Independent midwifery practices in Cape Town: birth outcomes and predictors for medical interventions from 2003-2009

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PROJECT TITLE

Independent midwifery practices in Cape Town: birth outcomes and predictors for medical interventions from 2003-2009

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2. ABSTRACT

The midwifery model of care is a safe, effective, inexpensive, holistic, woman and baby centered-approach to maternal and infant health. It is widely used in developing and developed world contexts and has proven to have birth outcomes that are comparable to hospital-based, obstetric models. In many settings however, application of the independent midwifery model of care has become increasingly difficult to maintain. Tensions surrounding perceived skills and competencies of midwives, the increasing acceptance of hospital-based, obstetric models of childbirth, controversy over necessity and use of medical interventions, rising insurance premiums, and competition over clients in private sector scenarios are all factors contributing to both low availability and utilization in many countries, including South Africa. In order to consider the role of this model in maternity services in South Africa and to potentially make this model available on a wider scale, it is necessary to understand the demographics of current utilization of existing independent midwifery services, as well their as birth outcomes. This retrospective cohort study documents the total number of deliveries attended by independent midwives, the socio-demographic and reproductive characteristics of women using independent midwives and the birth outcomes and delivery types in the greater Cape Town region among the 16 independent midwives who have practiced during the six and a half year period of January 2003 - end of June 2009. It identifies factors associated with normal vaginal deliveries, instrumental deliveries and caesarean sections, as well as documents the socio-demographic and professional characteristics of the 16 independent midwives. Ethical approval for this research was granted by the University of Cape Town. Anonymous client data was collected from midwifery practices' Maternity Registers and transferred onto a data abstraction sheet. Midwife data was collected via an interviewer-administered questionnaire. All data was entered into Microsoft Excel and analyzed using Stata. The findings of this study will be used to inform maternal and infant health care policy, as well as provide statistics for independent midwives' quality assurance and auditing of services.

3. BACKGROUND

3.1 Women's Maternal Health Care

Fundamental to the health and wellbeing of women is access to appropriate reproductive health services, and integral to these services is availability and experience of maternal health services including pre, intra and postpartum care for both mother and baby [1]. Childbirth is recognized throughout the world as a seminal, life-altering event for women [2]. It has been supported, contextualized and embedded in ritual, tradition and religious practices for millennia [3]. Unlike other health events in the lifespan of women, childbirth follows a well understood timeline where occurrence, risk factors and outcomes can be timeously identified and managed in an efficient and affordable way given the situation where trained birth attendants are available and skilled [4].

In recent years, there has been considerable attention paid to maternity service provision [5, 6, 7]. The medicalization of childbirth and its inherent problems have been well researched in terms of the effects on rising costs of childbirth, increasing use of medical interventions, and dissatisfaction by women in terms of lack of continuity of care and choice of delivery method, location and experience [8, 9, 10, 11, 12].

Over the last century, the midwifery model of care has been virtually replaced in many countries by obstetric-led maternity services [9, 13]. As birth has largely moved from the home to the hospital [2, 3, 13, 14, 15], from traditional birth attendants or midwives to doctors and/or obstetric nurses, there have been both gains and losses in terms of service provision and outcomes. And while the necessity of specialist training and availability of interventions during childbirth is not debatable, the appropriateness and affordability of obstetric-led maternity care is. Although emergency obstetric and paediatric back-up, life-saving medical interventions, pain relief, and educated birth attendants are critical to maternity care, they must go hand-in-hand with the emotional and psychological support integral to healthy mothers and babies [16].

It has been well documented that different types of practitioners have different philosophies and hence, practices underpinning their provision of maternal health care [4]. Midwives and medical practitioners (obstetricians, physicians, doctors) provide a different model of care and expertise in relation to childbirth and overall maternal health.

3.2 Midwifery Model of Care

Midwifery is an ancient profession that has been around as long as women have been giving birth. Midwife literally means 'to be with the woman' [2] and long before certification and licensing for midwifery, women were accompanying their sisters, mothers and community members giving birth.

The primary tenet of the midwifery model of care is that birth is a fundamentally normal physiological process that women have undergone for millennia, and in low-risk scenarios should be treated in a non-medicalized environment [17]. 'Normal birth' is characterized as a vaginal delivery 'without surgical interventions, induction, epidural, spinal or general anesthetic' [18]. Continuity of care, focusing on pre, intra and postnatal care, where physical, emotional and psychological wellbeing is at the centre, is the essence of the management strategy of midwives.

From a historical perspective, midwifery began with 'lay' midwives and traditional birth attendants, whom through their experience and their spiritual calling became the experts that oversaw pre, intra and postpartum care of mother and infant. Throughout history this has changed, and today midwifery is a complex profession with many different manifestations in many different countries.

For most of history, midwifery has been an autonomous profession, solely in the hands of midwives – who, up until the advent of the man-midwife in the 1700s [3], were women. Although this practice was undertaken by women at the community and family level, shifts towards medicalized, technology-driven, for-profit birthing environments in the last century has made the practice of midwifery increasingly political [9, 15, 16, 19]. During

the 20th century, midwifery shifted from the community setting to the hospital setting, where doctors and obstetricians became the primary decision makers responsible for the birthing process [9, 14, 20].

Recent History of Midwifery

Midwifery practice began to considerably change in the late 1800s when the role of obstetrics in normal deliveries, pain relief and antenatal care began to emerge, and later dominate in many countries. Before this, obstetrics were limited primarily to dealing with cases of obstructed labor and complications [3]. This change had different impacts for the profession of midwifery and delivery of maternal health services around the world.

Although 'midwife' now has a standard and accepted international definition (see Box 1), there are different types of midwives that practice in a variety of settings, under diverse philosophies - which depends on both the country they are qualified and/or licensed in and the underlying environment of maternal and infant health care and childbirth in that particular country. The way in which midwives qualify, their autonomy as professionals and the way in which licensing, regulation and re-imbursement are structured, affects the way in which the midwifery model of care is available and its ability to be delivered.

Box 1: The International Definition of a Midwife

A midwife is a person who, having been regularly admitted to a midwifery educational programme, duly recognised in the country in which it is located, has successfully completed the prescribed course of studies in midwifery and has acquired the requisite qualifications to be registered and/or legally licensed to practice midwifery.

The midwife is recognised as a responsible and accountable professional who works in partnership with women to give the necessary support, care and advice during pregnancy, labor and the postpartum period, to conduct births on the midwife's own responsibility and to provide care for the newborn and the infant. This care includes preventative measures, the promotion of normal birth, the detection of complications in mother and child, the accessing of medical care or other appropriate assistance and the carrying out of emergency measures.

The midwife has an important task in health counseling and education, not only for the woman, but also within the family and the community. This work should involve antenatal education and preparation for parenthood and may extend to women's health, sexual or reproductive health and child care.

A midwife may practice in any setting including the home, community, hospitals, clinics or health units.

Source: International Confederation of Midwives, 2005 http:// www.internationalmidwives.org/

United States of America (US)

With the advent of medical obstetrics in the early 1900s, midwife-attended births in the US began to decrease from over 40% in 1915 to less than 11% by the 1930s. This continued to decline until the 1960s, 70s and 80s when women began to show increasing interest in midwifery services again [9, 19, 21]. In 2003, certified nurse midwives (CNMs) attended close to 10% of vaginal births [22], a substantial increase from less

than 1% in 1975 [22, 23]. The majority of midwife-attended births – 94.3% in 2006 [24] - were attended by CNMs.

Reasons for the decline of midwifery in the US are multi-faceted and include the rise of the medical obstetric profession, who defined 'pregnancy and childbirth as a pathological process within a risk-based value system and, despite considerable evidence to the contrary, promised women better outcomes under a physician's care in a hospital setting' [9]. Lack of organization and unification are also cited as reasons why the medical profession succeeded in convincing the public that 'midwives were unsafe practitioners' [25] and childbirth belonged in the 'safe' environment of hospitals.

Nurse-midwifery, as a profession, was introduced to the US in the 1930s with the establishment of the first nurse-midwifery programme in New York [26]. In 1955, the American College of Nurse-Midwives (ACNM) was formed [27]. By ensuring that nurse-midwives had to be qualified as nurses who then specialized in midwifery training, the ACNM garnered support and legitimacy from the medical community and also firmly placed themselves within the biomedical framework of maternity care [25] – in 2003 approximately 97% of certified-nurse midwife births occurred in hospitals [28]. Although this succeeded in legitimizing the nurse-midwifery profession, it changed the model of practice, resulting in dissatisfaction among those midwives who did not agree that midwifery should sit within a biomedical framework for the delivery of maternity services.

In the early 1980s the Midwives' Alliance of North America (MANA) was formed [29]. This was in response to pressure from the ACNM for the 'lay' midwives to join the ACNM and subscribe to the underlying values entrenched in their practice of midwifery [25]. The midwives who formed and joined MANA believed in the midwifery model of care (see Box 2) and diversity in education and practice.

Box 2: Midwives Model of Care™

The Midwives Model of Care™ is based on the fact that pregnancy and birth are normal life events. The Midwives Model of Care includes:

- monitoring the physical, psychological and social well-being of the mother throughout the childbearing cycle

- providing the mother with individualized education, counseling, and prenatal care, continuous hands-on assistance during labor and delivery, and postpartum support

- minimizing technological interventions and;

- identifying and referring women who require obstetrical attention

The application of this model has been proven to reduce to incidence of birth injury, trauma, and caesarean section.

Source: Citizens for Midwifery, 2009 http://cfmidwifery.org/mmoc/define.aspx

In 2009, there are two different ways in which midwives can now get their qualification to practice midwifery in the US. And, in fact, these different ways of qualifying gives different licenses and different jurisdiction in which they can practice [30]. They are even called different names. For example, from a historical point of view, 'lay' midwives are now referred to as 'direct-entry' midwives. Historically, these midwives did not have a formalized certification process, but due to substantial pressure and endless questioning by certified-nurse midwives and the medical community in general, it was agreed in the 1980s that a standardized test was necessary to ensure they had the required skills and a way in which to determine this. They are now required to obtain the newly developed North American Registry of Midwives' (NARM) certification of Certified Professional Midwife (CPM) [25, 29].

This differs from the Certified Nurse Midwife (CNM), which is a means of qualifying to become a midwife through formalized education. The ACNM is the professional body overseeing this certification process and now requires that all CNMs obtain a baccalaureate degree before, during or upon completion of their midwifery education [25, 27]. In 1995, the ACNM members decided that it was important to have a route for 'direct-entry' through their qualification process. It was decided that Certified Midwives (CMs) would be qualified by taking the same exams as the CNMs and taking one of the ACNM's division of accreditation's programs which must lead to a baccalaureate degree.

Deliveries by midwives in the US have been growing in demand and consistent evidence has shown that birth outcomes are equal, if not better than obstetric providers, as well as more cost-effective [8, 11, 31]. The *National Vital Statistics Report's* final data for 2006 stated that 11% of babies in the US are delivered by nurse-midwives. It has also been argued by numerous researchers [8, 11, 32] that increasing use and availability of midwives would improve access to quality and affordable healthcare overall.

A concerning trend in the US is the increasing use of caesarean sections for deliveries. The caesarean section rate rose for the 11th consecutive year in 2007, by 2% and is now occurring in 31.7% of births in the US. At the same time as caesarean rates are increasing, assisted delivery techniques utilizing forceps and vacuum-extraction methods have decreased by over 50% from 1996 – 2006. Assisted deliveries using these techniques only occur in 4.5% of overall deliveries [33].

Canada

Despite Canada having a similar history to the US in terms of midwifery losing support and legitimacy at the end of the 1900s and the biomedical model of childbirth taking the forefront for most of the 20th century, a strong group of midwives and consumers in the 1980s advocated for the midwifery model of care to be re-established throughout Canada. This resulted in the establishment of a taskforce to study models of midwifery in the US, the Netherlands, Denmark and the UK and it was decided, starting in the province of

Ontario, that the best route for midwifery would be a direct-entry profession that would be self-regulated with an independent regulatory body [9]. Because of the data observed and country-models studied, this route was chosen and evaluated as the most effective for midwifery practice within maternity care. Canadians decided that it was essential that midwives were autonomous, and therefore practice within their own model in order to garner the best results for mothers and babies.

Since the early 1990s, when the Ontario Midwifery Act [34] was enacted, direct entry midwifery courses have been available and offered at university baccalaureate level. In order to recognize the diversity in background and qualification of midwives who were already practicing across Canada, a process of assessment and standardization of competencies and skills was undertaken over a couple of years to ensure that all Canadian midwives had comparably high skills and standards [35]. Midwives in Canada are referred to as 'Registered Midwives', who are recognized as a primary caregiver through the childbirth process – namely the provision of pre, intra and postpartum care. They are autonomous professionals who are able to provide services for home and hospital births, and are able to utilize the services of specialists if emergency situations occur during the care of the mother and/or baby. The number of Registered Midwives increased by 330% from 1993-2002 from 96 to 413 and correspondingly the number of deliveries by midwives has also increased in many provinces [5]. They are currently regulated in most provinces; and if they are yet not regulated, are in the process of being. Most provinces have both their own regulatory body and professional body. Most midwifery services are publicly funded by the government department who is responsible for health care provision in each of the provinces[**].

Trends in delivery patterns in Canada are consistent with the US. In Canada, the overall proportion of caesarean sections has also increased from 17.6 - 26.3% over the period of 2001 - 2006. The same decrease in assisted deliveries (overall 14.3%) utilizing vacuum

[**] Go to http://www.canadianmidwives.org/midwife.htm for updated status on provincial legislation for midwives and whether midwives are publicly-funded.

extraction (9.8%) and forceps (3.7%) has also been observed [36, 37]. Canadian obstetricians and gynecologists have expressed concern about the rising trend in caesarean sections and are 'actively working to provide continuing education for Canadian healthcare professionals on best practices relating to caesarean sections' [36].

The United Kingdom (UK)

The UK has a long history of midwife-led maternity services. The publicly-funded National Health Service (NHS) essentially has two different roles for midwives. The first is the hospital-based midwife, who attends births within hospitals throughout the UK. The second is the community midwife, who attends births either at home or in community birthing centers. There is also a third role for a midwife in the UK, and this is the independent midwife. Although independent midwives are regulated in the same way and must be registered with the Nursing and Midwifery Council, they are private practicing midwives, not funded or regulated within the NHS. Women utilize this type of midwife when they are willing to pay for their services and if they feel as though they are unable to get the type of birth that they are hoping for within the NHS system [12].

Recent calls for reform in UK maternity services due to increasing dissatisfaction with services [12, 38, 39] have led to a great deal of research on midwifery models of care. The UK has acknowledged there are considerably different ways of practicing and hence, the services rendered from midwives working within the NHS and those independent midwives working outside the NHS- either as private practitioners or as contractors - are significantly different.

Whether UK midwives work within or outside of the NHS does not affect the qualifications and regulatory bodies monitoring the scope of practice and educational/training component of midwifery. All midwives are required to be registered through the Nursing and Midwifery Council and all are required to take a 3 – 4 year degree through a regulated university programme for midwifery.

The proportion of caesarean sections in the UK has been relatively stable since 2005 and was 24.6% for the 2007 - 2008 period. Instrumental deliveries have increased slightly from 2005 - 2006 to 2007 - 2008 from 11.5 to 12.1% overall [38, 40].

The Netherlands

The Netherlands has midwifery care at the centre of its maternity service delivery. Midwives in the Dutch system are highly regarded and have remained as a central feature in obstetric care as autonomous professionals throughout the 20th - 21st century [41]. In comparison to the US, where 11% of deliveries are attended by midwives, in the Netherlands, approximately 70% are attended by midwives, with 60% of those births occurring at home [17]. About three-quarters of Dutch midwives are in independent practice [41]. The Netherlands has low use of medical interventions with 13.7% of deliveries being caesarean sections [17]. Midwives are incorporated in the Dutch system as the primary care givers for low-risk pregnant women and refer women who have high-risk assessments to specialist obstetricians [41]. The Royal Organisation of Midwives in the Netherlands (KNOV) is the only professional organization for midwives in the Netherlands. Their role is to represent midwives, develop standards and guidelines, as well as advocate and advise on policy issues [42]. As the professions of nursing and midwifery have always been developed and maintained quite separately in the Netherlands [43], the training that midwives undergo has remained distinct from nursing. Midwifery qualifications are currently granted through three midwifery schools, who offer four-year specialized programmes [44, 45].

South Africa

South African maternity services have not been nearly as well researched as the country-specific examples above. The care provided by maternity services has been firmly routed in the biomedical model of childbirth and has been 'shaped by both colonization and the apartheid system' [46]. Before 1968, there was midwifery training offered without the requirement of nursing. However, since 1968, when the South African Nursing Council

'accepted the principle that all midwives should be trained as registered nurses' [47], midwifery became embedded in nursing degrees and rooted in the biomedical model of maternity care provision. In 1986, nurse training changed into its current format of a four-year diploma or degree and midwifery was one of the three 6-month specialty areas. Traditional birth attendants, who have skills acquired experientially, are not a recognized sector in South Africa [46].

South Africa adopted a primary health care approach in 1994 [48] and free pre and intranatal care became available to all women who did not have access to private medical insurance. Currently, most births in South Africa occur in the public sector. According to the 2003 Demographic and Health Survey (DHS), 82.7% of births occurred in the public sector compared to 6% of births that occurred in the private sector and 6.6% that occurred at home. The public sector Maternity Obstetric Units (MOUs), which are nurse-midwife led, deal with low-risk, uncomplicated births and high-risk cases are referred to secondary and tertiary levels of care where the midwives work alongside doctors and specialists.

Within the greater Cape Town region, unpublished data from the Department of Health [49] from January 2005 - November 2009, indicates that from those public facilities who reported deliveries (4 district hospitals did not report any deliveries for this period) there have been 301, 520 deliveries (see Table 3.1). For all of these deliveries, which include all the public facilities together (MOUs, district, regional and national hospitals in the region), the proportion of normal vaginal deliveries (NVDs) was 77.2%, assisted deliveries were 2.6% and caesarean sections were 20.2%. The still birth rate was 22.3 per 1,000 deliveries.

Table 3.1: Deliveries for Public Facilities in Cape Town Metropolitan and Municipality (January 2005-November 2009)

Delivery Information	*Total (n)*	*Proportion of delivery (%)*
NVD with instrumentation	7843	2.6
Caesarean section	60,912	20.2
NVD	232, 765	77.2
Stillbirth	6898	2.3
Total deliveries	301, 520	

Source: Western Cape Department of Health 2010 (unpublished data)

When looking at the reported data from the eleven MOUs (see Table 3.2), this shows that 42% (n= 127, 840) of the total deliveries in the greater Cape Town region are occurring in the MOUs. There were 15 assisted deliveries at these facilities during this period, and the proportion of NVDs was 99.9%. The still birth rate was 9.5 per 1,000 deliveries.

Table 3.2: Deliveries at MOUs in Cape Town Metropolitan and Municipality (January 2005-November 2009)

Delivery information	*MOU #1*	*MOU #2*	*MOU #3*	*MOU #4*	*MOU #5*	*MOU #6*	*MOU #7*	*MOU #8*	*MOU #9*	*MOU #10*	*MOU #11*	*Total (n)*	*Proportion (%)*
NVD with instrumentation	4	0	0	0	0	0	0	0	8	2	1	15	0.0001
NVD	12179	9637	10465	8628	12330	10575	12856	11784	17902	12630	8839	127,825	0.999
Still birth	52	78	98	57	161	110	181	81	173	34	185	1210	0.0095
Total deliveries	12183	9637	10465	8628	12330	10575	12856	11784	17910	12632	8840	127840	

Source: Western Cape Department of Health 2010 (unpublished data)

South African midwives also work within the private sector where women who are covered by medical insurance can utilize maternity services. For the most part, these midwives fulfill the role of obstetric nurses working alongside obstetricians [47]. The discrepancy in the use of medical interventions is well documented between private and public maternity services – where the public sector throughout the country currently has 25% caesarean section deliveries [50] the private sector is thought to have 40-80% caesarean section deliveries [47, 50, 51]. This utilization of surgical intervention in the form of caesarean section is a cause for concern. Not only must it be asked why the proportions in the private sector are so high, but also why there is such a discrepancy between public and private services, what the cost implications are, as well as the health implications for mothers and babies. The World Health Organization (WHO) clearly states that at a country-level, caesarean section deliveries should be close to 15% [52]. This is viewed as acceptable in terms of those who need emergency procedures having access to them and in terms of interventions and technology not being over-utilized [53].

Interestingly, within the private sector services there are a small, unknown percentage of deliveries, which are managed by independent midwives whom take full responsibility for pre, intra and postnatal care of their clients. There has been no research done into this area in terms of utilization of these services or resulting birth outcomes. However, personal communication [54] with the independent midwives in Cape Town suggests that medical interventions are remarkably low compared to other private practitioners. Seven to fifteen percent of the independent midwife attended deliveries has been estimated as the need for caesarean sections.

3.3 Ensuring Appropriate Midwifery Practice

As referred to in Box 2, The Midwifery Model of Care is founded on the principles of 'minimizing technological interventions' and 'identifying and referring women who require obstetric attention'. It also assumes that childbirth is a normal event in the life of a woman and that women have the natural ability to experience birth with minimum or without routine intervention [31]. However, implicit in this model is the understanding that midwives have knowledge and training about when it is appropriate to seek partnership and consultation from other professionals. Guidelines for South African midwives in terms of when it is necessary to seek medical assistance during pregnancy, labor, during the puerperium and for the child are found in Section 10 within the South Africa Government Notice R2488 1990 (Appendix 1). In obstetrics there are known characteristics and predisposing factors in pregnancy and delivery that necessitate intervention. Identifying these factors is essential to ensure safety of mothers and babies.

Factors associated with pregnancy outcome

Maternal age

Maternal age is a known factor that influences both maternal and perinatal outcomes. Women who are under 20 years old and over 35 years old have increased maternal and perinatal mortality and morbidity. Reasons for this differ between the two age groups. Women who are under 20 years old have an increased risk of gestational proteinuric hypertension (GPH) and if they are very young, with under developed pelvises, have increased risk of obstructed labor due to cephalopelvic disproportion (CPD) resulting in caesarean sections. Women who are over 35 years often have increased prevalence of medical complications (diabetes, hypertension) which exacerbate pregnancy complications. Low birth weight babies are also more common in women under 20 years old and can be due to preterm delivery and intrauterine growth restriction (IUGR). Older mothers are more likely to have fetal chromosomal abnormalities [55].

