ] Trainers from the Ministry of Health

- [ ] I don't know
- [ ] Other (please specify):

What was the format of the training? Please tick all that apply. * *[Capability, Physical]*

- [ ] Workshop
- [ ] Presentation
- [ ] Simulation
- [ ] Case based
- [ ] Lectures
- [ ] Textbook
- [ ] Other (please specify):

Training

To what extent do you agree with the following statements...? *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I have not received training
I think that the postpartum haemorrhage training I received was useful *[Capability, Physical]*	☐	☐	☐	☐	☐	☐
I have been adequately trained how to **detect** postpartum haemorrhage after a vaginal birth *[Capability, Physical]*	☐	☐	☐	☐	☐	☐
I have been adequately trained how to **manage** postpartum haemorrhage after a vaginal birth *[Capability, Physical]*	☐	☐	☐	☐	☐	☐

Guidelines

We would now like to ask you a few questions about postpartum haemorrhage guidelines.

To clarify, guidelines are any local, hospital-specific, national, or international recommendations, steps, procedures or protocols for detecting and managing postpartum haemorrhage.

Are there clinical practice guidelines used in your facility to detect and manage postpartum haemorrhage? * *[Capability, Psychological]*

- [ ] Yes
- [ ] No

Are these clinical practice guidelines on display (e.g. posters, on a bulletin board)? * *[Opportunity, Physical]*

- [ ] Yes
- [ ] No

Where are the guidelines for postpartum haemorrhage detection and management displayed? Please tick all that apply. * *[Opportunity, Physical]*

- [ ] Labour and/or delivery rooms
- [ ] Tea room / break room
- [ ] Meeting room for clinical staff
- [ ] Other (please specify):

To what extent do you agree or disagree with the following statements...? *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I am aware of recommendations and guidelines for the management and detection of postpartum haemorrhage *[Capability, Psychological]*	☐	☐	☐	☐	☐
I use clinical guidelines when I am detecting and managing a postpartum haemorrhage *[Capability, Psychological]*	☐	☐	☐	☐	☐
I find recommendations and guidelines for detecting and managing postpartum haemorrhage useful for my clinical practice *[Capability, Psychological]*	☐	☐	☐	☐	☐
I can easily access a copy of clinical guidelines for detecting and managing postpartum haemorrhage in my hospital *[Opportunity, Physical]*	☐	☐	☐	☐	☐

Detecting Postpartum Haemorrhage

The next section of the survey is about how postpartum haemorrhage is **detected** after a vaginal birth at your hospital. *By detection we are referring to the initial diagnosis of postpartum haemorrhage.*

Is detecting postpartum haemorrhage after a vaginal birth part of your clinical role? * *[Motivation, Reflective]*

- [ ] Yes
- [ ] No

After a vaginal birth, how is a postpartum haemorrhage typically detected at your hospital? Please tick all that apply. ** [Capability, Psychological]*

- ☐ Visual estimation of blood loss
- ☐ Collecting and measuring blood using a tool
- ☐ Using vital signs, including: blood pressure, pulse, heart rate, respirations
- ☐ Using uterine tone and size
- ☐ CRADLE device
- ☐ Other (please specify):

Which tools would you use to measure blood lost after a vaginal birth? Please tick all that apply. ** [Capability, Psychological, and Opportunity, Physical]*

- ☐ Kidney basin
- ☐ Bed pan
- ☐ Counting of soaked swabs, gauzes, sponges, and/or linen
- ☐ Weighing of soaked swabs, gauzes, sponges, and/or linen
- ☐ Kelly's pad with basin
- ☐ Obstetric drape
- ☐ Cloth mat
- ☐ Khanga/Kanga method
- ☐ Q-mat
- ☐ Other (please specify):

In your opinion, how important are each of these methods in helping you to detect a postpartum haemorrhage? * *[Motivation, Reflective]*