Parity

Parity, which 'indicates the number of previous fetuses that reached viability, i.e. six months, 22 weeks or a birth of mass 500g' [56] is another well known and well researched factor that influences maternal and perinatal outcomes [57]. Women, who are nulliparous therefore giving birth for the first time, are more likely to have severe maternal complications. High parity (Para 5+) is also associated with increased prevalence of complications. Perinatal mortality is also slightly increased for nulliparous and markedly increased for women with a parity of 4 or more [55].

Socio-economic status

Socio-economic status is another factor associated with perinatal and maternal outcomes. This is not as straightforward as the relationship of age and parity however it is essential to keep socio-economic status in mind when managing childbearing women. Fawcus explains in her chapter in Obstetrics in Southern Africa that 'there are no easily measurable indicators of socio-economic status in this region' [55]. Until recently South

Africa has presented maternal and perinatal mortality in different racial groups; as recently as 1998, 92.6% of all maternal deaths occurred in black African women.

Maternal and fetal indications associated with delivery type

Induction of labor

Induction of labor is the initiation of labor with the intention of a vaginal delivery before spontaneous labor begins. Induction is normally done if maternal or fetal risks comprise continuing the pregnancy and outweigh the risks of delivery [58]. The indications for induction of labor are found in Table 3.3. *The Cochrane Library* recently wrote a review 'Induction of labor for improving birth outcomes for women at or beyond term' and reported that for the 18 studies that were reviewed there was no statistical evidence for those women induced at 41 or 42 completed weeks of increased risk of caesarean section delivery (RR 0.92; 95% CI 0.76 to 1.12; RR 0.97; 95% CI 0.72 to 1.31) [59].

Assisted deliveries

Similar results occurred for assisted vaginal deliveries, where 10 studies were reviewed and there was no evidence for those women induced at 41 or 42 weeks of increased risk of assisted deliveries (RR 1.05; 95%CI 0.94 to 1.17; RR 0.95; 95% CI 0.65 to 1.38)[59].

Table 3.3: Maternal and Fetal Indications for Induction

	Indications for Induction
Maternal	• Hypertension, pre-eclampsia • Preterm rupture of membranes • Chorio-amnionitis • Maternal medical problems exacerbated by pregnancy • Logistic factors (previous precipitate labor, distance from hospital) • Elective induction (patient's choic)
Fetal	• Suspected fetal jeopardy • Post date pregnancy • Fetal demise

Source: Adapted from Howarth, 2003 in Obstetrics in Southern Africa

Instrumental deliveries are among the most common obstetric interventions and are used during the second stage of labor to speed up delivery. Two common instrumental methods are utilized: forceps and vacuum extraction. The common maternal and fetal indications for both of these methods are found in Table 3.4. Forceps and vacuum extraction deliveries have different prerequisites that must be assessed by obstetric providers before undertaking the procedures.

Table 3.4: Indications for instrumental deliveries

	Indications for Forceps Delivery	*Indications for Vacuum Extraction*
Maternal	• Maternal diseases (examples: hypertensive conditions, cardiac disease) • Maternal exhaustion	
Fetal	• Fetal distress • Prematurity • Aftercoming head in the case of breech presentation • Prolonged second stage of labor	• Delayed second stage of labor is the classical indication

Source: Adapted from Cronje, 2003 in Obstetrics in Southern Africa

Caesarean section

A caesarean section delivery should be performed if the continuation of pregnancy or labor is considered harmful to the mother or baby and if vaginal delivery is seen as unsafe for either the mother or the baby. There are known risks to caesarean sections, especially for the mother. Maternal mortality is four - five times higher than vaginal delivery and maternal morbidity is also increased [60]. However they can also be advantageous in terms of avoiding birth injuries to mother and baby, birth asphyxia due to prolonged labor and complications of neglected, prolonged labor [61]. There are well known factors that influence the decision to have a caesarean section delivery. These are listed for maternal, fetal and combined maternal and fetal indications in Table 3.5.

Table 3.5: Medical indications for caesarean section deliveries

	Indications for caesarean section delivery
Maternal	• Life threatening uterine hemorrhage • Eclampsia or imminent eclampsia • Major placenta previa or vasa praevia • Space-occupying pelvic lesion • Gross pelvic contraction • Previous successful operation for urinary incontinence • Cervical carcinoma • Serious medical illness • Bearing-down efforts contraindicated • Previous classical caesarean section • Previous lower segment caesarean section, plus another significant factor • Uterine rupture • Maternal preference
Fetal	• Suspected fetal distress • Presentation or prolapse of the umbilical cord • Brow or mento-posterior face presentation • Transverse or oblique lie • Breech presentation unsuitable for vaginal delivery • Prematurity • Multiple pregnancies, particularly high multiples • Macrosomia • Certain fetal anomalies • Fetal thrombocytopenia • Risk of fetal infection
Combined Maternal and Fetal	• Failure to progress in labor • Failed forceps or vacuum extraction • Failed induction of labor

Source: Adapted from Hofmeyr, 2003 in Obstetrics in Southern Africa

Third stage management of labor

The third stage of labor is from when the baby is delivered to when the placenta is expelled. This stage and its management are known to be particularly important, and to have serious implications, for primarily the mother in terms of mortality and morbidity. The WHO highlighted in its report on 'Maternal mortality in 2000' that 25% of maternal mortality is caused by postpartum hemorrhage [62]. Obstetrics in Southern Africa describes that there are four different definitions of postpartum hemorrhage (see Table 3.6) that can be appropriately used depending on the situation. Research and evidence-based findings have consistently show that active management, including 1) the administration of uteronics immediately following birth of the baby, 2) controlled cord traction, and 3) uterine massage after delivery of placenta [63] shortens the length of time of the third stage of labor and therefore reduces the risk for postpartum hemorrhage [64, 65]. Both the International Confederation of Midwives (ICM) and the Federation of Gynecologists and Obstetricians (FIGO) recommend active management and that every attendant at a birth is properly trained and skilled in active management. It is

acknowledged that more research needs to focus and disentangle which uteronics are best used when, however it is clear that active management far exceeds expectant management (which relies on the natural contractions of the uterus, stimulated by a surge of oxytocin at birth, that is managed through nipple stimulation and massage of the uterus [65]) in terms of reducing risk of postpartum hemorrhaging [66].

Table 3.6: Definitions of postpartum hemorrhage

1. Blood loss of 500 ml or more at vaginal delivery or 1000 ml at caesarean section.
2. Vaginal bleeding or blood loss at caesarean section associated with hypotension and tachycardia.
3. Bleeding associated with a drop in haematocrit of 10% or more, both at vaginal delivery or caesarean section.
4. Bleeding at delivery necessitating blood transfusion.

Source: Daponte, A. 2003 in Obstetrics in Southern Africa

3.4 A Collaborative Approach to Maternal Health

The critical role of obstetrics and medical interventions to ensure safe delivery and minimize complications is not debatable, and since the rise of the obstetric model of childbirth there has been a considerable decrease in both maternal and infant mortality [3]. Lives saving interventions such as emergency caesarean sections, forceps and vacuum extraction deliveries, episiotomies, and techniques to control postpartum hemorrhage have all contributed to declining maternal and infant mortality. The unfortunate reality is that the increasing dominance of the obstetric model has coincided with the resulting rise in use of medical interventions that may not necessarily be for emergency purposes [50, 67, 68]. This has also coincided with a decrease in midwifery-led maternity services. When looking at service delivery that could be cost-effective, as well as safe and satisfying for mothers and babies, it is important to acknowledge and provide choices of practitioners and models of childbirth – that are all supported by both policies and resources, as well as being adequately skilled.

There is no doubt that obstetricians are critical in emergency situations and high-risk pregnancies where trained birth attendants encounter problems during the natural birthing

process. There is also no doubt that the health system structures surrounding the maternity services available must support the swift transfer and intake of clients who do in fact run into difficulties. When looking at the dramatic increase in use of medical interventions throughout the world and the rising costs and pressures on country health systems [8, 11, 21), there is no doubt that childbirth and maternity services should not be left out of evaluations of efficacy, efficiency and cost-effectiveness. The combination of midwife and obstetric models are necessary in order to have maternity services that encompass all of these elements [69]. The lack of availability or support of either of these services may lead to a situation where the lives of women and their babies may be compromised and unnecessary amounts of money wasted on technology being over-utilized.

Choice of providers for maternity services and continuity of care have been two critical areas where maternity health reform has focused in Canada and the United Kingdom. Both countries have found that these elements are essential to effective and progressive maternity services where client safety and satisfaction are both taken into account. In 2009, a review published in the *Cochrane Library*, 'Midwife-led versus other models of care for childbearing women' summarized findings of 11 studies including 12,276 women who had utilized midwife-led models. They found that women were less likely to experience episiotomies (RR 0.82, 95% CI 0.77 to 0.88), regional analgesia (RR 0.81, 95% CI 0.73 to 0.91), instrumental delivery (RR 0.86, 95% CI 0.78 to 0.96) and antenatal hospitalization (0.90, 95% CI 0.81 to 0.99). Women were more likely to experience spontaneous vaginal birth (RR 1.04, 95% CI 1.02 to 1.06), no intrapartum analgesia/anesthesia (RR 1.16, 95% CI 1.05 to 1.29), as well as feel in control during childbirth (RR 1.74, 95% CI 1.32 to 2.30) [31]. They did not however, find statistically significant differences between the groups in terms of proportions of caesarean section deliveries.

More research into obstetric-led, as well as midwifery-led services is critical in terms of ensuring services that are benefiting women and babies. Pattinson and Carpenter explain in the chapter on quality control in obstetrics in Obstetrics in Southern Africa that the

South African Medical Research Council stated in 1998 that 'death of babies in and around pregnancy carries the biggest burden of disease in South Africa' [72]. They explain that auditing services that provide care to mother and babies 'is probably the best way to point in the direction that should be followed to effect good care'. As countries go through health reforms that include re-looking at maternity service delivery, it is critical that data is collected for all available services – including independent midwives. This data availability and collection is critical in both auditing services and supporting midwifery as a profession to 'combat criticism of midwifery' [22, 67] and to ensure good practice is followed and disseminated.

3.5 The Case for Researching and Expanding the Use of the Midwifery Model of Care in South Africa

South Africa is a country with unique and substantial challenges for health care provision and service delivery. Not only because of the over-subscribed and under-skilled public services, but also the vast cultural, ethnic, geographical and linguistic differences throughout the country which depend on these services [48].

It has been well documented that private health care expenditures far exceed public health care expenditures even though public services are utilized by the majority of the population. According to Health Systems Trust, in 2007, 8% of South Africa's GDP was health expenditure, with 5% allocated to private health sector and 3.5% allocated to the public health sector [70]. In a country where almost 83% of deliveries are occurring within the public sector, this has serious implications for maternity service provision.

As described in the section outlining South African maternity services, the first tier of public sector service occurs at the MOUs where the majority of uncomplicated, low-risk pregnancies and deliveries are managed. The second tier consists of hospitals where women with pregnancy and delivery complications are referred and the third tier is the teaching and specialization hospitals. Research done by Jewkes et al has uncovered considerable dissatisfaction with services provided within the system of public maternity

clinics with late bookings, staff shortages, physical and verbal abuse by the staff towards clients, shortages of ambulances and flying squad for transfers listed as some of the major problems within this system [71].

On the other end of the spectrum are private sector maternity services that deal with a small proportion of deliveries for those who can either afford to pay directly or through medical insurance schemes. The private sector services have substantially higher health care expenditures per person alongside an equally high medical intervention rate. It seems that neither system has found an acceptable way in which these services are delivered that balances the need for provider choice, client satisfaction, cost-effectiveness, cultural-appropriateness and respect, and continuity of care. There seems to be a paradox within maternity services within the South Africa where public sector clients do not often get the care that they need and private sector clients have unnecessary access to expensive and highly specialized interventions.

And then there is the undocumented percentage of deliveries done by independent midwives around the country. This is an entire area of maternity services that has not had any research focus; that based on anecdotal evidence, personal communication, and evidence from around the world, seems to have potential lessons for enhancing services in both private and public sector maternity provision within South Africa. In the very least, undertaking research into birth outcomes, utilization patterns, costs associated with services and predictors for natural and assisted deliveries and caesarean sections can provide a missing piece of the puzzle and enable complete surveillance and data collection with respect to maternal health services within South Africa. It will also provide the independent midwives, and the colleagues they require for medical back-up, an accurate reflection of need and utilization of transfers and hospital services in cases of emergency during independent midwife-led deliveries.

4. STUDY AIMS

There is currently no research available on independent midwives in Cape Town in terms of utilization of services, number of deliveries, birth outcomes and delivery types, as well as specific socio-demographic and professional information on the 16 independent midwives, themselves.

There were three primary aims of this study:

1. To describe socio-demographics, birth outcomes, and delivery types for the cohort of women utilizing independent midwives in Cape Town from January 2003 - end of June 2009.
2. To identify factors associated with birth outcomes and delivery type in this cohort of women.
3. To describe socio-demographic and professional characteristics of the 16 independent midwives who practiced in the study period.

This data will not only be useful for the independent midwives themselves in terms of surveillance and auditing of services, but also in terms of providing necessary evidence for service planners if increasing provision and support of these services may be considered.

The specific objectives of this study were:

1. To describe utilization of independent midwives for deliveries in Cape Town including the number of women accessing their services and number of deliveries attended.

2. To assess the socio-demographics, reproductive, labor and delivery characteristics of women who have sought independent midwives.

3. To describe delivery types for women utilizing independent midwives specifically in terms of the proportion of a) those women who had natural vaginal deliveries with no interventions, b) those women who had natural vaginal deliveries with interventions, c) those women who had natural vaginal deliveries with instrumentation, and d) those women who had deliveries in which a caesarean section was necessary.

4. To describe the birth outcomes for women utilizing independent midwives specifically in terms of the proportion of live births, proportion of neonates needing intervention and proportion of women who experienced postpartum hemorrhage.

5. To identify patient pregnancy, labor and delivery-related factors associated with need for natural vaginal deliveries with instrumentation, caesarean sections, transfer to hospital and poor maternal or infant outcomes.

6. To describe the professional characteristics of the independent midwives and their practices.

5. SETTING

The research study took place in one of the six districts of the Western Cape, South Africa: the greater Cape Town region (also known as the Cape Town metropole), which is made up of 8 sub-districts (see map of region in Appendix 2). It involved a whole sample of women utilizing the 16 independent midwives operating in the greater Cape Town area over the six and a half year period from January 2003 - end of June 2009. All independent midwifery practices within the greater Cape Town area were included, regardless of client volumes.

6. STUDY DESIGN AND METHODOLOGY

This was a retrospective cohort study with descriptive and analytical components, as well as a cross sectional study describing the midwives and their practices. The study involved two components:

1) A midwife component-cross sectional survey.
2) A client component-retrospective cohort

6.1 Study population

Client component: The study population was women who have had independent midwife attended deliveries over the six and a half year period from January 2003-end of June 2009 in the greater Cape Town area.

Midwife component: Those independent midwives who participated in the study all provided services as independent midwives in the greater Cape Town area during the period January 2003 - end of June 2009.

6.2 Data Sources and Collection

Study Sources and Samples

1) A whole sample of women who have had independent midwives attended deliveries in Cape Town from January 2003 - end of June 2009.

2) A whole sample of independent midwives who have operated in Cape Town doing deliveries from January 2003 - end of June 2009.

Data Collection

All data recorded by individual midwives in their Maternity Registers' from January 2003 - end of June 2009 was collected. The Maternity Register is currently used by independent midwives to record information on patient socio-demographics, reproductive characteristics, antenatal care, labor and delivery characteristics and birth outcomes for all women delivering in their practices. The concept of Maternity Registers was utilized and implemented by all the midwives, however in different formats. There were three different formats which the Maternity Registers took. The first was a standardized register entitled 'Maternity Register' that thirteen of the sixteen midwives utilized. The second format that two of the midwives utilized was a computerized database that had similar variables to the standardized maternity register, but more space with which to write more detailed notes. The third format, which one midwife used, was a journal, where all the same variables were kept for each of the deliveries but written in a less formalized way.

All deliveries were included in the study where independent midwives were present at the birth. Data was be abstracted from these sources by the researcher and entered onto a standardized data abstraction sheet. A data abstraction sheet (see Appendix 3) captured all of the client data. Prior to data abstraction names and identifying characteristics of both the client and the midwife were obscured and replaced by a unique identification number. All data collection was anonymous.

A semi-structured interview-administered midwife questionnaire (see Appendix 4) was administered in order to collect socio-demographics and professional characteristics of the independent midwives. All questionnaires were administered by the principal investigator in private rooms at the midwives' practices or over the telephone when the midwife was not available to be interviewed in Cape Town.

7. DATA ANALYSIS

All of the data was entered into a custom-designed Microsoft Excel database by the principal investigator. There was one database for the client component and one database for the midwife component.

All quantitative data analysis was conducted using the statistical programme STATA9 (Stata Corporation, College Station, TX, USA). Descriptive statistics were employed to assist in data cleaning and for basic characterization of variables. Data analysis began with univariate inspection of the data.

Our variables of interest were as follows:

Data analysis and collection was dependent on the previously recorded data in the midwives' registers. Therefore, these variables represent the data that was recorded by the midwives in their maternity registers.

Descriptive measures:

For the midwife:

- Age
- Private sector hospital work duration
- Public sector hospital work duration
- MOU work duration
- Nursing qualification
- Midwifery qualification
- South Africa degree of study
- Group practice

- Individual practice
- Number of deliveries done per month
- Registration with South African Nursing Council
- Registration with DENOSA
- Malpractice Insurance
- Back up hospital
- Staff privileges at back up hospital

For the client:

- Maternal age
- Race (*data unusable as only 2 midwives kept complete records of this variable)
- Suburb (*data unusable. Unable to classify suburbs into meaningful indicators of socio-economic status)
- Marital status (*variable unusable. None of midwives reported on this)
- Profession (*variable unusable. None of midwives reported on this)
- Parity
- Gravidity
- Previous caesarean section (*data unusable. Only 114 cases reported on this variable)
- Gestational age at onset of delivery
- Pregnancy complications this pregnancy (2 variables: 1st- binary yes/no; 2nd- categorical with each complication coded as described by midwife)
- Presentation (*data unusable. Inconsistent reporting by midwives)
- Duration of labor (*data unusable. Inconsistent reporting by midwives)
- Induction of labor (IOL) (binary: yes/no; 1=yes if delivery had reported artificial rupturing of membranes (AROM), IOL, or if prostaglandin E/dinoprostone was utilized).
- Pain relief for NVD (binary: yes/no; 1=yes if the following drug was reported to be utilized during delivery: hydroxyzine, entenox, pethidine, morphine, epidural, spinal, local anesthetics and the delivery was NVD)

- Drugs administered for induction, augmentation of labor and normal postpartum management (binary: yes/no; 1=yes if IOL was reported and one of the following drugs was utilized: prostaglandin E/dinoprostone, oxcitocin) or if only one or more of the drugs was utilized.
- Delivery location
- Hospital transfer (*data unusable as information pertaining to where birth was intended, when in birth transfer occurred, and who the transfer was for was not in Maternity Registers)
- Delivery attendant
- Delivery type (categorical variable: 1=NVD: normal vaginal delivery with no instrumentation; 2= NVD with instrumentation; 3= caesarean section delivery)
- Episiotomy utilized
- Natural tearing
- Degree of perineum tear: 1^{st}, 2^{nd} or 3^{rd} (for those who tore)
- Delivery complications- (binary: yes/no; 1= yes indicates that there was a delivery complications that arose)
- Maternal delivery complications, fetal delivery complications, combined maternal and fetal delivery complications and positional delivery complications (1 binary variable for each complication category; and one categorical variable for each complication category. Each delivery complication that was reported by the midwives were coded and then classified into 1 of 4 categories: 1) maternal, 2) fetal and 3) combined fetal and maternal groupings, with 4) positional complications as an addition by the principal investigator. These categories (with the addition of positional complications) were an adaptation of GJ Hofmeyr's 'Indications for caesarean sections' in Obstetrics in Southern Africa)
- Infant dead or alive (*data used in descriptive component, but the sample size was too small to make bivariate analysis appropriate for this variable)
- Sex of infant
- Birth weight
- Head circumference (*data unusable. Inconsistent reporting by midwives)
- Length of infant (*data unusable. Inconsistent reporting by midwives)

- 1 min Apgar score
- 5 min Apgar score
- Maternal blood loss
- Placental weight (*data unusable. Inconsistent reporting by midwives)

Outcome measures:

- Delivery type
- Need for newborn intervention (binary: yes/ no 1=yes and included all neonates born with apgar score <7 at 1min)
- Postpartum hemorrhage (binary: yes/no; 1=yes and was calculated by combining those delivery complications labeled as 'postpartum hemorrage' and those maternal blood losses >500ml. It was assumed that if either were not reported, than average blood loss occurred and no intervention was required.

Appropriate bivariate comparisons between clients' socio-demographic, pregnancy/reproductive, labor, delivery and birth outcomes, as well as the outcome measures (delivery type, need for newborn intervention and postpartum hemorrhage) were described using student's T-tests (for means), chi-squared and Fisher's Exact tests (for proportions), and Wilcoxon rank sum-tests (for medians), as appropriate.

8. ETHICAL CONSIDERATIONS

8.1 Institutional Approval

Institutional ethical approval was obtained from the research ethics committee of the University of Cape Town.

8.2 Consent procedures

The researcher obtained individual written informed consent (Appendix 4) from each of the independent midwives prior to their involvement in data collection. The informed consent explained:

- the purpose of the study;
- what is involved in participation, including access to maternity registers;
- the benefits of participation;
- protection of privacy (ie: that all information provided will be completely confidential and will only be viewed and used by the researchers on this project, and that participants' names will not be recorded to ensure anonymity);

8.3 Data Collection/Interview procedure

Client data was obtained from midwifery practices' maternity registers and midwife data was collected via interview-administered, semi-structured questionnaires. Informed written consent was given for both of the study components. No data was identifiable and all data was made anonymous prior to data collection.

8.4 Protection of privacy and confidentiality

All data was identified only by a unique participant number and kept in confidential files. No individual identifying information either with respect to the midwife, midwifery practice or clients' identity was or will be disclosed in reports, publications, or presentations.

8.5 Risks and benefits of participation

The only risk of participation was some risk of loss of privacy; however, procedures for the protection of confidentiality of midwife information and anonymity of client data were observed to minimize this possibility. There were no guaranteed benefits to individual midwives or midwifery practices from participation, but participation in this study may help to improve maternal and infant health services in the Western Cape province.

9. TIMEFRAME

The project took place over a 7-month period. The timeline for project activities can be found in Appendix 6.

10. RESULTS-MIDWIFE COMPONENT

Over the period from January 2003 – end of June 2009 there were 16 independent midwives who practiced in the greater Cape Town area. Interview-administered questionnaires were completed on 14 of those midwives. One midwife had died in 2007 and one midwife was not able to be contacted during the time of the study. Maternity registers were available for all 16 midwives who practiced during the study period.

10.1 Midwife socio-demographic characteristics

The median age of independent midwives was 41.5 years, and they ranged in age from 35 - 51 years old (see Table 10.1). Of the 14 midwives who were available for the interview, all (n=14, 100%) had previously worked in a hospital setting, either public or private, as a midwife, prior to becoming an independent midwife. Most midwives (n=9, 64.3%) had worked in a private sector hospital; the median was 3 years, with a range between 0.17 years and 9 years. Almost all of the midwives (n=13, 92.9%) had worked in a public sector hospital; with the median number of years being 5.5 and the range from 0.5 to 15 years. A little less than half of the midwives had worked in a MOU (n=6, 42.9%) and for those who had worked there, the median number of working years was 2.5, with a range between 0.5 and 10 years.

Table 10.1: Midwife socio-demographic characteristics

Characteristic n (%)	*Midwife N=14*
Median age in years (range)	41.5 (35-51)
Practiced as an independent midwife in the greater Cape Town region over the period of 2003 - end of June 2009	
Yes	14 (100)
No	0
Worked in a hospital as a midwife	
Yes	14 (100)
No	0
Worked in the private sector as a midwife	
Yes	9 (64.3)
No	5 (35.7)
Median no years working in private sector (range)	3 (0.17-9)
No years in private sector	
<1 yrs	1 (11.1)
>=1 yrs <2 yrs	1 (11.1)
>=2yrs<3yrs	2 (22.2)
>=3yrs<5yrs	2 (22.2)
>=5 yrs	3 (33.3)
Worked in the public sector as a midwife	
Yes	13 (92.9)
No	1 (7.1)
Median no years working in public sector (range)	5.5 (0.5-15)
No years in public sector	
<1 yrs	1 (7.7)
>=1 yrs <2 yrs	0
>=2yrs<3yrs	2 (15.4)
>=3yrs<5yrs	3 (23.1)
>=5 yrs	7 (53.9)
Worked in a MOU as a midwife	
Yes	6 (42.9)
No	8 (57.1)
Median no years in MOU (range)	2.5 (0.5-10)
No years in MOU	
<1 yrs	1 (20)
>=1 yrs <2 yrs	1 (20)
>=2yrs<3yrs	1 (20)
>=3yrs<5yrs	0
>=5 yrs	2 (40)

10.2 Midwife qualification characteristics

The majority (n=12, 85.7%) of the midwives who were interviewed had a diploma in nursing; only 14.3% (n=2) had a nursing degree (see Table 10.2). None of the midwives qualified as midwives by taking a 'direct-entry' midwifery programme. The majority (n=10, 71.4%) of the midwives took a four year programme and just over half (n=8, 57.1%) of the midwives took their midwifery specialization during their nursing qualification, as opposed to after (n=6, 42.9%). All of the midwives qualified through a South African institution.

Table 10.2 Midwife qualification characteristics

Characteristic n (%)	*Midwives N=14*
Nursing degree or diploma	
Diploma	12 (85.7)
Degree	2 (14.3)
Direct-entry midwifery degree/diploma	
Yes	0
No	14 (100)
Length of degree/diploma	
3 year	4 (28.6)
4 year	10 (71.4)
Midwifery specialization	
During degree/diploma	
Yes	8 (57.1)
No	6 (42.9)
After degree/diploma	
Yes	6 (42.9)
No	8 (57.1)
South African institution qualification	
Yes	14 (100)
No	0

10.3 Midwife practice characteristics

Over the seven year period from January 2003 to the end of June 2009, the 16 independent midwives who practiced in the greater Cape Town area (see Table 10.3) attended 2,403 deliveries. There was two months of missing data from May through June 2009 from midwife 10. The largest number (n=14) of independent midwives practicing was in 2003. Since then, it has decreased each year with 2009 having only 7 independent

midwives practicing within the greater Cape Town region. The largest number of births (n=421) attended by independent midwives occurred in 2007.

Table 10.3 Total numbers of midwives and births

Midwife Number	*Number of births 2003 N=349*	*Number of births 2004 N=325*	*Number of births 2005 N=372*	*Number of births 2006 N=374*	*Number of births 2007 N=421*	*Number of births 2008 N=375*	*Number of births 2009 N=170*	*Total number of births N=2403*
1	37	47	41	49	40	50	26	290
2	33	34	45	42	50	41	31	276
3	1	0	19	14	35	29	17	119
4	0	0	0	0	13	17	4	35
5	0	0	0	18	28	38	23	108
6	63	53	53	52	56	42	0	319
7	20	21	23	41	35	13	5	158
8	2	3	14	9	15	48	20	111
9	8	14	51	41	52	60	31	260
10	44	57	62	63	88	37	13	365
11	20	1	1	0	0	0	0	22
12	4	0	0	0	0	0	0	4
13	56	31	0	0	0	0	0	89
14	11	1	0	0	0	0	0	12
15	33	43	44	42	9	0	0	173
16	17	20	19	3	0	0	0	61
Number of midwives practicing	14	10	9	9	9	8	7	

The median number of years that the independent midwives practiced over the study period was six years (see Table 10.4). More than a quarter (n=5, 35.7%) of the independent midwives practiced during all seven of the study years, whereas less than a quarter (n=3, 21.4%) practiced two years or less. Over three quarters (n=11, 78.6%) practiced in their own individual practices; the remainder (n=3, 21.4%) practiced in group practices consisting of two midwives sharing all of their clients. All (n=14, 100%) of the independent midwives were registered with the South African Nursing Council (SANC) and the Democratic Nursing Organization of South Africa (DENOSA). The majority (n=9, 64.3%) also belonged to the Society of Private Nursing Practitioners (SPNP). All midwives had malpractice insurance and obtained it through DENOSA. All midwives had hospitals that they used for back-up. Just under half (n=6, 42.9%) of the independent midwives had three back up hospitals they utilized. Just under a quarter (n=3, 21.4%) had

only one back up hospital they utilized and just under a quarter (n=3, 21.4%) had between four and five back up hospitals that they utilized. All midwives had staff privileges at these hospitals.

Table 10.4 Midwife Practice Characteristics

Characteristic n (%)	*Midwives N=14*
Median no of years as independent midwife during 2003-2009 (range)	6 (1-7)
Number of years as independent midwife during 2003-2009 1 year	1 (7.1)
2 years	2(14.3)
3 years	1 (7.1)
4 years	2 (14.3)
5 years	0
6 years	3 (21.4)
7 years	5 (35.7)
Belong to group practice with > 1 midwife	
Yes	3 (21.4)
No	11 (78.6)
Mean no midwives in group practice	2
Midwives share clients	
Yes	3 (100)
No	0
Own client base	
Yes	0
No	3(100)
Registered with South African Nursing Council	
Yes	14 (100)
No	0
Other professional bodies	
Yes	13 (92.9)
No	1 (7.1)
Belong to DENOSA	
Yes	13 (92.9)
No	1 (7.1)
Belong to SPNP	
Yes	9 (64.3)
No	5 (35.7)
Have malpractice insurance	
Yes – all thru DENOSA	13 (100)
No	0
Number of hospitals utilized for obstetric back up	
1	3 (21.4)
2	1 (7.1)
3	6 (42.9)
4	2 (14.3)
5	1 (7.1)
Have staff privileges at the back up hospitals	
Yes	12 (100)
No	0

10. 4 Motivation for becoming an independent midwife

The most common reason given for becoming an independent midwife was 'dissatisfaction with existing maternity services' (n=7, 50%) (see Table 10.5). Just over 35% (n=5) wanted to be able 'to offer a continuum of care including antenatal through postnatal care'. 'Practicing midwifery differently than the hospitals' (n= 4, 28.6%) was the next most common answer followed by 'not wanting to be an obstetric nurse anymore' (n=3, 21.4%) and 'to do homebirths' (n=2, 14.3%). One midwife said each of the following: 'broadening my horizons', 'offering more choices in childbirth', 'giving individualized care' and 'practicing the ideology of patient advocacy' as their reason for becoming an independent midwife.

Table 10.5 Reasons for becoming an independent midwife

Characteristic n (%)	*Midwives N=14*
To practice midwifery differently than hospitals	
Yes	4 (28.6)
No	10 (71.4)
To give individualized care	
Yes	1 (7.1)
No	13 (92.9)
To offer antenatal-postnatal care (continuum)	
Yes	5 (35.7)
No	9 (64.3)
To broaden horizons	
Yes	1 (7.1)
No	13 (92.9)
To do homebirths	
Yes	2 (14.3)
No	12 (85.7)
To offer more choices in childbirth	
Yes	1 (7.1)
No	13 (92.9)
Didn't want to be an obstetric nurse anymore	
Yes	3 (21.4)
No	11 (78.6)
To practice the ideology of patient advocacy	
Yes	1 (7.1)
No	13 (92.9)
Unsatisfied with existing maternity services offered	
Yes	7 (50)
No	7 (50)

10.5 The role of independent midwives in Cape Town

More than half (n=7, 53.9%) of the independent midwives said that the role of midwives in Cape Town is 'to provide safe natural births to women" (see Table 10.6). 'Offering supportive and positive birthing experiences' was the next most common answer with 38.5% (n=5) stating this as a role. 'Returning birthing to women' was another common answer (n=4, 30.8%). This was followed by patient advocacy (n=2, 15.4%) along with some uncommon answers (n=1, 7.7%) such as 'all low risk women being attended by independent midwives', 'to provide better care than hospitals', 'to preserve midwifery and natural birth' and 'to practice in group settings'.

Table 10.6 The role of independent midwives in Cape Town

Characteristic n (%)	*Midwives N=13**
All low risk women attended by independent midwives	
Yes	1 (7.7)
No	12 (92.3)
Patient advocacy	
Yes	2 (15.4)
No	11 (84.6)
To return birthing to women	
Yes	4 (30.8)
No	9 (69.2)
To provide better care than hospitals	
Yes	1 (7.7)
No	12 (92.3)
To preserve midwifery and natural birth	
Yes	1 (7.7)
No	12 (92.3)
Making birth affordable	
Yes	2 (15.4)
No	11 (84.6)
To offer support and positive birthing experiences	
Yes	5 (38.5)
No	8 (61.5)
Providing safe natural births	
Yes	7 (53.9)
No	6 (46.1)
To practice in group settings	
Yes	1 (7.7)
No	12 (92.3)

*Only 13 of the 14 midwives interviewed chose to answer this question.

10.6 Main challenges for independent midwives in Cape Town

The biggest challenge, reported by almost three quarters (n=10, 71.4%) of all independent midwives, was 'getting obstetric back up for deliveries' (see Table 10.7). This was followed by almost a third stating that 'the medical field's negative view of midwifery' (n=5, 35.7%) and 'the hospital staff' (n=4, 28.6%) were challenges. 'Women's lack of understanding of the role of midwives' and 'the job pressures/demands' of being an independent midwife were stated by 21.4% (n=3) of the midwives as challenges.

Table 10.7 Main challenges for independent midwives in Cape Town

Characteristic n (%)	*Midwives N=14*
Getting obstetric back up	
Yes	10 (71.4)
No	4 (28.6)
Medical field's negative view of midwifery	
Yes	5 (35.7)
No	9 (64.3)
Women's lack of understanding of role of midwife	
Yes	3 (21.4)
No	11 (78.6)
Small number of independent midwives	
Yes	2 (14.3)
No	12 (85.7)
Lack of systematic support	
Yes	1 (7.1)
No	13 (92.9)
Too many roles for independent midwives	
Yes	1 (7.1)
No	13(92.9)
Job demands and pressures	
Yes	3 (21.4)
No	11 (78.6)
Medical aid schemes	
Yes	1 (7.1)
No	13 (92.9)
Hospital staff	
Yes	4 (28.6)
No	10 (71.4)
Different birthing philosophy between midwives	
Yes	1 (7.1)
No	13 (92.9)
Reducing fears concerning pregnancy and birth among women	
Yes	1 (7.1)
No	13 (92.9)

Fourteen percent (n=2) mentioned 'the small number of midwives' as a challenge. Lastly, the following challenges were stated by 1 midwife each: 'lack of systematic support', 'too many roles for independent midwives', 'medical aid schemes', 'different birthing

philosophies', and 'reducing fears of pregnancy and birth amongst women' as one of their main challenges.

10.7 Solutions to being an independent midwife in Cape Town

Over half of the midwives (n=7, 53.9%) stated that the way to overcome their challenges was 'to have roles clearer: independent midwives should deal with low risk births and obstetricians should deal with high risk births' (see Table 10.8); the next most common suggestion (n=5, 38.5%) for overcoming challenges was 'awareness-raising of the roles of midwives'. 'Educating medical students on the roles of midwives' was the next most common challenge (n=3, 23.1%) followed by 15.4% (n=2) of midwives saying either that 'the challenges cannot be overcome' or suggesting to 'create an active birthing unit with established back up and postnatal care'. One midwife suggested each of the following: 'more obstetric back up', 'more hospital support', 'midwives being profession and safe practitioners', 'communication', 'working in group practices to avoid burnout', 'more midwives', 'changing the entire health system', 'working on a policy folder', 'relationship building with key decision makers', and 'educating South Africans on the state of birth in the country' as solutions.

Table 10.8 How to overcome challenges of independent midwives in Cape Town

Characteristic n (%)	*Midwives N=13*
Awareness-raising of midwives' roles	
Yes	5 (38.5)
No	8 (61.5)
Educating new medical students about role of midwives	
Yes	3 (23.1)
No	10 (76.9)
Creating active birthing unit with established obstetric back up and post natal care	
Yes	2 (15.4)
No	11 (84.6)
More obstetric back up	
Yes	1 (7.7)
No	12 (92.3)
More hospital support	
Yes	1 (7.7)
No	12 (92.3)
Midwives being professional and safe practitioners	
Yes	1 (7.7)
No	12 (92.3)
Communication	
Yes	1 (7.7)
No	12 (92.3)
Working in group practices to avoid burnout	
Yes	1 (7.7)
No	12 (92.3)
More midwives	
Yes	1 (7.7)
No	12 (92.3)
Must change entire health system	
Yes	1 (7.7)
No	12 (92.3)
Must work on a policy folder	
Yes	1 (7.7)
No	12 (92.3)
Relationship building with key decision makers	
Yes	1 (7.7)
No	12 (92.3)
Challenges cannot be overcome	
Yes	2 (15.4)
No	11 (84.6)
Educating South Africans on state of birth in the country	
Yes	1 (7.7)
No	12 (92.3)
Roles clearer – midwives dealing with low risk; ob/gyn deal with high risk pregnancies	
Yes	7 (53.9)
No	6 (46.1)

11. RESULTS-COHORT COMPONENT

Over the seven year period from January 2003 to the end of June 2009 there were 2,403 deliveries that were attended by independent midwives in the greater Cape Town area. For all of these deliveries it was envisioned by the client that an independent midwife would be the primary care giver responsible for the birthing process.

11.1 Socio-demographic characteristics of cohort

The median age of the cohort utilizing independent midwives was 31 years, with an age range from 16 - 46 years old. Most of the cohort was between 30 - 35 years (n=876, 39.5%) or 20 - 30 years (n=785, 35.4%) (see Table 11.1). One fifth of the cohort (n=459) were 35 - 40 years, followed by a small proportion who were over 40 years (n=74, 3.3%) and under 20 years (n=22, 1%). Race data was not recorded at all by 10 of the midwives. It was recorded incompletely by 3 of the midwives (less than 20% of clients had race information). Midwife 10 recorded race for 64.7% of her cohort (n=236). Midwives 2 (n=266) and 6 (n=308) were the only ones to record race data for over 95% of their cohort. Thus this information is only available for 836 births. Because over two thirds (n=574/803, 68.7%) of the data for race is from only 2 of the midwives, it is inappropriate to use this variable in analysis. No other socio-demographic characteristics of the cohort were systematically recorded by all midwives.

Table 11.1: Cohort socio-demographic characteristics

Characteristic n (%)	*Cohort N=2,403*
Median age in years (range)	31 (16-46)
Maternal age	
<20 yrs	22 (1)
>=20yrs - <30 yrs	785 (35.4)
>=30yrs - <35 yrs	876 (39.5)
>=35 yrs - <40 yrs	459 (20.7)
=+40yrs	74(3.3)
Race, n=836	
Black	32 (3.8)
Colored	176 (21)
Indian	2 (.2)
White	626 (74.9)

11.2 Reproductive/pregnancy characteristics of the cohort

Just under half (n=1055, 44.7%) of the cohort was nulliparous and just over a third (n=804) were primiparous (see Table 11.2). Twenty-one percent (n=504) were multiparous with 15% (n=366) having had two births, 4% (n=103) having had three births and 1.5% (n=35) having had four or more births. Just under half (n=787, 40.1%) of the cohort was primigravida; the remainder (n=1178, 59.9%) were multigravida. Thirty four percent (n=669) of the cohort had been pregnant twice, 17% (n=341) had been pregnant three times and 9% (n=168) had been pregnant four or more times. No data was available on previous pregnancy losses or stillbirths.

Table 11.2 Cohort reproductive/pregnancy characteristics

Characteristic n (%)	*Cohort N=2,403*
Parity	
0	1055 (44.7)
1	804 (34)
2	366 (15.5)
3	103 (4.4)
4+	35 (1.5)
Gravidity	
1	787 (40.1)
2	669 (34)
3	341 (17.3)
4+	168 (8.6)

11.3 Pregnancy complications in this pregnancy

Just under 5% (n=115) of the cohort had pregnancy complications diagnosed in this pregnancy. The most frequent pregnancy complication was breech presentation (n= 23, 0.96%) (see Table 11.3). Post dates was the second most frequently identified pregnancy complication (n=11, 0.5%), followed by preterm premature rupture of the membranes (PPROM) (n=9, 0.4%). Twins were identified in seven pregnancies (0.3%); obstetric cholestastis, intrauterine growth retardation and gestational proteinuric hypertension (GPH) were each diagnosed in 6 pregnancies (0.25%). Antepartum hemorrhage (APH) and increased blood pressure were diagnosed in 5 pregnancies (0.2%). Placenta previa and protein in urine were diagnosed in 4 pregnancies (0.2%). The remainder of the complications were diagnosed very infrequently (<0.1%) in pregnancies.

Table 11.3 Cohort pregnancy complications

Pregnancy complications n, (%)	*Cohort N=2,403*
Complications during this pregnancy	
Yes	115 (4.8)
No	2270 (95.2)
Pregnancy complications	
Breech	23 (0.96)
Post dates	11 (0.5)
PPROM	9 (0.4)
SROM at 36 weeks	1 (0.04)
SROM > 24 hrs	1 (0.04)
Partial abruption	1 (0.04)
Amnionitis	1 (0.04)
Flabrupto placenta	1 (0.04)
Twins	7 (0.3)
Obstetric cholestasis	6 (0.25)
Intrauterine growth retardation	6 (0.25)
GPH	6 (0.25)
APH	5 (0.2)
Increased blood pressure	5 (0.2)
Pregnancy induced hypertension	2 (0.1)
Placenta previa	4 (0.2)
Protein in urine	4 (0.2)
Pre-eclampsia	2 (0.1)
Eclampsia	1 (0.04)
Increase in liver function tests	2 (0.1)
Polyhydramnios	3 (0.1)
Decrease amniotic fluid index	2 (0.1)
Oligohydramnios	2 (0.1)
Gestational diabetes	2 (0.1)
Hepatitis B positive	1 (0.04)
HIV positive	2 (0.1)
Underlying medical condition, unspecified	1 (0.04)
Fetal heart rate deceleration	1 (0.04)
Big baby	2 (0.1)
Baby not engaged	1 (0.04)
Maternal pyrexia	1 (0.04)
Impaired glucose tolerance	1 (0.04)
No complications	2267 (94.3)
Missing data	18 (0.8)

11.4 Labor characteristics of the cohort

Gestational age

The median gestational period at onset of delivery was 40 weeks with a range between 24 - 42 weeks (see Table 11.4). Over half of the cohort (n=1318, 56.5%) had a gestational

age of >40 weeks. Very few (n=67, 2.9%) had a gestational age of less than 37 completed weeks. Forty percent (n=946) had a gestational age between 38 - 40 weeks.

Induction of labor

Very few (n=183, 7.6%) of the cohort had induction of labor using either artificial rupturing of membranes or induction drugs.

Pain relief

For those deliveries that were NVD or an NVD with instrumental delivery, 14.2% (n=338) utilized pain relief during labor. Within the entire cohort, just over a fifth (n=506, 21.3%) utilized epidural, spinal or general anesthetic. Under a tenth of the cohort (n=235, 9.8%) utilized induction, augmenting of labor or normal postpartum management drugs and under 1% (n=8, 0.33%) had antibiotics administered during labor.

Table 11.4 Cohort labor characteristics

Characteristic n (%)	*Cohort N=2403*
Median gestational period (wks) (range)	40 (24-42)
Gestational age at onset of delivery	
<37wks	67 (2.9)
>=37 wks - <=40 wks	946 (40.6)
>40 wks	1318 (56.5)
Induction of labor (AROM or drugs administered)	
Yes	183 (7.6)
No	2216 (92.4)
Drugs administered during labor	
Pain relief administered for NVD*	
Yes	338 (14.2)
No	2037 (85.8)
Epidural, spinal or general anesthetic administered in total sample	
Yes	506 (21.3)
No	1869 (78.7)
Epidural, spinal or general anesthetic administered for only caesarean section	
Yes	417 (17.4)
No	1985 (82.6)
Induction, augmenting of labor or normal postpartum management drugs** administered	
No	2156 (90.2)
Yes	235 (9.8)
Antibiotics administered	
No	2383 (99.7)
Yes	8 (.33)

*Pain relief drugs include hydroxyzine, entenox, pethidine, morphine, epidural, spinal, local anesthetics.
**Induction, augmenting of labor and normal postpartum management drugs included prostaglandin E/dinoprostone and oxcitocin,

11.5 Cohort delivery characteristics

Delivery Location

Over half (n= 1234, 51.7%) of deliveries occurred in private hospitals, followed by a third of deliveries (n=736, 30.9%) that occurred at home (see Table 11.5). Deliveries at MOUs/ABUs (n=292, 12.2%) and public hospitals (n=123, 5.2%) occurred in much smaller proportions. The need to transfer between delivery locations was 3.75% (n=90).