	Not at all important	Slightly important	Moderately important	Very important	Extremely important	I have never used this method
Visual estimation of blood loss	☐	☐	☐	☐	☐	☐
Collecting and measuring blood using a tool	☐	☐	☐	☐	☐	☐
Using vital signs, including blood pressure, pulse, heart rate, respirations	☐	☐	☐	☐	☐	☐
Modified Early Obstetric Warning System (MEOWS)	☐	☐	☐	☐	☐	☐
CRADLE device	☐	☐	☐	☐	☐	☐
Using uterine tone and size	☐	☐	☐	☐	☐	☐

To what extent do you agree or disagree with the following statements...? *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
My team is disciplined for failing to detect a PPH during a vaginal birth *[Motivation, Automatic]*	☐	☐	☐	☐	☐
My emotional state affects how I detect a PPH *[Motivation, Automatic]*	☐	☐	☐	☐	☐
When I detect a PPH during a vaginal birth I receive feedback on my performance *[Capability, Psychological]*	☐	☐	☐	☐	☐
I know what I need to do to detect a postpartum haemorrhage after a vaginal birth *[Capability, Psychological]*	☐	☐	☐	☐	☐
I get sufficient feedback about my performance when I detect a PPH during a vaginal birth *[Capability, Psychological]*	☐	☐	☐	☐	☐
I want to improve how I detect PPH during a vaginal birth *[Motivation, Reflective]*	☐	☐	☐	☐	☐
Fear of repercussions from the patient and their family affect how I detect a PPH *[Motivation, Automatic]*	☐	☐	☐	☐	☐
If I need help detecting a postpartum haemorrhage after a vaginal birth, I can easily get the support or assistance I need from my team *[Opportunity, Social]*	☐	☐	☐	☐	☐
I have the skills to detect postpartum haemorrhage after vaginal birth *[Capability, Physical]*	☐	☐	☐	☐	☐
In the past, I have needed assistance when detecting a postpartum haemorrhage after a vaginal birth, as I did not have the competency required *[Motivation, Reflective]*	☐	☐	☐	☐	☐
My emotions are negatively affected by detecting a PPH *[Motivation, Automatic]*	☐	☐	☐	☐	☐
I intend to improve my knowledge of PPH detection during vaginal birth *[Motivation, Reflective]*	☐	☐	☐	☐	☐
I am confident that I can detect a postpartum haemorrhage after a vaginal birth, even when there is little time *[Motivation, Reflective]*	☐	☐	☐	☐	☐

Improving PPH detection is not discussed in regular meetings at my facility *[Capability, Psychological]*	☐	☐	☐	☐	☐
If I successfully detect a PPH after a vaginal birth at my health facility I am commended *[Motivation, Automatic]*	☐	☐	☐	☐	☐
I feel good if I successfully detect a PPH during a vaginal birth *[Motivation, Automatic]*	☐	☐	☐	☐	☐
It is easy to accurately estimate the volume of blood lost after a vaginal birth *[Capability, Psychological]*	☐	☐	☐	☐	☐
It is easy to distinguish between normal blood loss and a postpartum haemorrhage after a vaginal birth *[Capability, Psychological]*	☐	☐	☐	☐	☐

Managing Postpartum Haemorrhage

The next section of this survey is about how postpartum haemorrhage is **managed** after vaginal birth at your facility.

Is managing postpartum haemorrhage after a vaginal birth part of your clinical role? * *[Motivation, Reflective]*

- ☐ Yes
- ☐ No

You have detected a postpartum haemorrhage following a vaginal birth. We are now interested in your initial response.

By initial response we mean all actions or interventions that you would always perform after a postpartum haemorrhage all at once or in quick succession before reassessing the woman.