Table 11.5 Cohort delivery characteristics

Characteristic n (%)	*Cohort N=2,403*
Need to transfer	
Yes	90 (3.75)
No	2310 (96.25)
Delivery location	
Home	736 (30.9)
Private hospital	1234 (51.7)
MOU/ABU	292 (12.2)
Public hospital	123 (5.2)
Delivery type NVD (natural)	1755 (73.2)
NVD with instrumentation (instrumental delivery)	41 (1.7)
NVD with only induction and/or epidural/spinal	186 (7.8)
Caesarean section	417 (17.4)
Forceps used	
Yes	8 (0.3)
No	2391(99.7)
Vacuum extraction used	
Yes	40 (1.7)
No	2359 (98.3)
Doctor delivered baby	
Yes	467 (19.5)
No	1932 (80.5)
Episiotomy	
Yes	88 (3.7)
No	2311 (96.3)
Natural tear	
Yes	717 (29.9)
No	1680 (70.1)
What degree of tear among those who tore naturally	
1st	240 (33.7)
2nd	469 (65.8)
3rd	4 (0.6)

Delivery type

Well over three quarters (n=1982, 82.7%) of deliveries were via NVD (see Table 11.5). Almost three quarters of deliveries were "completely natural births" (n=1755) defined as a vaginal delivery 'without surgical interventions, induction, epidural, spinal or general anesthetic' [40]), 8% had NVDs with intervention of epidural/spinal or induction of labor and only 2 percent of the total births (n=41) were delivered by instrumentation. There were 40 deliveries (1.7%) that utilized vacuum extraction and 8 deliveries (0.3%) that utilized forceps. Five of the deliveries that used vacuum extraction were eventually delivered by caesarean section and one delivery that utilized forceps was eventually delivered by caesarean section. One delivery utilized both forceps and vacuum extraction. Seventeen percent (n=417) of women had caesarean section deliveries.

Delivery personnel

Twenty percent (n=467) of all babies were delivered by doctors (see Table 11.5). Four percent (n=88) of the cohort had episiotomies and 30% (n=717) of the cohort tore naturally. Of those 717 that tore naturally, one third (n=240, 33.7%) had 1st degree tears, 65% (n=469) had second degree tears and less than 1% (n=4) had 3rd degree tears.

11.6 Delivery complications in this pregnancy

Fifteen percent (n=353) of deliveries had complications (see Table 11.6). Maternal delivery complications occurred in less than 1% of deliveries (n=14, 0.6%). The most common maternal delivery complications were identified as GPH (n=5, 0.24%), maternal exhaustion and cervical dystocia (n=3, 0.1%), followed by APH, low lying placenta and partial abruption (n=1, 0.04%).

Fetal delivery complications occurred in 4.5% (n=108) of deliveries. The most common fetal complication was classified as fetal distress occurring in 4% (n=102) of deliveries, this was followed by identifiable fetal infection that occurred in three deliveries (0.1%).

'Big baby' was identified in two deliveries (0.1%) as a complication and flat cardiotocograph (CTG) and prolapsed cord were all identified as fetal complications in one delivery.

Table 11.6 Cohort delivery complications

Characteristic n (%)	*Cohort N=2,403*
Delivery complications	
Yes	353 (14.7)
No	2043 (85.3)
Maternal complications	
Yes	14 (0.6)
No	2382 (99.2)
Occurrence of specified maternal complications	
APH	1 (.04)
GPH	5 (.24)
Low lying placenta	1 (.04)
Placental abruption	2 (.1)
Maternal exhaustion	3 (.1)
Cervical dystocia	3 (.1)
Fetal complications	
Yes	108 (4.5)
No	2288 (95.2)
Occurrence of specified fetal complications	
Infection	3 (.1)
Fetal distress	102 (4.3)
Flat cardiotocograph	1 (.04)
Prolapsed cord	1 (.04)
Big baby	2 (.1)
Combined maternal and fetal complication	
Yes	208 (8.7)
No	2201 (91.6)
Occurrence of specified combined maternal and fetal complications	
CPD	84 (3.5)
Failure to progress	117 (4.9)
Failed induction	6 (.25)
Shoulder dystocia	9(.4)
Obstructed labor	4 (.16)
Positional complications during delivery	
Yes	59 (2)
No	2201 (91.6)
Occurrence of specified positional complications	
Breech presentation at delivery	11 (.50)
Occipital position	42 (1.8)
Asynclitism	1 (.04)
Brow presentation	1 (.04)
Face to pubis	2 (.1)
Difficult shoulders	2 (.1)
Deep transverse arrest	1 (.04)

*Complication categories adapted from GJ Hofmeyr's 'Indications for caesarean section' in Obstetrics in Southern Africa. Positional complication category added by principal investigator.

Combined maternal and fetal complications occurred in 9% (n=208) of deliveries. Failure to progress occurred in 5% (n=117) of deliveries, followed by CPD which occurred in 3.5% of deliveries, followed by shoulder dystocia which happened in six (0.4%) of the deliveries.

Positional complications during delivery occurred in 59 deliveries (2%). The most common positional complication was occipital positioning (n=42, 1.8%), followed by breech presentation at delivery, which occurred in eleven women (0.5%). Difficult shoulders and face to pubis each occurred in two deliveries and asynclitism, brow presentation and deep transverse arrest occurred each in one delivery.

11.7 Cohort birth outcomes

Live births

Over 99% (n=2392, 99.5%) of midwife-attended births resulted in a live baby being born (see Table 11.7). There were eleven still births (0.5%) over the seven-year period.

Birth weight

Over 85% (n=1966, 86.1%) of the babies born were between 2500 - 4000 grams. Just over 10% (n=267, 11.7%) were more than 4000 grams. There were 50 babies (2.2%) that were considered low birth weight babies, weighing below 2500 grams. There was three babies (0.13%) that were very low birth weight babies (<1500 grams), and one baby (0.04%) that was in the extremely low birth weight (<1000 grams) category.

Apgar scores and newborn intervention

Ninety six percent (n=2210) of the babies had a 1 minute apgar score between 7 and10. Four percent (n= 93) of babies had apgar scores below 7 at 1 minute necessitating newborn intervention. Only eleven babies (0.44%) still had apgar scores below 7 at 5 minutes.

Postpartum hemorrhage

This was recorded by the midwives as occurring in only 2.9% (n=71) of deliveries.

Table 11.7 Cohort birth outcomes

Characteristic n (%)	*Cohort N=2,403*
Baby born dead/alive	
Dead	11 (0.5)
Alive	2392(99.5)
Sex of baby	
Male	1191 (51.4)
Female	1171 (49.6)
Birth weight (grams)	
<=1000	1 (0.04)
>1000-<=1500	3 (0.13)
>1500-<=2000	5 (0.22)
>2000-<=2500	41 (1.8)
>2500-<=4000	1966 (86.1)
>4000	267 (11.7)
1 min Apgar score	
7-10	2210 (96)
4-6	81 (3.5)
0-3	12 (0.5)
5 min Apgar score	
7-10	2290 (99.5)
4-6	10 (0.4)
0-3	1 (0.04)
Need for infant resuscitation	
Yes	93 (4)
No	2210 (96)
Postpartum hemorrhage	
Yes	71 (2.9)
No	2332 (97.1)

11.8 Factors associated with pregnancy complications

The overall proportion of pregnancy complications was 4.8% (n=115), Maternal age (p=0.006), parity (p=0.003) and gestational age at onset of delivery (p=0.000) were all significantly associated with pregnancy complications (see Table 11.8). There is a substantial variation in the proportion of pregnancy complications among the different age groups. Women under the age of twenty had the highest proportion of pregnancy complications (n=4, 18.2%), followed by women who were over 40 years-old (n=5, 6.8%). Nulliparous women accounted for over 60% (n=72/115, 6.9%) of the pregnancy complications in the sample. There was variation in the proportions of complication by parity ranging from 0 percent complications for those in the cohort who have given birth 4+ times to almost 7% in those who were nulliparous. For babies delivered at <37

completed weeks the proportion of pregnancy complications was 40% (n=27). This was much higher than babies born from 38-40 weeks (n=53, 5.6%) and those born over 40 weeks (n=29, 2.2%).

Table 11.8 Pregnancy complications associated with cohort socio-demographic and pregnancy/reproductive characteristics

Characteristic n (%)	*No pregnancy complications N= 2270 (95.2)*	*Pregnancy complications N= 115 (4.8)*	*P-value*
Maternal age			0.006
<20 yrs	18 (81.8)	4 (18.2)	
20-30 yrs	753 (96.7)	26 (3.3)	
30-35 yrs	822 (94.4)	49 (5.6)	
35-40 yrs	442 (96.5)	16 (3.5)	
>40 yrs	69 (93.2)	5 (6.8)	
Parity			0.003
0	977 (93.1)	72 (6.9)	
1	773 (96.6)	27 (3.4)	
2	348 (96.1)	14 (3.9)	
3	101 (98.1)	2 (1.9)	
+4	35 (100)	0	
Gestational age at onset of delivery			0.000
<37weeks	40 (59.7)	27 (40.3)	
38-40 weeks	893 (94.4)	53 (5.6)	
40+ weeks	1289 (97.8)	29 (2.2)	

11.9 Factors associated with delivery complications

The overall proportion of delivery complications was 14.7% (n=353). Both parity (p=0.000) and gestational age at onset of delivery (p=0.000) were significantly associated with delivery complications (see Table 11.9). Those who were nulliparous had a much higher proportion of delivery complication (n=236, 22.4%) than all of the other categories of parity. Those in the cohort who were nulliparous comprised two-thirds (n=236/353, 66.8%) of the delivery complications. There was also significant variation in proportions of delivery complications by gestational age at onset of delivery. Those babies who were delivered <37 completed weeks had the highest proportion of delivery complications (n=13, 19.4%) followed by those born over 40 weeks (n=224, 17.1%). Eleven percent (n=102) of babies delivered at 38 - 40 weeks had delivery complications

Table 11.9 Cohort socio - demographic and pregnancy characteristics associated with delivery complications

Characteristic n (%)	*No delivery complications N=2043 (85.3)*	*Delivery complications N= 353 (14.7)*	*P-value*
Maternal age			0.797
<20 yrs	19 (86.4)	3 (13.6)	
20-30 yrs	670 (85.6)	113 (14.4)	
30-35 yrs	731 (83.6)	143 (16.4)	
35-40 yrs	393 (85.8)	65 (14.2)	
>40 yrs	63 (86.3)	10 (13.7)	
Parity			0.000
0	816 (77.6)	236 (22.4)	
1	732 (91.2)	71 (8.8)	
2	336 (91.8)	30 (8.2)	
3	93 (92.1)	8 (7.9)	
+4	31 (88.6)	4 (11.4)	
Gestational age at onset of delivery			0.000
<37weeks	54 (80.6)	13 (19.4)	
38-40 weeks	844 (89.2)	102 (10.8)	
40+ weeks	1087 (82.9)	224 (17.1)	

11.10 Factors associated with postpartum hemorrhage

Parity (p=0.003) and delivery complications (p=0.026) were the only factors that were significantly associated with postpartum hemorrhaging in the cohort (see Table 11.10). There was a large variation in the proportion of hemorrhaging among the parity groups. Those in the cohort who had had 4 or more previous births had the highest proportion of postpartum hemorrhage (n=3, 8.6%) compared to those who were primiparous who only had 1.4%. Deliveries that had complications were significantly less likely to have postpartum hemorrhage (n=4, 1.1%) than those that did not have delivery complications (n=66, 3.2%).

Table 11.10 Postpartum hemorrhage associated with socio-demographic, pregnancy and delivery characteristics

Characteristic n (%)	*No postpartum hemorrhage N= 2332 (97.1)*	*Postpartum hemorrhage N= 71 (2.9)*	*P-value*
Maternal age			0.275
<20 yrs	21 (95.4)	1 (4.6)	
20-30 yrs	754 (96)	31 (4)	
30-35 yrs	853 (97.4)	23 (2.6)	
35-40 yrs	449 (97.8)	10 (2.2)	
>40 yrs	73 (98.6)	1 (1.3)	
Parity			0.003
0	1013 (96)	42 (4)	
1	793 (98.6)	11 (1.4)	
2	354 (96.7)	12 (3.3)	
3	100 (97.1)	3 (2.9)	
+4	32 (91.4)	3 (8.6)	
Gestational age at birth			0.720
<37weeks	65 (97)	2 (3)	
38-40 weeks	921 (97.4)	25 (2.6)	
40+ weeks	1276 (96.8)	42 (3.2)	
Complications during pregnancy			0.580
No	2200 (97)	68 (3)	
Yes	115 (98.3)	2 (1.7)	
Complications during delivery			0.026
No	1971 (96.8)	66 (3.2)	
Yes	355 (98.9)	4 (1.1)	

11.11 Assessing cohort characteristics, complications, birth type and birth outcomes by midwife practitioner

Cohort socio-demographic characteristics associated with midwife practitioner

Maternal age (p=0.000) was found to be significantly associated with midwife practitioner (see Table 11.11).

Table 11.11 Cohort socio-demographic characteristics associated by midwife

Characteristic, n (%)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*Total*	*P-value*
Maternal age (yrs)																		0.000
<20 yrs	0	2 (0.91)	2 (2.7)	0	0	0	1 (0.6)	0	4 (1.5)	11 (3.1)	0	0	1 (1.2)	0	0	1 (2.7)	22 (1)	
20-30 yrs	54 (19.9)	65 (29.7)	23 (30.7)	21 (60)	44 (41.1)	75 (25.2)	40 (25.3)	44 (41.5)	144 (55.6)	161 (44.9)	11 (50)	0	37 (44)	3 (27.3)	49 (29.3)	14 (31.8)	785 (35.4)	
30-35 yrs	126 (46.5)	88 (40.2)	29 (38.7)	10 (28.6)	39 (36.4)	132 (44.4)	69 (43.7)	36 (34)	74 (28.6)	127 (35.4)	10 (45.5)	2 (100)	33 (39.3)	5 (45.4)	76 (45.5)	20 (45.4)	876 (39.5)	
35-40 yrs	76 (28)	53 (24.2)	19 (25.3)	3 (8.6)	22 (20.6)	79 (26.6)	42 (26.6)	22 (20.7)	30 (11.6)	54 (15)	1 (4.5)	0	12 (14.3)	3 (27.3)	35 (21)	8 (18.2)	459 (20.7)	
>40 yrs	15 (5.5)	11 (5)	2 (2.7)	1 (2.9)	2 (1.9)	11 (3.7)	6 (3.8)	4 (3.8)	7 (2.7)	6 (1.7)	0	0	1 (1.2)	0	7 (4.2)	1 (2.3)	74 (3.3)	

Cohort pregnancy and reproductive characteristics associated with midwife practitioner

A significant association was found between the parity and midwife practitioner utilized (see Table 11.12). Most of the midwives' deliveries were for those who were nulliparous (n=1055/2363, 44.7%). However, within the nulliparous, the proportion delivered by each of the midwives varied substantially. Between the midwives, proportion of deliveries that were nulliparous ranged from 0 percent in midwife 12 to 71.4% (n=15) in midwife 11. All four of midwife 12's deliveries were for those who were primiparous. Primiparous deliveries for the other midwives ranged in proportion quite widely from 20 to 43.8%. Between midwives, proportions of deliveries done for those that have had two previous births also ranged widely - from 10 to 46.1%. Proportions of deliveries for those who had previous births or more than 4 previous births also ranged, but not as widely as the other categories of parity. There was an appreciable amount of variation in proportion of pregnancy complications between each of the midwives. The proportion of pregnancy complications varied widely between 0% for midwife 7, 12 and 14 to close to 10% for midwives 6 (n=36, 11.3%) and 16 (n=6, 9.8%). There was a significant association found between pregnancy complications and midwife practitioner (p=0.002). Gestational age at onset of delivery and midwife practitioner were also found to be significantly associated (p=0.000). While overall there was only 2.9% (n=67) babies who were born <37 weeks, proportions varied between midwives. Midwives 11, 12, 14 and 16 had no babies born before 37 completed weeks, whereas midwife 6 had 5.1% (n=16) of her deliveries and accounted for almost a quarter (23.9%) of all deliveries, before 37 weeks.

Table 11.12 Cohort pregnancy and reproductive characteristics associated by midwife

Characteristic, n (%)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	Total	*P-value*
Parity																		
0	100 (34.6)	109 (40.5)	54 (45.4)	13 (37.1)	38 (35.2)	150 (47.8)	82 (51.9)	58 (54.7)	152 (58.7)	131 (37.9)	15 (71.4)	0	36 (40.4)	2 (15.4)	73 (42.2)	42 (70)	1055 (44.7)	
1	116 (40.1)	104 (38.7)	36 (30.2)	8 (22.9)	33 (30.6)	106 (33.8)	50 (31.6)	31 (29.2)	74 (28.6)	118 (34.1)	5 (23.8)	4 (100)	39 (43.8)	4 (30.8)	64 (37)	12 (20)	804 (34)	
2	46 (15.9)	41 (15.2)	21 (17.6)	11 (31.4)	19 (17.6)	48 (15.3)	18 (11.4)	13 (12.3)	26 (10)	73 (21.1)	1 (4.8)	0	11 (12.4)	6 (46.1)	29 (16.8)	3 (5)	366 (15.5)	0.000
3	21 (7.3)	13 (4.8)	4 (3.4)	1 (2.9)	14 (13)	5 (1.6)	5 (3.2)	2 (1.9)	6 (2.3)	19 (5.5)	0	0	3 (3.4)	1 (7.7)	6 (3.5)	3 (5)	103 (4.4)	
+4	6 (2.1)	2 (0.7)	4 (3.4)	2 (5.7)	4 (3.7)	5 (1.6)	3 (1.9)	2 (1.9)	1 (0.4)	5 (1.4)	0	0	0	0	1 (0.6)	0	35 (1.5)	
Complications during pregnancy																		
No	281 (96.9)	262 (95.3)	107 (92.2)	25 (89.3)	102 (94.4)	283 (88.7)	158 (100)	106 (95.5)	254 (98.5)	348 (96.4)	19 (86.4)	4 (100)	83 (94.3)	13 (100)	168 (97.1)	55 (90.2)	2270 (95.2)	0.002
Yes	9 (3.1)	13 (4.7)	9 (7.8)	3 (10.7)	6 (5.6)	36 (11.3)	0	5 (4.5)	4 (1.5)	13 (3.6)	3 (13.6)	0	5 (5.7)	0	5 (2.9)	6 (9.8)	115 (4.8)	
Gestational age at onset of delivery																		
<37weeks	4 (1.4)	6 (2.2)	5 (4.5)	1 (4)	2 (2.1)	16 (5.1)	2 (1.3)	1 (0.9)	5 (2)	15 (4.2)	0	0	3 (3.7)	0	7 (4.1)	0	67 (2.9)	0.000
38-40 weeks	120 (41.4)	115 (42.6)	53 (47.3)	10 (40)	42 (44.2)	148 (47)	57 (36.1)	43 (39.4)	77 (30.6)	157 (44.3)	8 (38.1)	1 (25)	24 (29.6)	8 (61.5)	56 (61.5)	27 (45)	946 (40.6)	
40+ weeks	166 (57.2)	149 (55.2)	54 (48.2)	14 (56)	51 (53.7)	151 (47.9)	99 (62.7)	65 (59.6)	170 (67.5)	182 (51.4)	13 (61.9)	3 (75)	54 (66.7)	5 (38.5)	109 (63.4)	33 (55)	1318 (56.5)	

Cohort delivery characteristics associated with midwife practitioner

There was a significant association between delivery complications and midwife practitioner (p=0.000) (see Table 11.13). Although the overall proportion of delivery complications was 14.7% (n=353), variations in proportions of delivery complications between midwives were a lot. Whereas midwife 12 had no delivery complications, midwife 5 (n=35, 32.4%), midwife 6 (n=80, 25.1%) and midwife 11 (n=6, 27.3%) had proportions of delivery complications over 25%.

Medical interventions associated with midwife practitioner

An appreciable variation also occurred between midwives in terms of proportions of deliveries that utilized drugs for induction, augmentation of labor or normal postpartum management. The overall proportion of drugs used for these purposes was 9.8%. However, proportions varied between midwives from no drugs used for these purposes (midwife 12, 14, 15 and 16) to over 50% of deliveries for midwife 5 (n=74, 69.9%) and midwife 8 (58.6%). The association between drugs used for those purposes and midwife practitioner was statistically significant (p=0.000).

Delivery type associated with midwife practitioner

A significant association was found between midwife practitioner and delivery type (p=0.000). Although the overall proportion of caesarean sections was 17.4%, three of the midwives had proportions above 25%. Midwife 5 (n=29, 26.8%), midwife 6 (n=89, 27.9%) and midwife 11 (n=9, 40.9%) accounted for 30% (n=127/417) of the caesarean deliveries. These midwives correspondingly had the lowest proportions of NVDs. Their proportions differed markedly from the overall proportions of NVDs (80.9%). Midwife 11 had the lowest proportion (n=13, 59.1%), followed by midwife 6 (n=218, 68.3%) and midwife 5 (n=74, 68.5%). The proportion of instrumental deliveries were also the highest for midwife 5 (n=5, 4.6%) and midwife 6 (n=12, 3.8%). Midwife 8 also had proportion of instrumental deliveries of 3.6% (n=4) that was noticeably higher than the overall proportion of 1.7%. These three midwives accounted for half of the instrumental deliveries (n=21).

Newborn intervention associated with midwife practitioner

A significant association was found between midwife practitioners and the need for newborn intervention (p=0.000). Proportions of newborn interventions varied between practitioners. While the overall proportion was found to be 4% (n=93), midwife 7 (n=13, 8.3%), midwife 9 (n=19, 7.6%) and midwife 16 (n=6, 10%) delivered 41 percent (n=38/93) of those newborns who needed intervention. Five midwives (2, 4, 11, 12 and 14) had no deliveries where infants needed intervention.

Postpartum hemorrhage associated with midwife practitioner

A significant association (p=0.001) was found between midwife practitioners and postpartum hemorrhage. Proportions of postpartum hemorrhage varied between practitioners. While the overall proportion was found to be 2.9% (n=71), three midwives had over 6% of deliveries resulting in postpartum hemorrhage. Midwife 4 had the highest proportion (n=3, 8.5%), followed by midwife 14 (n=1, 7.7%) and midwife 2 (n=18, 6.5%).