What would be your initial response? Please tick all that apply. * *[Capability, Psychological]*

- ☐ Admission to ICU
- ☐ Administer ergometrine
- ☐ Repair of high vaginal or cervical tears
- ☐ Uterine massage
- ☐ Administer tranexamic acid (TXA)
- ☐ Blood pressure and pulse check
- ☐ Manual removal of placenta
- ☐ Administer carboprost

- [ ] Administer IV fluids
- [ ] Non-pneumatic anti-shock garment (NASG)
- [ ] Internal examination in delivery room
- [ ] Bimanual compression
- [ ] Uterine balloon tamponade
- [ ] Administer misoprostol
- [ ] Administer oxytocin
- [ ] Administer carbetocin
- [ ] Internal uterine exploration in theatre
- [ ] Other (please specify):

How important do you think each of these actions or interventions are in helping to manage postpartum haemorrhage after a vaginal birth? ** [Motivation, Reflective]*

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Admission to ICU	☐	☐	☐	☐	☐
Administer ergometrine	☐	☐	☐	☐	☐
Repair of high vaginal or cervical tears	☐	☐	☐	☐	☐
Uterine massage	☐	☐	☐	☐	☐
Administer tranexamic acid (TXA)	☐	☐	☐	☐	☐
Blood pressure and pulse check	☐	☐	☐	☐	☐
Manual removal of placenta	☐	☐	☐	☐	☐
Administer carboprost	☐	☐	☐	☐	☐
Administer IV fluids	☐	☐	☐	☐	☐
Non-pneumatic anti-shock garment (NASG)	☐	☐	☐	☐	☐
Internal examination in delivery room	☐	☐	☐	☐	☐
Bimanual compression	☐	☐	☐	☐	☐
Uterine balloon tamponade	☐	☐	☐	☐	☐
Administer misoprostol	☐	☐	☐	☐	☐
Administer oxytocin	☐	☐	☐	☐	☐
Administer carbetocin	☐	☐	☐	☐	☐
Internal uterine exploration in theatre	☐	☐	☐	☐	☐

How often do you and/or your team do the following when managing a postpartum haemorrhage following vaginal birth? * *[Capability, Psychological]*

	Never	Rarely	Sometimes	Often	Always
Admission to ICU	☐	☐	☐	☐	☐
Administer ergometrine	☐	☐	☐	☐	☐
Repair of high vaginal or cervical tears	☐	☐	☐	☐	☐
Uterine massage	☐	☐	☐	☐	☐
Administer tranexamic acid (TXA)	☐	☐	☐	☐	☐
Blood pressure and pulse check	☐	☐	☐	☐	☐
Manual removal of placenta	☐	☐	☐	☐	☐
Administer carboprost	☐	☐	☐	☐	☐
Administer IV fluids	☐	☐	☐	☐	☐
Non-pneumatic anti-shock garment (NASG)	☐	☐	☐	☐	☐
Internal examination in delivery room	☐	☐	☐	☐	☐
Bimanual compression	☐	☐	☐	☐	☐
Uterine balloon tamponade	☐	☐	☐	☐	☐
Administer misoprostol	☐	☐	☐	☐	☐
Administer oxytocin	☐	☐	☐	☐	☐
Administer carbetocin	☐	☐	☐	☐	☐
Internal uterine exploration in theatre	☐	☐	☐	☐	☐

To what extent do you agree or disagree with the following statements...? *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
If I need help managing a postpartum haemorrhage after a vaginal birth, I can easily get the support or assistance I need from my team *[Opportunity, Social]*	☐	☐	☐	☐	☐
Fear of repercussions from the patient and their family affect how I manage a PPH *[Motivation, Automatic]*	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I get sufficient feedback about my performance when I manage a PPH *[Capability, Psychological]*	☐	☐	☐	☐	☐
My team is disciplined for failing to manage a PPH during a vaginal birth *[Motivation, Automatic]*	☐	☐	☐	☐	☐
My emotions are negatively affected by managing a PPH *[Motivation, Automatic]*	☐	☐	☐	☐	☐
I am confident that I can manage a postpartum haemorrhage after a vaginal birth, even when there is little time *[Motivation, Reflective]*	☐	☐	☐	☐	☐
I have the skills to manage a postpartum haemorrhage after a vaginal birth *[Capability, Physical]*	☐	☐	☐	☐	☐
I want to improve how I manage PPH during a vaginal birth *[Motivation, Reflective]*	☐	☐	☐	☐	☐
If I successfully manage a PPH at my health facility I am commended *[Motivation, Automatic]*	☐	☐	☐	☐	☐
I feel good if I successfully manage a PPH during a vaginal birth *[Motivation, Automatic]*	☐	☐	☐	☐	☐
Improving PPH management is not discussed in regular meetings at my facility *[Capability, Psychological]*	☐	☐	☐	☐	☐
I intend to improve my knowledge of PPH management *[Motivation, Reflective]*	☐	☐	☐	☐	☐
My emotional state affects how I manage a PPH *[Motivation, Automatic]*	☐	☐	☐	☐	☐
In the past, I have needed assistance when managing a postpartum haemorrhage after a vaginal birth, as I did not have the competency required *[Motivation, Reflective]*	☐	☐	☐	☐	☐
I know what I need to do to manage a postpartum haemorrhage after a vaginal birth *[Capability, Psychological]*	☐	☐	☐	☐	☐
When I manage a PPH I receive feedback on my performance *[Capability, Psychological]*	☐	☐	☐	☐	☐