Table 11.13 Cohort delivery characteristics and key indicators for medical interventions by midwife

Characteristic, n (%)	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*Total*	*P-value*
Complications during delivery																		0.000
No	267 (92.7)	249 (90.2)	106 (89.1)	32 (91.4)	73 (67.6)	239 (74.9)	153 (96.8)	87 (78.4)	234 (90.3)	300 (82.4)	16 (72.7)	4 (100)	82 (92.1)	11 (84.6)	139 (84.6)	51 (86.4)	2037 (85)	
Yes	21 (7.3)	27 (9.8)	13 (10.9)	3 (8.6)	35 (32.4)	80 (25.1)	5 (3.2)	24 (21.6)	25 (9.7)	64 (17.6)	6 (27.3)	0	7 (7.9)	2 (15.4)	33 (15.4)	8 (13.6)	359 (15)	
Drugs used for induction, augmentation of labor or normal postpartum management																		0.000
No	272 (93.8)	259 (93.8)	107 (93)	31 (88.6)	32 (30.2)	304 (95.3)	144 (91.1)	46 (41.4)	251 (98)	357 (98.1)	15 (68.2)	4 (100)	88 (98.9)	13 (100)	172 (100)	61 (100)	2156 (90.2)	
Yes	18 (6.2)	17 (6.2)	8 (7)	4 (11.4)	74 (69.9)	15 (4.7)	14 (8.9)	65 (58.6)	5 (2)	7 (1.9)	7 (31.8)	0	1 (1.1)	0	0	0	235 (9.8)	
Delivery type																		0.000
NVD	258 (89)	240 (87)	101 (85)	27 (77.1)	74 (68.5)	218 (68.3)	136 (86.1)	83 (74.8)	221 (85)	297 (81.6)	13 (59.1)	4 (100)	77 (86.5)	11 (84.6)	137 (79.6)	44 (74.6)	1941 (80.9)	
Caesarean section	32 (11)	33 (12)	18 (15.1)	8 (22.9)	29 (26.8)	89 (27.9)	22 (13.9)	24 (21.6)	36 (13.8)	59 (16.2)	9 (40.9)	0	11 (12.4)	2 (15.4)	32 (18.6)	13 (22)	417 (17.4)	
Instrumental delivery (NVD with instrumentation)	0	3 (1.1)	0	0	5 (4.6)	12 (3.8)	0	4 (3.6)	3 (1.1)	8 (2.2)	0	0	1 (1.1)	0	3 (1.8)	2 (3.4)	41 (1.7)	
Need for newborn intervention																		0.000
No	2 (97.9)	257 (98.5)	102 (97.1)	35 (100)	100 (95.2)	299 (96.4)	143 (91.7)	101 (93.5)	232 (92.4)	338 (98.3)	16 (100)	4 (100)	79 (97.5)	13 (100)	158 (93.5)	54 (90)	2210 (96)	
Yes	6 (3)	4 (1.5)	2 (2.9)	0	5 (4.8)	11 (3.6)	13 (8.3)	7 (6.5)	19 (7.6)	6 (1.7)	0	0	2 (2.5)	0	11 (6.5)	7 (10)	93 (4)	
Postpartum hemorrhage																		0.000
No	279 (96.2)	258 (93.5)	116 (97.5)	32 (91.4)	103 (95.4)	311 (97.5)	158 (100)	106 (95.5)	250 (96.2)	363 (99.4)	22 (100)	4 (100)	89 (100)	12 (92.3)	169 (97.7)	60 (98.4)	2332 (97.1)	
Yes	11 (3.8)	18 (6.5)	3 (2.5)	3 (8.5)	5 (4.6)	8 (2.5)	0	5 (4.5)	10 (3.8)	2 (0.6)	0	0	0	1 (7.7)	4 (2.3)	1 (1.6)	71 (2.9)	

11.12 Cohort characteristics associated with medical interventions

Characteristics associated with delivery type

A significant association was found between delivery type and the following factors: parity (p=0.000), pregnancy complications (0.000), whether deliveries were induced (p=0.000), gestational age at delivery (0.001) doctor-delivered births (p=0.000), delivery complications (p=0.000), birth weight (p=0.005), apgar score at 5 minutes (p=0.028) and postpartum hemorrhage (p=0.000).

Delivery type did not differ significantly by year of birth (p=0.065) (see Table 11.14).

Table 11.14 Delivery type by year of birth

Year of birth	*NVD* *N=1941 (80.9)*	*Caesarean section* *N=417 (17.4)*	*Instrumental delivery* *N= 41 (1.7)*	*P-value*
2003	277 (79.4)	68 (19.5)	4 (1.1)	0.065
2004	262 (81.1)	56 (17.3)	5 (1.6)	
2005	295(79.5)	70 (18.9)	6(1.6)	
2006	283 (75.9)	80 (21.5)	10(2.7)	
2007	351 (83.4)	63 (15)	7 (1.7)	
2008	324 (86.4)	44 (11.7)	7 (1.8)	
2009	134 (78.8)	34 (20)	2 (1.2)	

There was no significant association between maternal age and delivery type (p=0.481) (see Table 11.16).

Table 11.16: Delivery type by cohort socio-demographic characteristics

Characteristic n (%)	*NVD* *N=1941(80.9)*	*Caesarean section* *N=417 (17.4)*	*Instrumental delivery* *N=41 (1.7)*	*P-value*
Maternal age				0.481
<20 yrs	16 (72.7)	5 (22.7)	1 (4.6)	
20-30 yrs	651 (83.1)	118 (15.1)	14 (1.8)	
30-35 yrs	695 (79.4)	167 (19.1)	13 (1.5)	
35-40 yrs	372 (81.1)	77 (16.8)	10 (2.2)	
>40 yrs	58 (78.4)	15 (20.3)	1 (1.3)	

The proportion of caesarean sections and instrumental deliveries were significantly higher amongst nulliparous than all other categories of parity (see Table 11.17). Those who were nulliparous had 66.4% (n=277/417) of the caesarean section deliveries and 80.5% (n=33/41) of the instrumental deliveries. Those who were diagnosed with a complication during pregnancy were significantly less likely (p=0.000) to have a NVD (n=39, 33.3%) than those that did not have a complication (n=1893, 83.6%).

Table 11.17 Delivery type by cohort pregnancy/reproductive characteristics

Characteristic n (%)	*NVD* *N=1941 (80.9)*	*Caesarean section* *N=417 (17.4)*	*Instrumental delivery* *N=41 (1.7)*	*P-value*
Parity				0.000
0	743 (70.6)	277 (26.3)	33 (3.1)	
1	704 (87.7)	93 (11.6)	6 (.75)	
2	333 (91)	32 (8.7)	1 (.3)	
3	96 (93.2)	7 (6.8)	0	
4	33 (94.3)	2 (5.7)	0	
Complications during pregnancy				0.000
No	1893 (83.6)	333 (14.7)	38 (1.7)	
Yes	39 (33.3)	73 (64.1)	3 (2.6)	

Deliveries that were induced were significantly more likely to have a caesarean section (n= 51, 28%) than those that were not induced (n=364, 16.4%) (see Table 11.18). Those who had gestational ages at delivery <37 weeks were significantly more likely to have caesarean section deliveries (n=22, 32.8%) than those who had gestational age at delivery of 38 - 40 weeks (n=140, 14.8%) or over 40 weeks (n=231, 17.6%).

Table 11.18 Delivery type by cohort labor characteristics

Characteristic n (%)	*NVD* *N=1941 (80.9)*	*Caesarean section* *N= 417 (17.4)*	*Instrumental delivery* *N= 41 (1.7)*	*P-value*
Induction of labor				0.000
No	1817 (82.1)	364 (16.4)	33 (1.5)	
Yes	123 (67.6)	51 (28)	8 (4.4)	
Gestational age at onset of delivery				0.001
<37weeks	43 (64.2)	22 (32.8)	2 (3)	
38-40 weeks	793 (83.9)	140 (14.8)	12 (1.3)	
40+ weeks	1058 (80.5)	231 (17.6)	26 (2)	

100% of those deliveries that were caesarean sections and instrumental deliveries were doctor-delivered, whereas only 0.005% (n=9/1941) of NVDs were doctor delivered (see Table 11.19). Those who had complications during delivery were also significantly more likely to have a caesarean delivery (n=285, 80.7%) or instrumental delivery (n=18, 5.1%)

than those with no delivery complications (caesarean section n=128, 6.3%; instrumental delivery n=23, 1.1%).

Table 11.19 Delivery type by cohort delivery characteristics

Characteristic n (%)	*NVD* *N=1941 (80.9)*	*Caesarean section* *N= 417 (17.4)*	*Instrumental delivery* *N= 41 (1.7)*	*P-value*
Delivery location				0.000
Home	736 (100)	0	0	
Private hospital	858 (69.7)	338 (27.5)	35 (2.8)	
Mou/abu	292 (100)	0	0	
Public Hospital	40 (32.5)	77 (62.6)	6 (4.9)	
Doctor delivered baby				0.000
No	1932 (100)	0	0	
Yes	9 (1.9)	417 (89.29)	41 (8.8)	
Complications during delivery				0.000
No	1891 (92.6)	128 (6.3)	23 (1.1)	
Yes	50 (14.2)	285 (80.7)	18 (5.1)	
Maternal delivery complications				0.000
No	1940 (81.5)	403 (16.9)	38 (1.6)	
Yes	1 (7.1)	10 (71.4)	3 (21.4)	
Fetal complications during delivery				0.000
No	1909 (83.5)	342 (14.9)	36(1.6)	
Yes	32 (29.6)	71 (65.7)	5 (4.6)	
Combined maternal and fetal delivery complication				0.000
No	1931 (88.2)	225 (10.3)	32 (1.5)	
Yes	10 (4.8)	188 (90.8)	9 (4.3)	
Positional complications during delivery				0.000
No	1932 (82.7)	366(15.7)	37 (1.6)	
Yes	9(15)	47 (78.3)	4 (6.4)	

There was substantial variation in the proportion of delivery types between the different birth weight categories (see Table 11.20). For instance, the highest proportion of caesareans were found in babies who were born between 1000-1500 grams (n=2, 66.7%) and 1500-2000 grams (n=3, 60%). There were no caesarean sections done for babies who weighed less than 1000 grams and no instrumental deliveries done on babies who were

less than 2500 grams. The highest proportion of NVDs were in the 2500-4000 grams birth weight category (n=1621, 82.6%) and this category also had the highest proportion of instrumental deliveries (n=35, 1.8%) and second lowest proportion of caesarean sections (n=307, 15.6%). Those that had a postpartum hemorrhage are significantly more likely to have had an NVD (n=65, 92.9%) than those that did not have a postpartum hemorrhage (n=1876, 80.5%).

Table 11.20 Delivery type associated with client birth outcomes

Characteristic n (%)	*NVD* *N=1941 (80.9)*	*Caesarean section* *N= 417 (17.4)*	*Instrumental delivery* *N= 41 (1.7)*	*P-value*
Birth weight (gm)				0.006
<= 1000	1 (100)	0	0	
>1000-<= 1500	1 (33.3)	2 (66.7)	0	
>1500-<=2000	2 (40)	3 (60)	0	
>2000-<=2500	29 (70.7)	12 (29.3)	0	
>2500-<=4000	1621 (82.6)	307 (15.6)	35 (1.8)	
+4000	211 (79)	55 (20.6)	1 (.4)	
1 min Apgar				0.195
7-10	1807 (81.9)	363 (16.5)	36 (1.6)	
4-6	62 (76.5)	17 (21)	2 (2.5)	
0-3	10 (83.3)	1 (8.3)	1 (8.3)	
5 min Apgar				0.042
7-10	1869 (81.8)	379 (16.6)	38 (1.7)	
4-6	9 (90)	0	1 (10)	
0-3	0	1 (100)	0	
Did baby need intervention (1min apgar <7)				.243
No	1807 (81.9)	363 (16.5)	36 (1.6)	
Yes	72 (77.4)	18 (19.3)	3 (3.2)	
PPH				0.000
No	1876 (80.5)	415 (17.8)	38 (1.6)	
Yes	65 (92.9)	2 (2.9)	3 (4.3)	

Characteristics associated with newborns needing intervention

The factors that were significantly associated with needing newborn intervention were: parity (p=0.000), pregnancy complications (p=0.013), gestational age at onset of delivery (p=0.045), delivery complications (p=0.000) and birth weight (p=0.048).

There was no significant association (p=0.588) found between years of birth and need for newborn intervention (see Table 11.21).

Table 11.21 Need for newborn intervention associated with year of birth

Year of birth	*No newborn intervention N=2310 (96)*	*Needed newborn intervention N=93 (4)*	*P-value*
2003	318 (96.4)	12 (3.6)	0.588
2004	298 (96.1)	12 (3.9)	
2005	337 (95.2)	17 (4.8)	
2006	343 (95.2)	17 (4.7)	
2007	391 (96.8)	13 (3.2)	
2008	351 (95.1)	18 (4.9)	
2009	163 (98.2)	3(1.8)	

None of the socio-demographic characteristics were significantly associated with need for newborn intervention (see Table 11.22).

Table 11.22 Need for newborn intervention associated with cohort socio-demographic characteristics

Characteristic n (%)	*No newborn intervention N=2310 (96)*	*Needed newborn intervention N= 93 (4)*	*P-value*
Maternal age			0.744
<20 yrs	20 (95.2)	1 (4.8)	
20-30 yrs	718 (95.5)	34 (4.5)	
30-35 yrs	817 (96)	34 (4)	
35-40 yrs	431 (96.2)	17 (3.8)	
>40 yrs	71 (98.6)	1 (1.4)	

Those that were nulliparous had the highest proportion of newborn interventions (n=62, 6%) (see Table 11.23). Those that have had two previous births had the lowest proportion of interventions (n=4, 1.1%). The cohort who had pregnancy complications were significantly more likely to need newborn intervention (n=9, 8.8%) than those who didn't have pregnancy complications (n=84, 3.8%).

Table 11.23 Need for newborn intervention associated with cohort pregnancy/reproductive characteristics

Characteristic n (%)	*No newborn intervention N=2310 (96)*	*Needed newborn intervention N= 93 (4)*	*P-value*
Parity			0.000
0	948 (93.9)	62 (6.1)	
1	752 (97.3)	21 (2.7)	
2	350 (98.9)	4 (1.1)	
3	97 (97)	3 (3)	
4	33 (97.1)	1 (2.9)	
Complications during pregnancy			0.013
No	2106 (96.2)	84 (3.8)	
Yes	93 (95.9)	94 (4.1)	

There was no significant association between induction of labor and the need for newborn intervention (p=0.687) (see Table 11.24). Babies who were delivered at <37 completed weeks had a proportion of newborn interventions of 7% (n=4). Babies born at more than 40 gestational weeks had a proportion of interventions of almost 5% (n=59) and the lowest proportion (n=27, 2.9%) was for those babies born between 38 - 40 weeks.

Table 11.24 Need for newborn intervention associated with cohort labor characteristics

Characteristic n (%)	*No newborn intervention N=2310 (96)*	*Needed newborn intervention N= 93 (4)*	*P-value*
Induction of labor			0.687
No	2042 (96)	85 (4)	
Yes	165 (95.4)	8 (4.6)	
Gestational age at onset of delivery			0.045
<37weeks	52 (92.9)	4 (7.1)	
38-40 weeks	897 (97.1)	27 (2.9)	
40+ weeks	1222(95.4)	59 (4.6)	

Those in the cohort who had complications during delivery were significantly more likely to require newborn intervention (n=26, 7.8%) than those who did not have delivery complications (n=67, 3.4%) (see Table 11.25).

Table 11.25 Need for newborn intervention and cohort delivery characteristics

Characteristic n (%)	*No newborn intervention N=2310 (96)*	*Needed newborn intervention N= 93 (4)*	*P-value*
Delivery location			0.003
Home	689 (95.8)	20 (4.2)	
Private hospital	1142 (96.8)	38 (3.2)	
Mou/abu	273 (95.1)	14 (4.9)	
Public Hospital	93 (89.4)	11 (10.6)	
Dr delivered baby			0.069
No	1802 (96.3)	69 (3.7)	
Yes	404 (94.4)	24 (5.6)	
Complications during delivery			0.000
No	1897 (96.6)	67 (3.4)	
Yes	306 (92.2)	26 (7.8)	
Maternal delivery complications			0.600
No	2193 (96)	92 (4)	
Yes	10 (90.9)	1 (9.1)	
Missing data	7 (100)	0	
Fetal delivery complications			0.001
No	2113 (96.3)	82 (3.7)	
Yes	90 (89.1)	11 (10.9)	
Missing data	7(100)	0	
Combined maternal and fetal delivery complications			0.024
No	2022 (96.3)	78 (3.7)	
Yes	181 (92.3)	15 (7.7)	
Missing data	7 (100)	0	
Positional complications during delivery			0.834
No	2146 (95.9)	91 (4.1)	
Yes	57 (96.6)	2(3.4)	
Missing data	7 (100)	0	

Babies who were born between 1500 - 2000 grams had a proportion of newborn interventions of 25% (n=1), whereas of those babies who were born weighing over 4000 grams, 17% needed newborn intervention (n=16) (see Table 11.26). For women who had

a postpartum hemorrhage it is significantly more likely that they needed newborn intervention (n=7, 9.9%) than if they did not postpartum hemorrhage (n=86, 3.9%).

Table 11.26 Need for newborn intervention and cohort birth outcomes

Characteristic n (%)	*No newborn intervention N=2310 (96)*	*Needed newborn intervention N= 93 (4)*	*P-value*
Birth weight (gms)			
<= 1000	0	0	
>1000-<= 1500	0	0	
>1500-<=2000	3 (75)	1 (25)	0.048
>2000-<=2500	36 (94.7)	2 (5.3)	
>2500-<=4000	1844 (96.3)	71 (3.7)	
+4000	247 (93.9)	16 (6.1)	
PPH			
No	2146 (96.1)	86 (3.9)	0.011
Yes	64 (90.1)	7 (9.9)	

12. DISCUSSION

12.1 Motivation

This is the first study that has been conducted in South Africa to assess the utilization, practices, delivery types and birth outcomes of independent midwife practitioners.

While independent midwives have been a well documented and integral part of maternity services in the Netherlands [17, 41, 42], and are gaining prominence in countries such as the UK [12, 38, 39] and Canada [9, 35] where maternity service reforms have been underway for some time, South African independent midwives have been under the radar of maternity services. In South Africa, there has been no research conducted on utilization of independent midwives, their practices and qualifications; or their delivery types, birth outcomes and use of medical interventions. There is also no surveillance or auditing system in place for independent midwife services.

Just over ten years ago, South Africa launched a confidential enquiry into maternal and perinatal deaths. In the wake of the recognition of its high maternal and perinatal mortality rates, South Africa began investigations and reforms in protocols and practices to address these problems. In the 'Saving Babies: A Perinatal Survey of South Africa' (2000), it is highlighted that most provinces do not have functioning systems to supply data on perinatal statistics or do they have consistency in what data is collected and who is responsible for its collection. The Western Cape and Gauteng provinces are exceptions to this. The Western Cape in particular has been collecting reasonable data for over two decades [73].

The importance of auditing maternity services has been recognized as an essential component of guaranteeing good care for mothers and babies and improving outcomes [74]. Considering that the greater Cape Town region public facilities reported a total of 301, 520 deliveries for the five year period of January 2005 - November 2009 [49], and that the independent midwives in this same region attended only 2,403 deliveries over the seven year period from January 2003- end of June 2009, it is clear that the utilization of

these services is small. Although independent midwives attend a small proportion of the overall number of births in the greater Cape Town region, it is critical to quality care and complete auditing of maternity services to ensure that utilization and outcomes of practices are documented and proper surveillance is undertaken.

The purpose of this study was thus to present an until now missing piece of information on maternity services in the greater Cape Town area: to describe utilization of the independent midwives, their qualifications and practices, their delivery types and outcomes; and how they fare in terms of need for medical interventions.

12.2 Independent midwifery services in Cape Town

Sixteen independent midwives have practiced in the greater Cape Town region over the period from January 2003 to the end of June 2009. They have collectively attended 2,403 deliveries, with substantial variation in the years of experience of independent midwifery and the number of deliveries attended. The number of births per midwife ranged from 4 to 365 over the seven year period. All of the independent midwives have a nursing diploma or degree from a South African institution and belong to DENOSA, through which they obtained malpractice insurance. None of the midwives did a direct-entry route to qualifying as midwives, and are therefore firmly routed in the biomedical model, as taught in nursing schools throughout South Africa [46, 47]. This differs to the US [25, 29, 30], Canada [34, 35], and the Netherlands [43, 44, 45] who all have options of direct-entry midwifery programmes and/or certification processes consisting of standardized exams for 'lay' midwives to qualify as a midwife. All of the independent midwives have worked in hospitals in South Africa before becoming an independent midwife, with almost all having worked in the public sector and most having also worked in the private sector. In evaluating the reasons for becoming independent midwives, over half stated that it was their 'dissatisfaction with existing maternity services' and a third stated the need to offer 'a continuum of care including antenatal thru postnatal care'.

The number of midwives in the greater Cape Town area has decreased over the seven year period, with only seven left practicing in 2009, compared to 14 in 2003. The

midwives described substantial challenges in practicing in Cape Town. The most commonly mentioned challenge was 'getting obstetric back up for deliveries'. The midwives also highlighted the challenge of unsupportive medical colleagues with whom they have to work in partnership with in order to provide appropriate care to their clients. A third of the midwives reported that 'the medical field's negative view of midwifery' and the attitudes and obstructive nature of 'the hospital staff' were their biggest challenges. This trend of declining independent midwives is not unique to this context and has been described as occurring in the United States as well [9, 19, 21]. Generally, this is attributed to midwives' lack of organizing ability and unification and the success of the medical profession in convincing the public that midwives are unsafe practitioners [9, 25]. It appears that Cape Town independent midwives are aware of this situation, as half of them described the main way to overcome their challenges as defining clearer roles for midwifery practice in South Africa in relation to other maternity services. And, over a third suggested that awareness-raising among potential clients and other health care practitioners about the roles and practices of midwives should be a priority.

It is important to note that despite the reported challenges of obstetric back up and support, independent midwives in the greater Cape Town area do have access to back up facilities. Two thirds of them have access to three or more back up hospitals and all reported having staff privileges at these hospitals. It is important to bear in mind that agreed hospital back-up alone does not equate to support/integration into broader maternity services.

12.3 Who is using independent midwifery services?

To consider the role of independent midwives in South African maternity services, understanding the profiles of women choosing to use these services is important. Unfortunately, as few socio-demographic and reproductive characteristics were systematically recorded by all of the midwives, it was difficult to fully ascertain 'who' the clients were who were utilizing the independent midwives. There was no reliable data on race, language, employment/profession, marital status, income, socio-economic status, or reproductive history. Race was recorded by six of the midwives on 34.8% of the total

2,403 deliveries. From this incomplete data, white women make up three quarters of the independent midwives' deliveries. As independent midwifery services do not currently fall under the free services offered from the public sector, as they are private practitioners, this impacts whom is able to utilize their services in terms of both affordability and access. It may also be that private midwives could be a middle ground for those who cannot afford a private doctor but can in fact, afford private midwife services. The predominance of white women, in this cohort, of independent midwife-attended deliveries, is not surprising as race and socio-economic status are correlated in South Africa [55]. The only variables that were consistently and almost completely recorded were cohort's age (92.2%) and parity (98.3%). The median age for the cohort was 31 years old. Very few were under 20 years (1%), whereas almost a quarter of the cohort was above 35 years old. Almost half were nulliparous. While unavailable for this study, it would be useful to get information on what motivates women to seek independent midwife care and what the perceived advantages from the client's perspective that motivates them to seek this care.