Refractory Postpartum Haemorrhage

We are now interested in finding out what you would do if the initial response is unsuccessful in managing the postpartum haemorrhage, and the woman continues to bleed. We are calling this your 'next response'.

To clarify, by next response we mean all actions or interventions that you would always perform as a second-line response if the woman continues to bleed despite the first response. If you ticked any of these options as your first response, please only tick here if you would do this again in your second response e.g. if you would administer a second dose of oxytocin.

What would be your next response? Please tick all that apply. ** [Motivation, Reflective]*

- [ ] Admission to ICU
- [ ] Administer ergometrine
- [ ] Repair of high vaginal or cervical tears
- [ ] Uterine massage
- [ ] Administer tranexamic acid (TXA)
- [ ] Blood pressure and pulse check
- [ ] Manual removal of placenta
- [ ] Administer carboprost
- [ ] Administer IV fluids
- [ ] Non-pneumatic anti-shock garment (NASG)
- [ ] Internal examination in delivery room
- [ ] Bimanual compression
- [ ] Uterine balloon tamponade
- [ ] Administer misoprostol
- [ ] Administer oxytocin
- [ ] Administer carbetocin
- [ ] Internal uterine exploration in theatre
- [ ] Other (please specify):

Detecting and Managing Postpartum Haemorrhage

To what extent do you agree or disagree with the following statements *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Unsure
Postpartum haemorrhage is a problem for women giving birth vaginally in my hospital *[Motivation, Reflective]*	☐	☐	☐	☐	☐	☐
Postpartum haemorrhage is something that concerns me *[Motivation, Automatic]*	☐	☐	☐	☐	☐	☐
I find detecting and managing postpartum haemorrhage stressful *[Motivation, Automatic]*	☐	☐	☐	☐	☐	☐
Postpartum haemorrhage is a priority compared to my other clinical responsibilities in my current role *[Motivation, Reflective]*	☐	☐	☐	☐	☐	☐

Availability

The next section will ask how readily available different tools and treatments are in your hospital.

Measuring Tool

At your hospital, how readily available are...? * *[Opportunity, Physical]*

	Never available	Rarely available	Sometimes available	Often available	Always available
Tools to measure the volume of blood lost	☐	☐	☐	☐	☐

Why are tools to measure the volume of blood lost not readily available? Please tick all that apply. * *[Opportunity, Physical, and Capability, Physical]*

- ☐ Not routinely stocked
- ☐ Inconsistent supplies
- ☐ Incorrect supplies
- ☐ Not easily located when needed
- ☐ Storage issues - lack of space
- ☐ Inadequate staffing
- ☐ Other (please specify):

Uterotonic Drugs

At your hospital, how readily available are...? **[Opportunity, Physical]*

	Never available	Rarely available	Sometimes available	Often available	Always available
Uterotonic drugs e.g. oxytocin	☐	☐	☐	☐	☐

Why are uterotonic drugs not readily available? Please tick all that apply. ** [Opportunity, Physical, and Capability, Physical]*

- ☐ Not routinely stocked
- ☐ Inconsistent supplies
- ☐ Incorrect supplies
- ☐ Not easily located when needed
- ☐ Storage issues - no refrigeration
- ☐ Storage issues - lack of space
- ☐ No trained staff to administer tranexamic acid
- ☐ Other (please specify):

Tranexamic Acid (TXA)

At your hospital, how readily available is...? ** [Opportunity, Physical]*

	Never available	Rarely available	Sometimes available	Often available	Always available
Tranexamic acid (TXA)	☐	☐	☐	☐	☐

Why is tranexamic acid (TXA) not readily available? Please tick all that apply. ** [Opportunity, Physical, and Capability, Physical]*

- ☐ Not routinely stocked
- ☐ Inconsistent supplies
- ☐ Incorrect supplies
- ☐ Not easily located when needed
- ☐ Storage issues - lack of space
- ☐ No trained staff to administer tranexamic acid
- ☐ Other (please specify):

IV Fluids

At your hospital, how readily available are...? * *[Opportunity, Physical]*

	Never available	Rarely available	Sometimes available	Often available	Always available
IV fluids	☐	☐	☐	☐	☐

Why are IV fluids not readily available? Please tick all that apply. * *[Opportunity, Physical, and Capability, Physical]*

- ☐ Not routinely stocked
- ☐ Inconsistent supplies
- ☐ Incorrect supplies
- ☐ Not easily located when needed
- ☐ Storage issues - lack of space
- ☐ No trained staff to administer IV fluids
- ☐ Other (please specify):

Blood Transfusion

At your hospital, how readily available are...? * *[Opportunity, Physical]*

	Never available	Rarely available	Sometimes available	Often available	Always available
Blood transfusions	☐	☐	☐	☐	☐

Why are blood transfusions not readily available? Please tick all that apply. * *[Opportunity, Physical, and Capability, Physical]*

- ☐ Not routinely stocked
- ☐ Inconsistent supplies
- ☐ Incorrect supplies
- ☐ Time constraints with preparing blood
- ☐ Storage issues - lack of space
- ☐ No trained staff to administer blood transfusion
- ☐ Other (please specify):

Non-Pneumatic Anti-Shock Garments (NASG)

At your hospital, how readily available are...? * *[Opportunity, Physical]*

	Never available	Rarely available	Sometimes available	Often available	Always available
Non-pneumatic anti-shock garments (NASG)	☐	☐	☐	☐	☐

Why are non-pneumatic anti-shock garments (NASG) not readily available? Please tick all that apply. **[Opportunity, Physical, and Capability, Physical]*

- ☐ Not routinely stocked
- ☐ Inconsistent supplies
- ☐ Incorrect supplies
- ☐ Not easily located when needed
- ☐ Storage issues - lack of space
- ☐ No trained staff to apply NASG
- ☐ Other (please specify):

Uterine Balloon Tamponades (UBT)

At your hospital, how readily available are...? * *[Opportunity, Physical]*

	Never available	Rarely available	Sometimes available	Often available	Always available
Uterine balloon tamponades (UBT)	☐	☐	☐	☐	☐

Why are uterine balloon tamponades (UBT) not readily available? Please tick all that apply. **[Opportunity, Physical, and Capability, Physical]*

- ☐ Not routinely stocked
- ☐ Inconsistent supplies
- ☐ Incorrect supplies
- ☐ Not easily located when needed
- ☐ Storage issues - lack of space
- ☐ No trained staff to insert the uterine balloon tamponade
- ☐ Other (please specify):

Laparotomy

At your hospital, how readily available is...? *[Opportunity, Physical]

	Never available	Rarely available	Sometimes available	Often available	Always available
Surgical theatre for laparotomy	☐	☐	☐	☐	☐

Why is surgical theatre for laparotomy not readily available? Please tick all that apply.
**[Opportunity, Physical, and Capability, Physical]*