Importantly, based on the available data, it appears that client profiles in terms of maternal age and parity varied significantly by midwife. As both of these characteristics are well-documented predictors of pregnancy complications and maternal and perinatal outcomes [55], any interpretation of outcome data by midwife must bear this in mind.

12.4 Characteristics of pregnancies managed by independent midwives

Five percent (n=115) of the cohort attended by independent midwives had some kind of pregnancy complication diagnosed during pregnancy, with the most frequent complications being reported as breech presentation (20% of pregnancy complications; 1% of all deliveries) and post dates (10% of pregnancy complications; 0.5% of all deliveries). It is important to note that details of these diagnoses and how they were made is not available in the maternity registers. Breech presentation is known to be the most common malpresentation that occurs in pregnancies, with 2-3% of pregnancies >37 completed weeks being breech [75]. Considering there were 23 breech presentations that were identified during pregnancy and 11 identified at delivery, making up 1% of the

deliveries having breech presentation, this is consistent with the existing literature on breech occurrence. Post dates are also known to be quite common in pregnancies. The literature states that it is quite normal for approximately 10% of pregnancies to extend past 42 weeks [76]. It is unclear however, from the midwives records of 'postdates' whether it refers to simply after the woman's expected due date, or whether the pregnancy was in fact over 42 weeks. In our study, higher levels of pregnancy complications were found to be significantly associated with maternal age, parity and earlier gestational age at onset of delivery. Those who were under 20 years old, nulliparous, or who had a gestational age at onset of delivery of <37 weeks were significantly more likely to have pregnancy complications. This is consistent with the vast literature available on predictors of pregnancy complications. For instance it is known that women <20 years old have an increased risk and severity of gestational proteinuric hypertension (GPH), stress related disorders, preterm deliveries, intrauterine growth restriction (IUGR) and cases of undetected hypertension and anaemia due to poor attendance at antenatal clinics. Women who are over 35 years are known to have increased medical complications with pregnancies such as diabetes and hypertension [55]. Nulliparous women are known to have increased pregnancy complications such as GPH, and women who have given birth five times or more are known to have increased antepartum hemorrhages (APH) [55].

As was true of the socio-demographic and reproductive profiles of women in this cohort, the proportion of clients who had pregnancy complications also differed significantly among the midwives. Because it is well established that certain pregnancies complications influence pregnancy, maternal and perinatal outcomes [55, 76, 77, 78, 79], this variation in pregnancy complications by midwife is important in interpreting different outcomes by midwife.

12.5 Types of delivery among clients of independent midwives

Although not specifically explored in this study, women who utilize independent midwives are assumed to be seeking a safe, natural birth (vaginal delivery without surgical interventions, induction, epidural, spinal or general anesthetic [17]) and a

different antenatal and labor/delivery experience involving a continuum of care and 'genuine partnership' that is not offered by other existing maternity services [12]. Evidence from the UK study done by Symon et al reported that women utilized independent midwives in order to get a birth experience (as described above) that they did not feel that they would otherwise access in the existing NHS maternity services [12]. In the independent midwife cohort of the Symon et al study, the deliveries were significantly more likely to be via unassisted vertex delivery (77.9%) than the comparison NHS cohort (54.3%). The independent midwives in Cape Town facilitated 81% of their cohort to unassisted vertex deliveries (i.e. NVDS without instrumentation). Three quarters of their cohort (73.2%) had spontaneous vaginal delivery with no medical intervention ('natural deliveries'). Another 9.5% had vaginal deliveries with some kind of intervention (with 7.8% induced or utilizing epidural or spinal as pain relief and 2% having instrumental vaginal deliveries). The episiotomy rate was 4%. This is consistent with findings from global studies indicating high rates of spontaneous vaginal deliveries, low use of assisted deliveries, low use of episiotomies and anesthetics when the midwifery model of care is utilized [12, 31]. The Cape Town independent midwife results with respect to proportions of normal vaginal deliveries (NVDs) achieved are comparable to delivery types in the Netherlands, where 70% of maternity services are provided by independent midwives and there is 13.7% [17] proportion of caesarean sections. Results are also comparable to UK independent midwives' reported results in both Symon et al's study and in unpublished findings on the Independent Midwives UK website that indicates from January 2006 - February 2009, 78% of their deliveries were via NVD without instrumentation [86]. When compared to the deliveries at greater Cape Town area public facilities, the independent midwives had slightly higher proportion of NVDs (independent midwives: 81%; greater Cape Town public facilities: 77.2%), and lower proportions of assisted and caesarean section deliveries (independent midwives: assisted - 2%, caesarean- 17.4%; greater Cape Town public facilities: assisted- 2.6%, caesarean -20.2%) [49].

Therefore it is clear: the vast majority of births by the independent midwives were natural vaginal deliveries, with the overall proportions of caesarean section deliveries and

instrumental vaginal deliveries were 17.4% and 1.7%, respectively. Two-thirds of those who had pregnancy complications ended up having caesarean section deliveries (64.1%) and instrumental deliveries (2.6%). This observed statistically significant association between pregnancy complications and delivery type is expected, as women with pregnancy complications are more likely to need obstetric intervention, which depending on the severity of pregnancy complication, could lead to caesarean section [55, 76, 77, 78, 79]. Furthermore, 14.7% of the cohort had delivery complications. It is encouraging and consistent with the literature to find that most of the women who had caesarean sections, had pregnancy or delivery complications.

It is important to note that this level of caesarean section delivery (17.4%) among the independent midwives may be higher than expected, given the WHO's recommendation that country level caesarean section deliveries should be no more than 15%, which includes of the contribution of high risk pregnancies. From personal discussions with the midwives before the study was undertaken, they estimated caesarean levels would be between 7-15% in their practices [54]. The South African Demographic and Health Survey (DHS) of 2003 reported a 33.6% proportion of caesarean deliveries overall for the Western Cape Province of South Africa, and the Western Cape Department of Health reported 20.2% for the greater Cape Town region during the period of 2005 - 2009. Both sources included high risk pregnancies. However, the DHS includes private sector deliveries, which may increase caesarean section proportions. Without more detailed information on the severity and timing of diagnosis of pregnancy complications (which was not recorded by the midwives in their Registers), drawing conclusions about the appropriateness of the caesarian section levels in this cohort is not possible.

The significant association observed between delivery complications and delivery type was expected, based on the literature. The fact 80.7% of those who had complications during delivery had a caesarean section and 5% had NVD with instrumentation is predictable since complications (depending on severity) would generally involve the midwife seeking obstetric back-up and possibly intervention. There are many delivery complications which would indicate and necessitate the need for caesarean section or

instrumental deliveries [61, 80]. J. Hofmeyr explains in his section on Caesarean Sections in Obstetrics in Southern Africa (adapted in Table 11.6) the maternal, fetal and combined maternal and fetal indications/complications that could result in caesarean section delivery. While not done in this study, it would be interesting to assess which of the reported delivery complications resulted in a caesarean section. This is an area that was not explored in this study, but would be interesting to investigate to ascertain practices and protocols of independent midwives in relation to when delivery complications are observed and their resulting action.

Delivery type (the proportion of NVDs, instrumental deliveries and caesarean sections) varied significantly by midwife. There is not sufficient information available to fully investigate the reasons for this variation, but it may be due to several factors. For example, differing client profiles by midwife in terms of maternal age, parity, gestational age at onset of labor, and pregnancy complications, all of which are known to influence delivery type, may have contributed [55, 76, 77, 78, 79]. It may also be partially explained by different protocols and practice styles (e.g. preferred delivery location, differing use of induction drugs, etc).

In an attempt to better understand this association between midwife and delivery type, midwives were stratified and the proportion of NVDs, instrumental deliveries and caesarean sections were analyzed in relation to the variables that varied significantly among midwives and are known from the literature to be associated with pregnancy and delivery outcomes (maternal age, parity, gestational age at onset of delivery, pregnancy and delivery complications (see Appendix 6). The general pattern that emerged (though this was often not amenable to formal statistical analysis because of the sometimes small numbers in each category) was that within each of the midwives NVDs were lowest (and therefore, caesarean sections/instrumental deliveries were highest) in the cohort who were at the extremes of age, parity and with those with reported pregnancy and delivery complications. This suggests that the observed differences in client profiles with respect to age, parity and pregnancy and delivery complications are likely to explain, at least in

part, differences in delivery type by midwife. Further investigation into this is beyond the scope of this thesis.

12.6 Delivery location

The observed association between delivery type and delivery location is expected (i.e. only NVDs can occur at home, and instrumental and caesarean deliveries can only be performed in hospital settings). However, it was surprising to find that over half of all of the deliveries (51.7%) occurred in private sector hospitals, and that of these deliveries almost 70% were NVDs. This finding is surprising for several reasons: 1) private sector hospitals in South Africa [47, 50, 51] and around the world [81, 82, 83] are known for extraordinarily high caesarean rates; 2) they are settings in which the midwives feel unsupported; and 3) the transfer rate into hospitals was only 3.75%, meaning that the vast majority of these deliveries started in the hospital as opposed to at home, an MOU or ABU. This finding also differs from midwife-attended births in the UK and the Netherlands. In the UK, within the independent midwife attended births from January 2006 - February 2009, 64% occurred at home, and 36% occurred at the hospital [86]. In the Netherlands, of the midwife attended births (where 75% are independent midwives) 60% occurred at home and 40% occurred at the hospital [17]. This may mean, within Cape Town, women are choosing to utilize independent midwives within a private hospital setting, and raises interesting questions of why women are choosing private sector hospitals over MOUs, ABUs or home where only 48.3% percent of deliveries occurred in this cohort. Complete understanding of this finding is not possible given that we do not have data on where women intended to deliver or usable information about why, who and when hospital transfers occurred. Further exploration into why clients are utilizing independent midwifery services in Cape Town and what they want their experiences to be from them would be useful.

12.7 Birth outcomes: stillbirths, newborn intervention and postpartum haemorrhage

Within this cohort, there were 11 stillbirths, giving a still birth rate of 4.5 per 1,000 deliveries. The overall stillbirth rate for the greater Cape Town area from January 2005 - November 2009 was 22.3 per 1,000 deliveries as reported by the Western Cape

Department of Health. The stillbirth rate for the MOUs of the greater Cape Town area during that same period was 9.5 per 1,000 deliveries [49]. The still birth rate in most developed countries is 6 - 7 per 1,000 deliveries [84]. It is inappropriate to compare this however as populations in developed countries have differing access to medical care, nutrition and resources in general than the South Africa population; and because it appears that midwives care for populations highly selected to low risk profiles, which one would expect to affect outcomes and therefore be better than population-based outcomes.

The independent midwives' proportions of newborns needing intervention was 4%. Need for newborn intervention (those babies with apgar scores <7) was associated with parity, pregnancy complications, gestational age at onset of delivery, delivery complications, and birth weight. This is consistent with what the literature explains as factors that are known to influence perinatal outcomes [55, 76, 77, 78, 79]. The proportion of deliveries with postpartum hemorrhage was 2.7%. Postpartum hemorrhage was significantly more likely in the cohort who had had more than 4 previous births and with who did not have delivery complications in this cohort. As indicated in the literature [55], observations in this cohort, that those who have had four or more previous births were more likely to have hemorrhaging, was consistent.

Midwife practitioner was associated with both newborn intervention and postpartum hemorrhage. This could potentially be explained by the earlier discussion around differing client profiles and hence different risk profiles and management. Perhaps an alternate explanation could be that midwives do in fact practice differently and have different protocols and standards that they utilize when managing deliveries. Further exploration is needed into this association.

Differences in postpartum haemorrhage could possibly be explained by differing approached to management of third stage of labor. There was a statistically significant association between use of drugs for induction/augmentation of labor /postpartum management and midwife practitioner. Although the data collected from the midwives did not allow us to investigate these three categories of drugs separately it is an

association that needs further exploration in order to disentangle the intricacies of midwife practices in relation to postpartum haemorrhage management.

12.8 Limitations of the study

This is the first study done in South Africa on independent midwife practitioners and the outcomes of their practices. It was identified as a gap in the knowledge about maternity services in South Africa and conducted from a sympathetic perspective by the researcher. It provides an overview of the independent midwives themselves, their practices, as well as the utilization and outcomes of the services they provide.

However, there are several limitations to this study which influence the conclusions that can be drawn from it.

1. Retrospective cohort study design- One of the main challenges in retrospective study design is the fact that data collection is dependent on the data that has already been recorded [85]. This is true of the independent midwives' data and records. Although, after initial consultations with the midwives, we had anticipated gathering detailed information on socio-demographics (race, socio-economic status, profession, marital status), pregnancy and reproductive characteristics (previous caesarean sections, pregnancy complications), labor/delivery characteristics (presentation, length of labor, specific drugs administered for pain relief, induction, augmentation of labor and postpartum management, time of transfer, intended place of delivery), when the maternity registers were made available much of this data was either not recorded or not recorded completely. Despite this, the data that was available and complete enables us to describe the cohort in terms of maternal age and parity; occurrence of pregnancy and delivery complications; use of inductions, pain relief drugs, episiotomies; delivery location; delivery type; birth weight; apgar score at 1 and 5 minutes; as well as maternal tears and postpartum hemorrhaging.

2. Reliability and validity of data recorded - As mentioned above, the data that was recorded by the midwives was not always standardized and complete and analyses had to be restricted to variables that were completely recorded and recorded in a similar way by all of the midwives. The Maternity Register was the most common way of recording data, and while the registers were not conceptualized identically, the variables that were recorded were generally consistent from midwife to midwife. Within all of the midwives' records there was a large variety of variables recorded and the ways in which these variables were recorded was inconsistent and unstandardized. For instance, labor length (not clear definitions of start, completion, various stages) was a variable recorded by many midwives; however the way in which it was recorded was inconsistent and, thus, ultimately unusable.

3. Lack of access to client files - The only data sources available to the study were the Maternity Registers. We were not able to gain access to individual client files because many of the midwives that were in practice during the seven year study are no longer in practice or living in Cape Town. Thus access to these files was impossible. One of the midwives had died in 2007 and while her register was available for the study, her client files were in storage and unable to be accessed. At least four of the midwives in the study had all or some of their client files with the midwives' files that had died. Thus, information could not be obtained to fill in missing data, to figure out the timing and severity of pregnancy or delivery complications, or timing and reasons for hospital transfers.

4. Missing data from one midwife - While a whole sample was hoped for, for the January 2003 - end of June 2009 period it was unattainable because one of the midwives' data was not up-to-date. Therefore, there was 2 months of missing data from May - end of June 2009 that could not be included in the study. This is unfortunate as the 2 months of missing data was from the midwife who also did the most births.

12.9 Strengths

This is the first study to be done that describes independent midwife services in South Africa and audits their practices, outcomes and associations with delivery types. This study provides data on all of the independent midwife-attended deliveries in the greater Cape Town region over the seven year period from January 2003 to end of June 2009 and encompasses all 2,403 deliveries during this time.

12.10 Recommendations

This research was identified by the researcher as a gap in the knowledge surrounding maternal and infant health services provision in Cape Town, particularly the use and characteristics of independent midwives and their practices, as well as how the midwifery model of care fares in terms of birth outcomes and use of medical interventions. In personal communication with the 16 independent midwives, each stated that the information would be highly useful for their service provision. Therefore, the research was anticipated to add to the knowledge base concerning use of independent midwives so as to inform practices and policies surround pre, intra and postpartum care for mothers and babies in the greater Cape Town region.

Recommendation #1: Standardized data collection and reporting

Considering the single biggest limitation was inconsistent and unstandardized data reporting among the midwives themselves, it is obvious that standardized data collection and record keeping is the biggest recommendation. It is essential that the independent midwives create a system for standardized data recording that allows them to keep up to date records, capture the critical variables needed for surveillance in a way that is easy and efficient to utilize. This is critical for further surveillance and research that could be undertaken. If the midwife register is decided as the way forward in terms of data reporting, it is essential that there is a standardized register. Independent midwives and key stakeholders must identify key variables to record and agree on standardized definitions of these variables and ways in which they will record them.

Recommendation #2: Standardized practices and protocols

Judging by the fact that midwife practitioners were associated to all of the outcome variables (delivery type, infant intervention and postpartum hemorrhage), this seems to indicate that each of the midwives not only has quite different client profiles (maternal age, parity, gestation age at onset of delivery, pregnancy complications, delivery complications), but also different standards and practices (use of drugs for induction, augmentation of labor and postpartum management, where deliveries occur). Considering the climate that the independent midwives are practicing in within Cape Town and the reported negative view by the medical establishment and the difficulty obtaining back-up services, it could be a significant benefit to independent midwife practice in Cape Town if standardized protocols were agreed upon, followed and disseminated to obstetric practitioners that are needed to support them. It is also critical that evidence based practices be the basis of these protocols.

Recommendation #3: Active management of third stage of labor

It has been well documented that postpartum hemorrhage makes up a significant proportion of maternal mortality rates in sub-Saharan Africa, and while this sample is obviously different than the sub-Saharan African examples, evidence based practice from developing countries strongly encourages active management of the third stage of labor. It is difficult to unravel midwife practices in terms of utilization of active management in this stage of labor, as the drugs administered to clients were not systematically or thoroughly recorded, and their purpose of administration was often not given. It is difficult to ascertain whether the 9.8% of women who were given drugs for induction, augmentation of labor or normal postpartum management were in fact the only ones given these drugs, or if midwives simply did not record this drug administration. Either way, it is strongly recommended that evidence based practice be implemented and active management of the third stage of labor be considered for all independent midwife-attended deliveries.

12.11 Areas for further research

1. *Independent midwife practices and protocols*: There has been no research done on the practices and protocols followed by independent midwives in South Africa. In order to standardize practices and find out whether evidence based research is being followed, it is important to determine what the different practices are for midwives. Practices that are important to determine could be: assessment of high risk/low risk clients; protocols and indicators for hospital transfer for both mother and fetus before, during and after delivery; what drugs are administered under what circumstances; and what is normal postpartum management that should being followed.
2. *Clients' decision making about utilizing midwifery services and intended place of delivery*: No research has been done on why women in South Africa are choosing to utilize independent midwife services, or the varying locations in which they choose to deliver. In order to understand the needs of pregnant women, and provide the services that could benefit them, it is critical to understand choices in provider and delivery location.

12.12 Overall Conclusions

This study provides information on independent midwives in Cape Town, an aspect of maternity services in South Africa that has never been described, and whose practices and outcomes have never been researched before. Although independent midwives deliver a small proportion of total babies in the greater Cape Town region, outcomes are generally comparable to other settings in which independent midwives are utilized such as the UK and the Netherlands. It is clear from the reasons that were given for becoming independent practitioners and the main challenges that were described, that consistent with midwives all over the world, independent midwives in Cape Town feel unsupported, vilified and unhappy with existing maternity services and the practitioners within these services with which they have to work with to provide comprehensive services to their clients.

Independent midwives in the greater Cape Town region assisted 81% of their cohort to have normal vaginal deliveries. Their proportion of caesarean sections was 17%, which is lower than both the greater Cape Town region's public sector's reported proportion of caesareans (20.2%), as well as the extraordinarily high private sector proportions throughout the country (40-80%). Only 4% of the newborns delivered needed intervention and the proportion of mothers who had postpartum hemorrhaging was 2.7% for the independent midwife deliveries. The independent midwives' clientele varied significantly between practitioners. After stratifying by midwife, the association with delivery type and client's socio-demographic characteristics such as age and parity, as well as pregnancy and delivery complications held true. Within the independent midwives' clients the general tendency was for women who were at the extremes of age and parity, and who had pregnancy and delivery complications were less likely to have an NVD.

A key difference found between independent midwife deliveries in Cape Town compared to the UK and the Netherlands is the differing proportions of deliveries at home vs. hospitals. Within Cape Town, over half (51.7%) of the deliveries are occurring in private sector hospitals, where as in the UK (36%) and Netherlands (40%) this is quite a lot lower. What is unclear, and in need of further research, is the impact of different practices and protocols that the independent midwives utilize, and how these impact on the medical interventions and the delivery locations that are utilized. Without clear reporting on timing and severity of pregnancy complications; intended place of birth; duration of all stages of labor; what drugs are used when, and for what purpose; when, why and who transfer to hospital occurred for; and postpartum management including maternal blood loss; further investigation into independent midwife managed deliveries, and the possibility of making this aspect of maternity service provision increasingly available in Cape Town, is not possible.

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To my husband, Aron: thank you for your belief in me and in this project; and for having the patience and love to let me to finish it. To my son, Zacari: thank you for coming into this world and awakening me to the need for re-looking at maternity services throughout the country.

To the independent midwives in Cape Town, thank you for believing in this project and your willingness to fight the endless battle for midwifery and women's health. Thank you for opening your practices and hearts to me. A luta continua!

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15. Appendices

Appendix 1: Section 10 of South African Government Notice R2488 1990

'Regulations Relating to the Conditions under which Registered Midwives and Enrolled Midwives may Carry on Their Profession'

Medical assistance

10. (1) In the event of any of the following illnesses, abnormalities or complications occurring during pregnancy, labor or the puerperium or in the child, the registered midwife shall, subject to the provisions of subregulation (4), with the consent of the mother, call in a medical practitioner or refer the patient to a medical practitioner:

(a) *During pregnancy:*

Excessive nausea and vomiting;
abortion, actual or threatened;
vaginal bleeding;
apparent intra-uterine growth retardation;
hypertension;
albumin or sugar in the urine;
oedema of the hands, face or feet;
convulsions;
abnormal vaginal discharge;
sores on the genitals;
any condition suggesting a disproportion between head and pelvis;
abnormal presentation after the 32nd week;
multiple pregnancy;
tenderness or abnormal distension of the abdomen.

(b) *During labor:*

Convulsions;
abnormal vaginal discharge;
sores on the genitals;
excessive vaginal bleeding;
premature labor before the 37th week;
presentation other than an uncomplicated head presentation;
when no presentation can be determined;
multiple pregnancy;
non-engagement of the head in the case of a primigravida;
undue prolongation of any stage of labor;
disordered or abnormal uterine action;
presentation or prolapse of the cord;

foetal distress;
placenta not completely expelled one hour after the birth of the child;
third degree perineal tear.

(c) *During the puerperium:*

Convulsions;
abdominal distension and tenderness;
malodorous lochia;
rigor;
rise in body temperature to 37,7°C for 24 hours, or its recurrence within that period, or a rise in body temperature to 37,4°C on two successive days;
continuously rapid or steadily rising pulse rate;
unusual swelling of the breasts with local tenderness or pain;
excessive or prolonged bleeding;
pain in the lower limbs, especially pain in the calves.