- ☐ No surgical theatre at hospital
- ☐ No dedicated obstetric theatre at the hospital
- ☐ The surgical theatre is too busy
- ☐ Inconsistent supplies in theatre
- ☐ Incorrect supplies in theatre
- ☐ Inadequate staffing - no anaesthetist
- ☐ Inadequate staffing - no trained surgeon
- ☐ Other (please specify):

Assistance

What type of assistance would you require if you were asked to do the following to manage a postpartum haemorrhage after a vaginal birth? Please tick all that apply. *
[Capability, Physical, and Opportunity, Physical, and Opportunity, Social]

	More training	More supervision	More supplies	More time	No assistance	Not able to do
Administer ergometrine	☐	☐	☐	☐	☐	☐
Uterine balloon tamponade	☐	☐	☐	☐	☐	☐
Bimanual compression	☐	☐	☐	☐	☐	☐
Administer IV fluids	☐	☐	☐	☐	☐	☐
Internal uterine exploration in theatre	☐	☐	☐	☐	☐	☐
Administer misoprostol	☐	☐	☐	☐	☐	☐
Administer tranexamic acid (TXA)	☐	☐	☐	☐	☐	☐
Administer carbetocin	☐	☐	☐	☐	☐	☐
Manual removal of placenta	☐	☐	☐	☐	☐	☐

What type of assistance would you require if you were asked to do the following to manage a postpartum haemorrhage after a vaginal birth? Please tick all that apply. *
[Capability, Physical, and Opportunity, Physical, and Opportunity, Social]

	More training	More supervision	More supplies	More time	No assistance	Not able to do
Administer oxytocin	☐	☐	☐	☐	☐	☐
Administer carboprost	☐	☐	☐	☐	☐	☐
Uterine massage	☐	☐	☐	☐	☐	☐
Internal examination in delivery room	☐	☐	☐	☐	☐	☐
Blood pressure and pulse check	☐	☐	☐	☐	☐	☐
Admission to ICU	☐	☐	☐	☐	☐	☐
Repair of high vaginal or cervical tears	☐	☐	☐	☐	☐	☐
Non-pneumatic anti-shock garment (NASG)	☐	☐	☐	☐	☐	☐

Multiple Interventions

Imagine that you were asked to perform multiple interventions: e.g. uterine massage, uterotonic drugs, tranexamic acid, IV fluids, examination of the genital tract, in the shortest possible time period. To what extent do you agree that this would...? *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	I don't know
Make sense to me *[Capability, Psychological]*	☐	☐	☐	☐	☐	☐
Be too much for one person to do *[Motivation, Reflective]*	☐	☐	☐	☐	☐	☐
Help to improve the management of postpartum haemorrhage for vaginal births *[Motivation, Reflective]*	☐	☐	☐	☐	☐	☐
Be too much for a team to do *[Opportunity, Social]*	☐	☐	☐	☐	☐	☐
Require us to change how we work as a team *[Opportunity, Social]*	☐	☐	☐	☐	☐	☐
Be easy to remember to do *[Capability, Psychological]*	☐	☐	☐	☐	☐	☐
Be burdensome for me to do *[Motivation, Reflective]*	☐	☐	☐	☐	☐	☐
Be more effective than how postpartum haemorrhage is currently managed for vaginal births at our hospital *[Motivation, Reflective]*	☐	☐	☐	☐	☐	☐

What might make it easier to perform multiple interventions together at your hospital? Please tick all that apply. *

- [ ] Improving team working *[Opportunity, Social]*
- [ ] Having reminders *[Opportunity, Social]*
- [ ] Increasing availability of supplies *[Opportunity, Physical]*
- [ ] Having all the required supplies in one place e.g. a box or a trolley *[Opportunity, Physical]*
- [ ] More training *[Capability, Physical]*
- [ ] Having opportunities to practice *[Capability, Physical]*
- [ ] Having plans, protocols or guidelines in place *[Capability, Psychological]*
- [ ] Other (please specify):

Improving the Detection and Management of Postpartum Haemorrhage

Finally, we would like to ask some questions about improving postpartum haemorrhage detection and management after vaginal births in your hospital specifically.