(d) *The child:*

Injuries received during birth;
malformation or deformity (whether endangering life or not);
undue feebleness, whether the child is premature or not;
inflammation of or any discharge from the eyes;
serious skin eruptions, especially those marked by the formation of watery blisters;
inflammation of or haemorrhage from the umbilicus;
jaundice;
convulsions;
neonatal haemorrhage.

(2) Where any illness, abnormality or complication other than the illnesses, abnormalities or complications referred to in subregulation (1), occurs during pregnancy, labor or the puerperium or in the child, a registered midwife may if he deems it necessary, subject to the provisions of subregulation (4) and with the consent of the mother, call in a medical practitioner or refer the patient to a medical practitioner.

(3) Where a medical practitioner is called in or consulted as contemplated in subregulations (1) and (2), a registered midwife shall-

(a) remain with the patient and deal with the emergency to the best of his ability until the medical practioner arrives; or

(b) accompany the patient if she is to be sent to medical assistance.

(4) When calling in medical assistance as contemplated in subregulations (1) and (2) the registered midwife shall call in the medical practitioner desired by the mother.

(5) Where, in the course of pregnancy, labor or the puerperium a registered midwife-

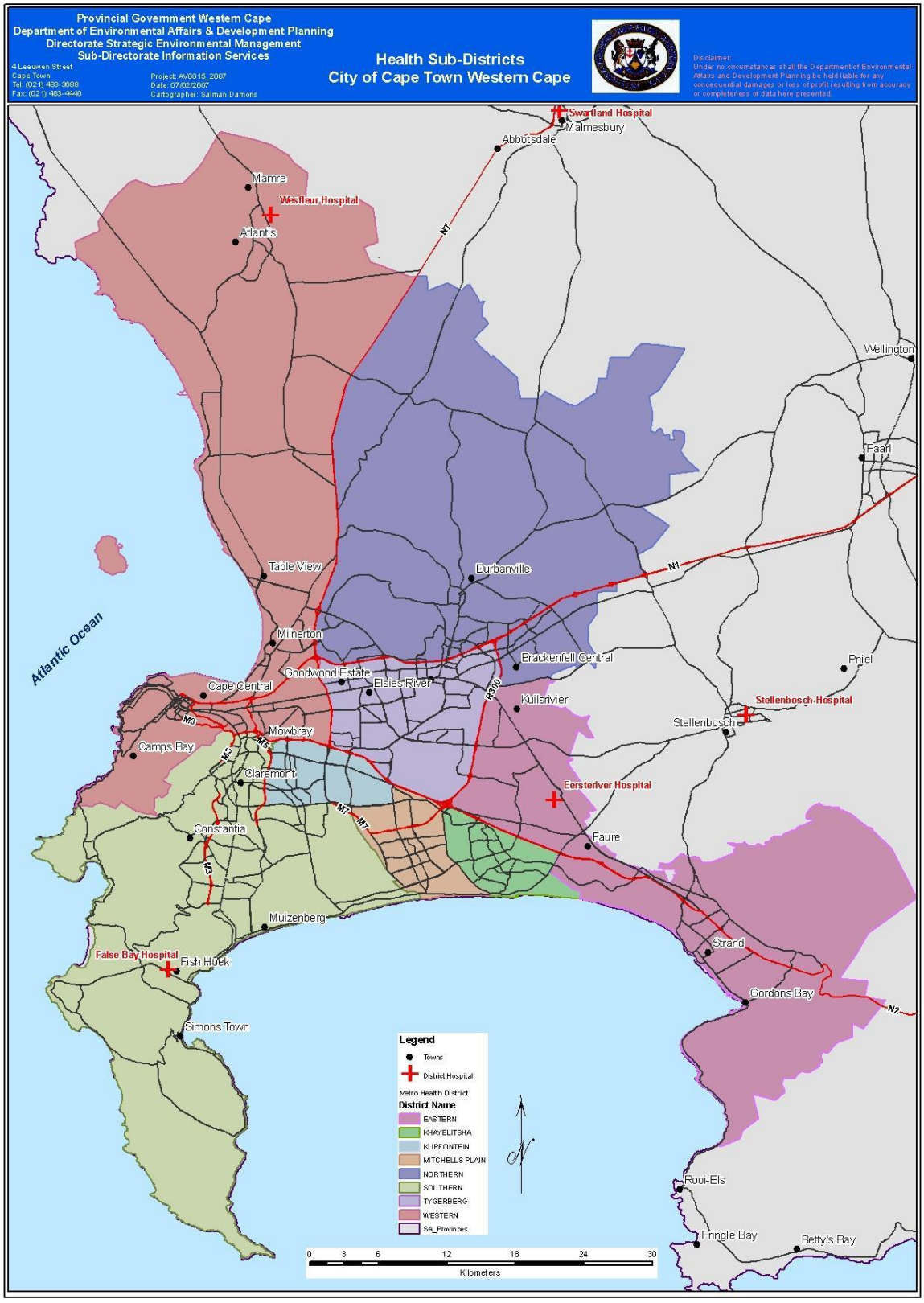
(a) advises the patient to consult a medical practitioner;

(b) refers the patient to a registered person other than a medical practitioner;

(c) consults the patient with a view to calling in medical assistance, the relevant particulars, as well as any refusal by the patient to consent to any of the above, shall be recorded as set out in Annexure A of this Chapter.

Source: South African Nursing Council 2008 accessed at: http://www.sanc.co.za/regulat/Reg-cmi.htm

Appendix 2: Map of greater Cape Town region



Appendix 3: Client data capturing sheet

Qs. #	Item	Outcomes	Code for DE
	Midwife Number		
	Date of Capturing	DD/MM/YYYY	
	Client ID Number		
Socio-demographic characteristics			
100	Age	Age in years	
101	Race	1=White 2=Colored 3=Black 4=Indian	
102	Suburb	Write in suburb	
103	Marital status	1= Single 2= Married	
104	Profession	Write in profession	
Reproductive characteristics			
105	Parity		
106	Gravidity		
107	Previous caesarean section	1=yes 2=no	
Pregnancy characteristics			
108	Gestational age	Wks, days	
109	Any complications during pregnancy	1=yes, go to 110 2=no, go to 111	
110	Please list complications here.		
Labor characteristics			
111	Date of confinement	DD/MM/YY	
112	Period of gestation	Wks, days	
113	Presentation		

Qs. #	Item	Outcomes	Code for DE
114	First stage of labor	Duration of latent phase: hrs mins Duration of active phase: hrs mins	
115	Second stage of labor	Duration of phase 1: hrs mins Duration of phase 2 (pushing): hrs mins	
116	Third stage of labor	Duration from delivery of baby to delivery of placenta: hrs mins	
117	Was labored induced and membranes artificially ruptured?	1= yes 2= no	
118	Were drugs administered?	1 = yes (if so, what?) _____ _____ 2= no	
Delivery characteristics			
119	Where was your delivery?	1= home 2= private hospital 3=MOU 4= public hospital	

Qs. #	Item	Outcomes	Code for DE
120	Did you have a natural vaginal delivery?	1= yes 2=no	
121	Did you transfer to hospital?	1=yes 2=no	
122	Did you have an assisted delivery?	1=yes 2=no	
123	Did a doctor deliver your baby?	1=yes 2=no	
124	Were forceps used to deliver your baby?	1=yes 2=no	

Qs. #	Item	Outcomes	Code for DE
125	Was vacuum extraction used to deliver your baby?	1=yes 2=no	
126	Did you have an episiotomy?	1=yes 2=no	
127	Did you tear naturally?	1=yes 2=no (go to question 129)	
128	What degree of tear?	1st 2nd 3rd 4th	
129	Did you have a caesarean section?	1=yes 2=no	

Qs. #	Item	Outcomes	Code for DE
130	Did you have any complications during delivery?	1=yes 2=no (got to question 132)	
131	What were these complications?		
Birth outcomes			
132	Was your infant delivered dead or alive?	1=Alive 2=Dead	
133	What is the sex of your infant?	1=Male 2=Female	
134	What was the weight of your infant (in grams)	Enter weight in grams here.	
135	What was the head circumference? (in cms)	Enter head circumference in cms here	
136	What was the length of your infant (in cms)	Enter length in cms here	
137	What was 1 min apgar of baby?		
138	What was 5 min apgar of baby?		
139	What was maternal blood loss (in g)	Enter g of maternal blood loss	
140	What was placenta weight (in gm)	Enter placenta weight here.	

Appendix 4

Midwife Questionnaire

Qs. #	Item	Responses	Code for DE
	Interviewer Initials		
	Date of Interview	DD/MM/YYYY	
	Midwife ID Number		
	Has the midwife completed the informed consent process?	Yes=1 No=2 ***If No, complete consent before proceeding***	
Socio-demographic and professional characteristics			
100	How old are you?	Age in years	
101	Are you currently practicing as an independent midwife?	1=Yes 2=No (Stop questionnaire)	
102	Did you work in a hospital before becoming an independent midwife?	1=Yes (Skip to question 103) 2=No (Skip to question 107)	
103	Did you work in the private sector?	1=Yes (Skip to question 104) 2=No (Skip to question 105)	
104	For how many years?	Time in years/mos	
105	Did you work in the public sector?	1=Yes 2=No, skip to question 109)	
106	For how many years?	Time in years/mos	
107	Did you work in a Maternity Obstetric Unit (MOU) before becoming an independent midwife?	1=Yes (Skip to question 108) 2=No (Skip to question 109)	
108	For how many years?	Time in years/mos	
109	Have you worked as a midwife in any other setting other than hospital-based (private/public), an MOU, or as a independent midwife?	1=Yes (skip to question 110) 2=No (skip to question 112)	

Qs. #	Item	Responses	Code for DE
110	Please specify where	Location	
111	For how many years?	Time in years/mos	
112	Why did you decide to become an independent midwife?		
113	What do you see as the role for independent midwives in Cape Town?		
114	What are the main challenges for independent midwives in Cape Town?		

Qs. #	Item	Responses	Code for DE
115	How do you feel like these challenges can be overcome?		
Qualification characteristics			
116	Did you graduate varsity with a nursing degree?	1=Yes (skip to question 119) 2=No	
117	Did you do a 'direct-entry' midwifery degree?	1=Yes (skip to question 123) 2=No (skip to question 118)	
118	Please specify your training for midwifery.	*After answer inserted skip to question	
119	Did you take a 3 or 4 yr degree?	3 = 3 yr degree 4 = 4 yr degree	
120	Did you take a midwifery specialization during the degree?	1=Yes 2=No	
121	Did you take a midwifery specialization after the degree?	1=Yes 2=No	
122	Was your midwifery qualifications obtained through a South African institution?	1=Yes (skip to question 124) 2=No (skip to question 123)	
123	In which country was your midwifery qualifications obtained?		
Midwifery Practice Characteristics			
124	Do you belong to a group practice, where there is more than one midwife working with a group of clients?	1=Yes 2=No (skip to question 130)	
125	How many midwives are in your group practice?		
126	How many clients does the practice see per/month?		
127	Do midwives share clients?	1=Yes (skip to question 129) 2=No	
128	Does each midwife have their own clientele base?	1=Yes 2=No (skip to question 130)	
129	How many clients per/month?		
130	Are you currently registered with the South African Nursing Council?	1=Yes 2=No	
131	Do you belong to any other professional	1=Yes	

Qs. #	Item	Responses	Code for DE
	bodies within South Africa?	2=No (skip to question 133)	
132	Please specify who the organization is.		
133	Is your practice covered by malpractice insurance?	1=Yes 2=No (skip to question 135)	
134	Who is the insurance cover thru?		
135	What hospital do you use for your back-up hospital in case of an emergency during a delivery?		
136	Do you have staff privileges at this hospital?	1=Yes 2=No	

Thank you for your time!!!!!

Appendix 5

University of Cape Town
Women's Health Research Unit
School of Public Health and Family Medicine

MIDWIFE CONSENT FORM/SUBJECT INFORMATION SHEET

Independent midwifery practices in Cape Town: birth outcomes and predictors for medical interventions from 2003-2009

I am a MPH STUDENT in the School of Public Health and Family Medicine at the University of Cape Town. I am gathering some information on independent midwife practices in Cape Town. Specifically, through a questionnaire I will ask you about your qualifications, the services you provide and your experiences being an independent midwife in South Africa. I am also asking your permission to access your Maternity Registers from 2003-2009 in order to ascertain utilization patterns, socio-demographics, labor and delivery characteristics of the clients utilizing your services. All information will be kept confidential and client names will be replaced with unique identification number before data abstraction so all client data will be anonymous. Your participation in both the questionnaire and provision of your Maternity Registers is completely voluntary.

If you decide to participate:

- This will involve you answering short questions for about 20 minutes.
- All of the information that you provide will be completely confidential and will only be viewed and used by the researchers on this project.
- We will record the information you give us on a form so that we know what you have said, but we will never record your name or anything that could be used to identify you anywhere on the study form. Your participation is completely confidential.
- You have the right to decide not to participate in the study, to refuse to answer any question, or to withdraw from the study at any time without any penalty.
- All information gathered will be identified only by a clinic and unique participant number and kept in confidential files. No individual identifying information will be obtained and no identifying information will be disclosed in reports, publications, or presentations.
- The information you provide may help us to improve reproductive and maternity health services for all women in the Western Cape Province.

- If there is anything that is unclear or if you need further information, please ask us and we will provide it. Do you have any questions?

Provider declaration

- I have understood that the purpose of the study is to understand independent midwives' qualifications, the services you provide and your experiences being an independent midwife in South Africa, as well as ascertain utilization patterns, socio-demographics, labor and delivery characteristics of the clients utilizing your services.

- I have read the above information. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate in this study and understand that I have the right to withdraw from the study at any time without penalty.

Please indicate your consent with your signature.

_____

Signature of Midwife Date

_____

Signature of Researcher Date

Thank you.

Appendix 6:

Timeframe

	Month						
	1	2	3	4	5	6	7
Start-up							
Finalise study instruments	XX						
Institutional approvals *	XX						
Cape Town fieldwork							
Informed consent	XX						
Midwife questionnaire		XXXX					
Data capturing sheet of maternity registers		X X	X				
Data analysis				XXX	XX		
Reporting					XX	XX	XXXX

Appendix 7:

Factors associated with delivery type by midwife

Summary:

A statistically significant association with delivery type and maternal age (p=0.017) was only found for midwife 1. The only midwife who had a statistically significant association with delivery type and need for infant intervention (p=0.000) was midwife 6. Midwifes 5 (p=0.012) and 10 (p=0.001) had a statistically significant association with delivery type and gestational age at onset of delivery. A statistically significant association between delivery type and parity was found for midwife 1 (p=0.032), midwife 2 (p=0.000), midwife 5 (p=0.051), midwife 7 (p=0.017), midwife 10 (p=0.001) and midwife 15 (p=0.002).

Midwives 7, 8, 9, 11 and 12 did not find a statistically significant association with delivery type and pregnancy complications. All other midwives did have an association that was significant.

All midwives except midwife 12 had a statistically significant association with delivery type and delivery complications.

By Midwife:

For midwife 1, there is a significant association with delivery type and maternal age (p=0.017), parity (p=0.032), complications during pregnancy (p=0.000) and complications during delivery (p=0.000).

There is substantial variation between overall proportions of women who have caesarean sections within the maternal age categories. Women over 40 years old are significantly more likely to have a caesarean section (n=4, 26.7%) than any other age category.
Women who are between 20-30 years old, are significantly more likely to have a NVD (n=53, 98.1%) than any other age group.

Women who were nulliparous (n=18, 18%) and who have had four or more previous births (n=1, 16.7%) were significantly more likely to have caesarean sections than the other women of different parities.

Women who had pregnancy complications were also significantly more likely to have caesarean section deliveries (n=7, 77.8%) than those with no pregnancy complications. And those women with delivery complications were significantly less likely to have a NVD (n=3, 14.3%) than those with no delivery complications (n=255, 95.5%).

Table 15.1: Midwife #1 - factors associated with delivery type

Characteristic n (%)	*NVD* *N= 258 (89)*	*Caesarean section* *N= 32 (11)*	*Instrumental delivery* *N= 0*	*P-value*
Maternal age				0.017
<20 yrs	0	0	0	
20-30 yrs	53 (98.1)	1 (1.9)	0	
30-35 yrs	110 (87.3)	16 (12.7)	0	
35-40 yrs	69 (90.8)	7 (9.2)	0	
>40 yrs	11 (73.3)	4 (26.7)	0	
Parity				0.032
0	82 (82)	18 (18)	0	
1	106 (91.4)	10 (8.6)	0	
2	45 (97.8)	1 (2.2)	0	
3	19 (90.5)	2 (9.5)	0	
4	5 (83.3)	1 (16.7)		
Complications during pregnancy				0.000
No	256 (91.1)	25 (8.9)	0	
Yes	2 (22.2)	7 (77.8)	0	
Gestational age at onset of delivery				0.246
<37weeks	3 (75)	1 (25)	0	
38-40 weeks	110 (91.7)	10 (8.3)	0	
40+ weeks	145 (87.3)	21 (12.7)	0	
Complications during delivery				0.000
No	255 (95.5)	12 (4.5)	0	
Yes	3 (14.3)	18 (85.7)	0	
Did baby need intervention (1min apgar <7)				1.000
No	248 (88.9)	31 (11.1)	0	
Yes	6 (100)	0	0	

For midwife 2, there is a significant association with delivery type and parity (p=0.000), complications during pregnancy (p=0.001) and complications during delivery (p=0.000).

Nulliparous women are significantly more likely to have a caesarean section (n=27, 24.8%) than women of all other parities. There is substantial variation in proportions of caesarean deliveries between the parity categories - from none of the women who have given birth to 3 or more babies having had caesarean deliveries, to nulliparous women have the largest proportion (n=27/33, 81.8%) of caesarean sections.

Women who had pregnancy complications are significantly more likely to have a caesarean delivery (n=7, 53.8%) than those who had no pregnancy complications (n=26, 9.9%). Women who had delivery complications were also significantly more likely to have caesarean deliveries (n=22, 81.5%) than those women who did not have delivery complications (n=11, 4.4%).

Table 15.2: Midwife #2 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=240 (87)*	*Caesarean section* *N=33 (12)*	*Instrumental delivery* *N=3 (1.1)*	*P-value*
Maternal age				
<20 yrs	2 (100)	0	0	0.750
20-30 yrs	58 (89.2)	5 (7.7)	2 (3.1)	
30-35 yrs	76 (86.4)	11 (12.5)	1 (1.1)	
35-40 yrs	46 (86.8)	7 (13.2)	0	
>40 yrs	9 (81.8)	1 (18.2)	0	
Parity				
0	79 (72.5)	27 (24.8)	3 (2.7)	0.000
1	99 (95.2)	5 (4.8)	0	
2	40 (97.6)	1 (2.4)	0	
3	13 (100)	0	0	
4	2 (100)	0	0	
Complications during pregnancy				0.001
No	233 (88.9)	26 (9.9)	3 (1.1)	
Yes	6 (46.2)	7 (53.8)	0	
Gestational age at onset of delivery				0.526
<37weeks	6 (100)	0	0	
38-40 weeks	102 (88.7)	13 (11.3)	0	
40+ weeks	127 (85.2)	19 (12.7)	3 (1.1)	
Complications during delivery				0.000
No	237 (95.2)	11 (4.4)	1 (0.4)	
Yes	3 (11.1)	22 (81.5)	2 (7.4)	
Did baby need intervention (1min apgar <7)				0.420
No	225 (87.6)	29 (11.2)	3 (1.2)	
Yes	3 (75)	1 (25)	0	

For midwife 3, there is a significant association with delivery type and both complications during pregnancy (p=0.000) and delivery (p=0.000).

Women who had pregnancy complications were significantly more likely to have a caesarean delivery (n=6, 66.7%) than those women who did not have pregnancy complications (n=9, 8.4%). Women who had delivery complications were also significantly more likely to have a caesarean delivery (n=9, 69.2%) than those who did not have delivery complications (n=9, 8.5%).

Table 15.3: Midwife #3 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=101 (85)*	*Caesarean section* *N=18 (15)*	*Instrumental delivery* *N=0*	*P-value*
Maternal age				
<20 yrs	1 (50)	1 (50)	0	0.341
20-30 yrs	19 (82.6)	4 (17.4)	0	
30-35 yrs	24 (82.8)	5 (17.2)	0	
35-40 yrs	18 (94.7)	1 (5.3)	0	
>40 yrs	2 (100)	0	0	
Parity				
0	41 (75.9)	13 (24.1)	0	0.243
1	33 (91.7)	3 (8.3)	0	
2	19 (90.5)	2 (9.5)	0	
3	4 (100)	0	0	
4	4 (100)	0	0	
Complications during pregnancy				0.000
No	98 (91.6)	9 (8.4)	0	
Yes	3 (33.3)	6 (66.7)	0	
Gestational age at onset of delivery				0.062
<37weeks	3 (60)	2 (40)	0	
38-40 weeks	44 (83)	9 (17)	0	
40+ weeks	50 (92.6)	4 (7.4)	0	
Complications during delivery				0.000
No	97 (91.5)	9 (8.5)	0	
Yes	4 (30.8)	9 (69.2)	0	
Did baby need intervention (1min apgar <7)				0.330
No	90 (88.2)	12 (11.8)	0	
Yes	2 (66.7)	1 (33.3)	0	

For midwife 4, there is a significant association with delivery type and both complications during pregnancy (p=0.000) and delivery (p=0.009).

All of the women who had pregnancy complications ended up having a caesarean delivery (n=3, 100%) compared to all of those who had no pregnancy complications who all had NVDs (n=25, 100%). All women who had delivery complications ended up having a caesarean delivery (n=3, 100%) compared to a smaller proportion of those women with no delivery complications who ended up having a caesarean delivery (n=8, 22.9%).

Table 15.4: Midwife #4 - factors associated with delivery type

Characteristic n (%)	*NVD* *N= 27 (77.1)*	*Caesarean section* *N=8 (22.9)*	*Instrumental delivery* *N=0*	*P-value*
Maternal age				
<20 yrs	0	0	0	0.515
20-30 yrs	17 (81)	4 (19)	0	
30-35 yrs	6 (60)	4 (40)	0	
35-40 yrs	3 (100)	0	0	
>40 yrs	1 (100)	0	0	
Parity*				
0	11 (84.6)	2 (15.4)	0	0.392
1	7 (87.5)	1 (12.5)	0	
2	6 (54.5)	5 (45.5)	0	
3	1 (100)	0	0	
4	2 (100)	0	0	
Complications during pregnancy				0.000
No	25 (100)	0	0	
Yes	0	3 (100)	0	
Gestational age at onset of delivery				
<37weeks	1 (100)	0	0	
38-40 weeks	10 (100)	0	0	
40+ weeks	14 (100)	0	0	
Complications during delivery				0.009
No	27 (84.4)	5 (15.6)	0	
Yes	0	3 (100)	0	
Did baby need intervention (1min apgar <7)				
No	27 (77.1)	8 (22.9)	0	
Yes	0	0	0	

For midwife 5, there is a significant association with delivery type and parity (p=0.051), gestational age at onset of delivery (p=0.034), complications during pregnancy (p=0.012) and delivery (p=0.000).

Nulliparous women were significantly more likely to have a caesarean section (n=16, 42.1%) than all other women. Women who had pregnancy complications were significantly more likely to have a caesarean delivery (n=5, 83.3%) than those women who did not have pregnancy complications (n=24, 23.5%). There was a large variation in the proportion of women who had caesarean sections by gestational age at onset of delivery. Women who gave birth before 37 completed weeks were significantly more likely to have a caesarean section (n=1, 50%) and instrumental deliveries (n=1, 50%) than those who gave birth after 37 completed weeks. Women who gave birth after 40 weeks were significantly more likely to have a caesarean section (n=16, 31.4%) than those who gave birth between 38 - 40 weeks (n=8, 9%). Women who had delivery complications were also significantly more likely to have a caesarean delivery (n=24, 68.6%) than those who did not have delivery complications (n=5, 6.8%).

Table 15.5: Midwife #5 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=74 (68.5)*	*Caesarean section* *N=29 (26.8)*	*Instrumental delivery* *N= 5(4.6)*	*P-value*
Maternal age				0.361
<20 yrs	0	0	0	
20-30 yrs	30 (68.2)	14 (30.8)	0	
30-35 yrs	28 (71.8)	8 (20.5)	3 (7.7)	
35-40 yrs	14 (63.6)	6 (27.3)	2 (9.1)	
>40 yrs	2 (100)	0	0	
Parity				0.051
0	18 (47.4)	16 (42.1)	4 (10.5)	
1	25 (75.8)	8 (24.2)	0	
2	15 (78.9)	3 (15.8)	1 (5.3)	
3	12 (85.7)	2 (14.3)	0	
4	4 (100)	0	0	
Complications during pregnancy				0.012
No	73 (71.6)	24 (23.5)	5 (4.9)	
Yes	1 (16.7)	5 (83.3)	0	
Gestational age at onset of delivery				0.034
<37weeks	0	1 (50)	1 (50)	
38-40 weeks	33 (78.6)	8 (19.0)	1 (2.4)	
40+ weeks	33 (64.7)	16 (31.4)	2 (3.9)	
Complications during delivery				0.000
No	67 (19.8)	5 (6.8)	1 (1.4)	
Yes	7 (20)	24 (68.6)	4 (11.4)	
Did baby need intervention (1min apgar <7)				1.000
No	68 (68)	27 (27)	5 (5)	
Yes	4 (80)	1 (20)	0	

For midwife 6, there is a significant association with delivery type and both complications during pregnancy (p=0.000) and delivery (p=0.000), as well as whether newborns needing intervention (p=0.040).

Women who had pregnancy complications were significantly less likely to have a NVD (n=12, 33.3%) than those women who did not have pregnancy complications (n=206, 72.8%). Women who had delivery complications were significantly more likely to have a caesarean delivery (n=67, 83.7%) than those who did not have delivery complications (n=22, 9.2%). Women who had babies that needed newborn intervention were significantly more likely to have had a caesarean delivery (n=4, 36.4%) or an

instrumental delivery (n=2, 18.2%) than those whose babies did not need newborn intervention (caesarean section: n=80, 26.8%; instrumental: n=10, 3.3%).

Table 15.6: Midwife #6 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=218 (68.3)*	*Caesarean section* *N=89 (27.9)*	*Instrumental delivery* *N=12 (3.8)*	*P-value*
Maternal age				0.465
<20 yrs	0	0	0	
20-30 yrs	55 (73.3)	18 (24)	2 (2.7)	
30-35 yrs	90 (68.2)	39 (29.5)	3 (2.3)	
35-40 yrs	52 (65.8)	22 (27.8)	5 (6.3)	
>40 yrs	6 (54.5)	4 (36.4)	1 (9.1)	
Parity				0.072
0	90 (60)	53 (35.3)	7 (4.7)	
1	77 (72.6)	25 (23.6)	4 (3.8)	
2	40 (83.3)	8 (16.7)	0	
3	5 (100)	0	0	
4	4 (80)	1 (20)	0	
Complications during pregnancy				0.000
No	206 (72.8)	67 (23.7)	10 (3.5)	
Yes	12 (33.3)	22 (61.1)	1 (5.6)	
Gestational age at onset of delivery				0.075
<37weeks	7 (43.7)	9 (56.2)	0	
38-40 weeks	99 (66.9)	44 (29.7)	5 (3.4)	
40+ weeks	110 (72.8)	34 (22.5)	7 (4.6)	
Complications during delivery				0.000
No	215 (90)	22 (9.2)	2 (0.8)	
Yes	3 (3.7)	67 (83.7)	10 (12.5)	
Did baby need intervention (1min apgar <7)				0.040
No	209 (69.9)	80 (26.8)	10 (3.3)	
Yes	5 (45.4)	4 (36.4)	2 (18.2)	

For midwife 7, there is a significant association with delivery type and parity (p=0.017) and delivery complications (p=0.000).

Nulliparous women were significantly more likely to have caesarean sections (n=19, 23.2%) than all other women. All women who had delivery complications ended up having a caesarean section (n=5, 100%). Of the women who did not have delivery complications, (n=17, 11.1%) had caesarean sections.

Table 15.7: Midwife #7 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=136 (86.1)*	*Caesarean section* *N=22 (13.9)*	*Instrumental delivery* *N=0*	*P-value*
Maternal age				0.492
<20 yrs	1 (100)	0	0	
20-30 yrs	36 (90)	4 (10)	0	
30-35 yrs	60 (87)	9 (13)	0	
35-40 yrs	33 (78.6)	9 (21.4)	0	
>40 yrs	6 (100)	0	0	
Parity*				0.017
0	63 (76.8)	19 (23.2)	0	
1	47 (94)	3 (6)	0	
2	18 (100)	0	0	
3	5 (100)	0	0	
4	3 (100)	0	0	
Complications during pregnancy				
No	136 (86.1)	22 (13.9)	0	
Yes	0	0	0	
Gestational age at onset of delivery				0.380
<37weeks	2 (100)	0	0	
38-40 weeks	52 (91.2)	5 (8.8)	0	
40+ weeks	82 (82.9)	17 (17.2)	0	
Complications during delivery				0.000
No	136 (88.9)	17 (11.1)	0	
Yes	0	5 (100)	0	
Did baby need intervention (1min apgar <7)				1.000
No	124 (86.7)	19 (13.3)	0	
Yes	12 (92.3)	1 (7.7)	0	

For midwife 8, only delivery complications and delivery type had a statistically significant association (p=0.000).

Women who had delivery complications were significantly more likely to have caesarean sections (n=20, 83.3%) than those who did not have delivery complications (n=4, 4.6%).

Table 15.8: Midwife #8 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=83 (74.8)*	*Caesarean section* *N=24 (21.6)*	*Instrumental delivery* *N=4 (3.6)*	*P-value*
Maternal age				0.676
<20 yrs	0	0	0	
20-30 yrs	36 (81.8)	7 (15.9)	1 (2.3)	
30-35 yrs	24 (66.7)	10 (27.8)	2 (5.6)	
35-40 yrs	15 (68.2)	6 (27.3)	1 (4.5)	
>40 yrs	3 (75)	1 (25)	0	
Parity				0.254
0	37 (63.8)	18 (31)	3 (5.2)	
1	27 (87.1)	3 (9.7)	1 (3.2)	
2	11 (84.6)	2 (15.4)	0	
3	1 (50)	1 (50)	0	
4	2 (100)	0	0	
Complications during pregnancy				0.429
No	80 (75.5)	22 (20.7)	4 (3.8)	
Yes	3 (60)	2 (40)	0	
Gestational age at onset of delivery				0.232
<37weeks	0	1 (100)	0	
38-40 weeks	35 (81.4)	7 (16.3)	1 (2.3)	
40+ weeks	46 (70.8)	16 (24.6)	3 (4.6)	
Complications during delivery				0.000
No	80 (92)	4 (4.6)	3 (3.4)	
Yes	3 (12.5)	20 (83.3)	1 (4.2)	
Did baby need intervention (1min apgar <7)				0.724
No	77 (76.2)	20 (19.8)	4 (4)	
Yes	5 (71.4)	2 (28.6)	0	

For midwife 9, only delivery complications and delivery type had a statistically significant association (p=0.000).

Women who had delivery complications were significantly more likely to have caesarean sections (n=3, 92%) than those who did not have delivery complications (n=12, 15.1%).

Table 15.9: Midwife #9 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=221 (85)*	*Caesarean section* *N=36 (13.8)*	*Instrumental delivery* *N=3 (1.1)*	*P-value*
Maternal age				0.625
<20 yrs	4 (100)	0	0	
20-30 yrs	126 (87.5)	16 (11.1)	2 (1.4)	
30-35 yrs	62 (83.8)	11 (14.9)	1 (1.3)	
35-40 yrs	24 (80)	6 (20)	0	
>40 yrs	5 (71.4)	2 (28.6)	0	
Parity				0.775
0	125 (82.2)	24 (15.8)	3 (2)	
1	65 (87.8)	9 (12.2)	0	
2	24 (92.3)	2 (7.7)	0	
3	6 (100)	0	0	
4	1 (100)	0	0	
Complications during pregnancy				0.134
No	218 (85.8)	33 (13)	3 (1.2)	
Yes	2 (50)	2 (50)	0	
Gestational age at onset of delivery				0.669
<37weeks	4 (80)	1 (20)	0	
38-40 weeks	67 (87)	10 (13)	0	
40+ weeks	144 (84.7)	23 (13.5)	3 (1.8)	
Complications during delivery				0.000
No	219 (93.6)	12 (5.1)	3 (1.3)	
Yes	2 (8)	3 (92)	0	
Did baby need intervention (1min apgar <7)				0.223
No	199 (85.8)	31 (13.4)	2 (0.9)	
Yes	15 (78.9)	3 (15.8)	1 (5.3)	

For midwife 10, there is a significant association with delivery type and parity (p=0.000), gestational age at onset of delivery (p=0.001), complications during pregnancy (p=0.001) and delivery (p=0.000).

Nulliparous women were significantly more likely to have caesarean sections (n=38, 29%) or instrumental deliveries (n=8, 6.1%) than the rest of the women. Women who had pregnancy complications were significantly more likely to have caesarean deliveries (n=7, 53.8%) and instrumental deliveries (n=1, 7.7%) than those women who did not have pregnancy complications (caesarean: n=52, 15%; instrumental: n=7, 2%). Women who had gestational age at onset of delivery of more than 40 weeks and under 37 completed weeks were significantly more likely to have caesarean deliveries (over 40: n=42, 23.2%; under 37: n=3, 20%) than those women who were between 38 and 40

weeks (n=12, 7.6%). Women who had delivery complications were also significantly more likely to have caesarean deliveries (n=48, 75%) than those who did not have delivery complications (n=11, 3.7%).

Table 15.10: Midwife #10 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=297 (81.6)*	*Caesarean section* *N=59 (16.2)*	*Instrumental delivery* *N=8 (2.2)*	*P-value*
Maternal age				0.091
<20 yrs	7 (63.6)	3 (27.3)	1 (9.1)	
20-30 yrs	133 (83.1)	22 (13.8)	5 (3.1)	
30-35 yrs	99 (77.9)	27 (21.3)	1 (0.8)	
35-40 yrs	49 (90.7)	4 (7.4)	1 (1.9)	
>40 yrs	5 (83.3)	1 (16.7)	0	
Parity				0.000
0	85 (64.9)	38 (29)	8 (6.1)	
1	104 (88.1)	14 (11.9)	0	
2	68 (93.1)	5 (6.9)	0	
3	18 (94.7)	1 (5.3)	0	
4	5 (100)	0	0	
Complications during pregnancy				0.001
No	288 (83)	52 (15)	7 (2)	
Yes	5 (38.5)	7 (53.8)	1 (7.7)	
Gestational age at onset of delivery				0.001
<37weeks	11 (73.3)	3 (20)	1 (6.7)	
38-40 weeks	142 (90.5)	12 (7.6)	3 (1.9)	
40+ weeks	135 (74.6)	42 (23.2)	4 (2.2)	
Complications during delivery				0.000
No	282 (94)	11 (3.7)	7 (2.3)	
Yes	15 (23.4)	48 (75)	1 (1.6)	
Did baby need intervention (1min apgar <7)				1.000
No	284 (84.3)	47 (13.9)	6 (1.8)	
Yes	5 (83.3)	1 (16.7)	0	

For midwife 11, a statistically significant association was found between delivery complications and delivery type (p=0.001).

All of the women who had delivery complications ended up having caesarean section deliveries (n=6, 100%). The proportion of women who had caesarean sections with no delivery complications was 18.8% (n=3).

Table 15.11: Midwife #11 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=13 (59.1)*	*Caesarean section* *N=9 (40.9)*	*Instrumental delivery* *N=0*	*P-value*
Maternal age				0.638
<20 yrs	0	0	0	
20-30 yrs	7 (63.6)	4 (36.4)	0	
30-35 yrs	6 (60)	4 (40)	0	
35-40 yrs	0	1 (100)	0	
>40 yrs	0	0	0	
Parity				0.754
0	8 (53.3)	7 (46.7)	0	
1	4 (80)	1 (20)	0	
2	1 (100)	0	0	
3	0	0	0	
4	0	0	0	
Complications during pregnancy				0.544
No	12 (63.2)	7 (36.8)	0	
Yes	1 (33.3)	2 (66.7)	0	
Gestational age at onset of delivery				1.000
<37weeks	0	0	0	
38-40 weeks	5 (62.5)	3 (37.5)	0	
40+ weeks	8 (61.5)	5 (38.1)	0	
Complications during delivery				0.001
No	13 (81.2)	3 (18.8)	0	
Yes	0	6 (100)	0	
Did baby need intervention (1min apgar <7)				
No	10 (62.5)	6 (37.5)	0	
Yes	0	0	0	

For midwife 12, all births were delivered via NVD. Bivariate association to investigate factors associated with delivery type was therefore, not appropriate.

Table 15.12: Midwife #12 - factors associated with delivery type

Characteristic n (%)	*NVD* *N= 4(100)*	*Caesarean section* *N=0*	*Instrumental delivery* *N=0*	*P-value*
Maternal age				
<20 yrs	0	0	0	
20-30 yrs	0	0	0	
30-35 yrs	2 (100)	0	0	
35-40 yrs	0	0	0	
>40 yrs	0	0	0	
Parity*				
0	0	0	0	
1	4 (100)	0	0	
2	0	0	0	
3	0	0	0	
4	0	0	0	
Complications during pregnancy				
No	4 (100)	0	0	
Yes	0	0	0	
Gestational age at onset of delivery				
<37weeks	0	0	0	
38-40 weeks	1 (100)	0	0	
40+ weeks	3 (100)	0	0	
Complications during delivery				
No	4 (100)	0	0	
Yes	0	0	0	
Did baby need intervention (1min apgar <7)				
No	4 (100)	0	0	
Yes	0	0	0	

For midwife 13, a statistically significant association was found with delivery type and both pregnancy complications (p=0.017) and delivery complications (p=0.000).

Women who had delivery complications were significantly more likely to have caesarean deliveries (n=5, 71.4%) than those who did not have delivery complications (n=6, 7.3%). Women who had complications during pregnancy were significantly more likely to have a caesarean section (n=3, 60%) than those who did not have pregnancy complications (n=8, 9.6%).

Table 15.13: Midwife #13 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=77 (86.5)*	*Caesarean section* *N= 11 (12.4)*	*Instrumental delivery* *N=1 (1.1)*	*P-value*
Maternal age				0.303
<20 yrs	0	1 (100)	0	
20-30 yrs	31 (83.8)	5 (13.5)	1 (2.7)	
30-35 yrs	30 (90.9)	3 (9.1)	0	
35-40 yrs	10 (83.3)	2 (16.7)	0	
>40 yrs	1 (100)	0	0	
Parity				0.811
0	29 (80.6)	6 (16.7)	1 (2.8)	
1	35 (89.7)	4 (10.3)	0	
2	10 (90.9)	1 (9.1)	0	
3	3 (100)	0	0	
4	0	0	0	
Complications during pregnancy				0.017
No	74 (89.2)	8 (9.6)	1 (1.2)	
Yes	2 (40)	3 (60)	0	
Gestational age at onset of delivery				0.095
<37weeks	1 (33.3)	2 (66.7)	0	
38-40 weeks	21 (87.5)	3 (12.5)	0	
40+ weeks	48 (88.9)	5 (9.3)	1 (1.8)	
Complications during delivery				0.000
No	75 (91.5)	6 (7.3)	1 (1.2)	
Yes	2 (28.6)	5 (71.4)	0	
Did baby need intervention (1min apgar <7)				1.000
No	68 (86.1)	10 (12.7)	1 (1.3)	
Yes	2 (100)	0	0	

For midwife 14, there was only a statistically significant association with delivery complications and delivery type (p=0.013).

All of those women with delivery complications had caesarean sections (n=2, 100%). All of the women with no delivery complications had a NVD (n=11, 100%).

Table 15.14: Midwife #14 - factors associated with delivery type

Characteristic n (%)	*NVD* *N= 11 (84.6)*	*Caesarean section* *N=2 (15.4)*	*Instrumental delivery* *N=0*	*P-value*
Maternal age				
<20 yrs	0	0	0	0.273
20-30 yrs	2 (66.7)	1 (33.3)	0	
30-35 yrs	5 (100)	0	0	
35-40 yrs	2 (66.7)	1 (33.3)	0	
>40 yrs	0	0	0	
Parity				
0	2 (100)	0	0	0.244
1	4 (100)	0	0	
2	5 (83.3)	1 (16.7)	0	
3	0	1 (100)	0	
4	0	0	0	
Complications during pregnancy				
No	11 (84.6)	2 (15.4)	0	
Yes	0	0	0	
Gestational age at onset of delivery				1.000
<37weeks	0	0	0	
38-40 weeks	7 (87.5)	1 (12.5)	0	
40+ weeks	4 (80)	1 (20)	0	
Complications during delivery				0.013
No	11 (100)	0	0	
Yes	0	2 (100)	0	
Did baby need intervention (1min apgar <7)				
No	11 (84.6)	2 (15.4)	0	
Yes	0	0	0	

For midwife 15, a statistically significant association was found with delivery type and parity (p=0.002), pregnancy complications (p=0.008) and delivery complications (p=0.000). Women who were nulliparous were significantly more likely to have a caesarean section (n=24, 33.3%) or an instrumental delivery (n=2, 2.8%) than all of the other women. Women who had pregnancy complications were significantly more likely to have caesarean deliveries (n=4, 80%) than those who did not have pregnancy complications (n=28, 16.8%).Women who had delivery complications were significantly more likely to have caesarean deliveries (n=26, 78.8%) than those who did not have delivery complications (n=6, 4.3%).

Table 15.15: Midwife #15 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=137 (79.6)*	*Caesarean section* *N=32 (18.6)*	*Instrumental delivery* *N=3 (1.8)*	*P-value*
Maternal age				0.616
<20 yrs	0	0	0	
20-30 yrs	38 (77.6)	10 (20.4)	1 (2)	
30-35 yrs	58 (77.3)	16 (21.3)	1 (1.3)	
35-40 yrs	31 (88.6)	4 (11.4)	0	
>40 yrs	7 (100)	0	0	
Parity				0.002
0	46 (63.9)	24 (33.3)	2 (2.8)	
1	56 (87.5)	7 (10.9)	1 (1.6)	
2	28 (96.5)	1 (3.5)	0	
3	6 (100)	0	0	
4	1 (100)	0	0	
Complications during pregnancy				0.008
No	136 (81.4)	28 (16.8)	3 (1.8)	
Yes	1 (20)	4 (80)	0	
Gestational age at onset of delivery				0.910
<37weeks	5 (71.4)	2 (28.6)	0	
38-40 weeks	45 (80.4)	10 (17.9)	1 (1.8)	
40+ weeks	86 (79.6)	20 (18.5)	2 (1.9)	
Complications during delivery				0.000
No	130 (93.5)	6 (4.3)	3 (2.2)	
Yes	7 (21.2)	26 (78.8)	0	
Did baby need intervention (1min apgar <7)				0.550
No	125 (79.6)	29 (18.5)	3 (1.9)	
Yes	8 (72.7)	3 (27.3)	0	

For midwife 16, there was a statistically significant association with delivery type for women with pregnancy complications (p=0.002) and delivery complications (p=0.000). Women who had pregnancy complications were significantly more likely to have caesarean deliveries (n=5, 83.3%) than those who did not have pregnancy complications (n=8, 15.1%).Women who had delivery complications were significantly more likely to have caesarean deliveries (n=7, 87.5%) than those who did not have delivery complications (n=5, 10 %).

Table 15.16: Midwife #16 - factors associated with delivery type

Characteristic n (%)	*NVD* *N=44 (74.6)*	*Caesarean section* *N= 13 (22)*	*Instrumental delivery* *N=2 (3.4)*	*P-value*
Maternal age				0.576
<20 yrs	1 (100)	0	0	
20-30 yrs	10 (76.9)	3 (23.1)	0	
30-35 yrs	15 (75)	4 (20)	1 (5)	
35-40 yrs	6 (75)	1 (12.5)	1 (12.5)	
>40 yrs	0	1 (100)	0	
Parity				0.258
0	27 (65.8)	12 (29.3)	2 (4.9)	
1	11 (100)	0	0	
2	3 (100)	0	0	
3	3 (100)	0	0	
4	0	0	0	
Complications during pregnancy				0.002
No	43 (81.1)	8 (15.1)	2 (3.8)	
Yes	1 (16.7)	5 (83.3)	0	
Gestational age at onset of delivery				0.876
<37weeks	0	0	0	
38-40 weeks	20 (76.9)	5 (19.2)	1 (3.9)	
40+ weeks	23 (71.9)	8 (25)	1 (3.1)	
Complications during delivery				0.000
No	43 (86)	5 (10)	2 (4)	
Yes	1 (12.5)	7 (87.5)	0	
Did baby need intervention (1min apgar <7)				1.000
No	38 (73.1)	12 (23.1)	2 (3.8)	
Yes	5 (83.3)	1 (16.7)	0	