To what extent do you agree with the following statements...? *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Postpartum haemorrhage detection after vaginal birth needs to improve at my hospital *[Motivation, Reflective]*	☐	☐	☐	☐	☐
Postpartum haemorrhage management after vaginal birth needs to improve at my hospital *[Motivation, Reflective]*	☐	☐	☐	☐	☐

Are any of the following strategies currently in place at your hospital to improve postpartum haemorrhage detection and management? Please tick all that you know are in place. *

- [ ] Training and education *[Capability, Physical, and Capability, Psychological]*
- [ ] Decision aids *[Capability, Psychological]*
- [ ] Visual reminders/ posters *[Capability, Psychological]*
- [ ] Feedback on current practice *[Capability, Psychological]*
- [ ] Guidelines and protocols on display *[Opportunity, Physical]*
- [ ] Peer support *[Opportunity, Social]*
- [ ] Local postpartum haemorrhage (PPH) champions and leads *[Opportunity, Social]*
- [ ] Improving ease of access to supplies *[Opportunity, Physical]*

- [ ] None of these strategies are in place
- [ ] Other (please specify):

How effective do you think each of the following strategies might be in improving postpartum haemorrhage detection and management at your hospital? *

	Not at all effective	Slightly effective	Moderately effective	Very effective	Extremely effective	No opinion
Training and education	☐	☐	☐	☐	☐	☐
Decision aids	☐	☐	☐	☐	☐	☐
Reminders e.g. posters	☐	☐	☐	☐	☐	☐
Feedback on current practice	☐	☐	☐	☐	☐	☐
Guidelines and protocols on display	☐	☐	☐	☐	☐	☐
Peer support	☐	☐	☐	☐	☐	☐
Local postpartum haemorrhage (PPH) champions and leads	☐	☐	☐	☐	☐	☐
Improving ease of access to supplies	☐	☐	☐	☐	☐	☐

COVID-19

The final section of this survey will focus on the COVID-19 (coronavirus) pandemic.

Do you think that the COVID-19 pandemic has affected how you detect and manage postpartum haemorrhage? *

- [ ] Yes - how I **detect** postpartum haemorrhage has changed
- [ ] Yes - how I **manage** postpartum haemorrhage has changed
- [ ] Yes - how I **detect and manage** postpartum haemorrhage has changed
- [ ] No - how I detect and manage postpartum haemorrhage has not changed

How has your practice surrounding the detection and management of postpartum haemorrhage changed? As a result of COVID-19... *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Non-COVID maternal care has been deprioritised *[Motivation, Reflective]*	☐	☐	☐	☐	☐
There is less access to routine tests for PPH *[Opportunity, Physical]*	☐	☐	☐	☐	☐

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It is more difficult to access medications to manage PPH *[Opportunity, Physical]*	☐	☐	☐	☐	☐
There are less staff available to monitor women pre-birth *[Opportunity, Social]*	☐	☐	☐	☐	☐
There are less staff available to monitor women post-birth *[Opportunity, Social]*	☐	☐	☐	☐	☐
Patients are coming to hospital less *[Opportunity, Social]*	☐	☐	☐	☐	☐
We have more equipment and supplies to detect and manage PPH *[Opportunity, Physical]*	☐	☐	☐	☐	☐
I have less time to detect and manage PPH *[Opportunity, Physical]*	☐	☐	☐	☐	☐
There are new policies and guidelines to follow *[Capability, Psychological]*	☐	☐	☐	☐	☐
The maternity ward has been converted to a COVID-19 ward *[Opportunity, Physical]*	☐	☐	☐	☐	☐
More women are choosing to have home births than come into the hospital *Opportunity, Social]*	☐	☐	☐	☐	☐

Thank You

Thank you very much for the time you have taken to complete this survey.

If there is anything further you would like to share about anything covered in this survey, please feel free to do so in the box below: