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Could introducing vacuum delivery into the education curriculum of community midwives in Yemen improve maternal and neonatal mortality and morbidity outcomes?

Abstract

At present in Yemen the neonatal mortality rate stands at 12%. A contributing factor is that when abnormalities arise during labour in rural areas, there is an absence of trained medical staff to manage complications. Consequently, childbearing women are expected to travel long distances to hospitals to receive Emergency Obstetric Care (EOC). This paper presents a debate over whether vacuum delivery should be introduced into the education curriculum of community midwifery courses in Yemen. It is proposed that this fundamental change to both the educational system and the community midwives role could facilitate a reduction in maternal and neonatal mortality and morbidity figures in Yemen.

Keywords: education, community, midwifery, morbidity, mortality, vacuum delivery, ventouse, Yemen

Key Points

- (1) At present neonatal mortality is reported to be 12% in Yemen.
- (2) Few physicians are employed within the remote health centres of Yemen, which has resulted in lack of surgical expertise when problems arise during labour.
- (3) Transport of labouring women from many rural areas of Yemen to the nearest maternity hospital takes on average 4-6 hours.
- (4) Educating and legally permitting community midwives to conduct vacuum delivery during second stage of labour could work towards reducing the currently high neonatal mortality figures in Yemen.

Could introducing vacuum delivery into the education curriculum of community midwives in Yemen improve maternal and neonatal mortality and morbidity outcomes?

Introduction

Yemen has a high neonatal mortality rate (MoPHP, 2009; WHO, 2010a), which currently stands at 12% (WHO, 2010b). The highest incidents of neonatal death customarily occur in rural areas (MoPHP, 2003), which is in part is due to an absence of practicing obstetricians and the time delays incurred during transit to hospital when abnormalities arise during labour. Deficits in medical attention are driven by two factors. Firstly, the political climate does not attract doctors to work in remote health centers of Yemen (Al Serouri et al., 2009; Hofmeyr et al., 2009), and secondly, cultural restrictions inhibit the majority of childbearing women from being attended upon by a male doctor (EMRO, 2006; Encyclopedia of the Nations, 2007; Penney, 2000). Due to the impoverished road infrastructure, transporting childbearing women to the closest hospital is an arduous task that can take as long as 4-6 hours (Penney, 2000). Few people own a car, with renting one expensive and the only means of transportation to the towns and cities (MoPHP, 2003).

To improve rural access to Essential Obstetric Care (EOC), the profession community midwife was introduced in 1997 (Penney, 2000). At present, time taken to train as a community midwife in Yemen takes two years. These courses are offered in the health manpower institutes of Aden and Sanaa, which are based in the different governorates of Yemen (EMRO, 2006). In 2009, 4115 community midwives were employed by the Yemeni government. Around this

time, there were 2266 health centers that offered Maternal-Child Health Services throughout Yemen (MoPHP, 2009). The majority of these health centers engaged a community midwife on their staff (Al Serouri et al., 2009) and few retained a general practitioner. Emergency Obstetric Care (EmOC) was only available in 69 government hospitals throughout Yemen (Bailey et al., 2006; Darmstadt et al., 2009), with this portrayal depicting a picture that is much the same today. Few deliveries take place in the smaller health centers (Al Serouri et al., 2009), with most childbearing women opting to give birth at home and few attended by a community midwife (MoPHP, 2003). Many families resist seeking medical support during labour through belief that “home is better (48% of rural women / 65% of urban women), lack of available services, cost of services and place of service is far” (MoPHP, 2003, p. 96).

One factor that inhibits delivery of effective EmOC to childbearing women in the rural areas of Yemen, is that during labour the midwife is characteristically only contacted when the woman has become majorly distressed and/or the family has assessed the situation as a state of emergency. Consequently, often diagnosis of fetal distress occurs as late as during second stage (Bailey, 2005).

In response to these indicators, the aim of this paper is to provide a rationale for educating community midwives to perform vacuum extraction. It is hypothesized that such action could contribute towards improving maternal and neonatal mortality and morbidity outcomes within the context of the current economic and political climate in Yemen. Vacuum delivery involves the practitioner attaching a plunger like device (ventouse) to the baby's head when

the second stage of labour has progressed inadequately. Ventouse extraction is an accepted alternative to using forceps. It is a recognized life-saving procedure for both mother and neonate, because it expedites fetal delivery and abruptly terminates second stage complications. The literature has been organized to argue potential improvements to mortality figures of task shifting the procedure of vacuum extraction from doctors to midwives within the rural areas of Yemen. Three overarching themes have been presented to support this proposition.

(1) Demographic, cultural and political factors in Yemen

To explore the political, cultural and demographic influences on the studied enquiry, the results of the Yemeni Family Health (YFH) survey (MoPHP, 2003) and the Annual Statistical Health Report (MoPHP, 2009) have been used to argue the case. The YFH survey used structured interviews to collect data. One finding revealed that in Yemen (especially in rural areas) most health professionals are ascribed the title of “doctor”. The majority of participants reported that they did not know the actual qualifications of health workers, which indicates that the results of the YFH survey of doctor led (20.1%) and midwife led (6.7%) deliveries (MoPHP, 2003) may not in fact provide true representation of professional community service provision.

Also within Yemeni culture women are forbidden to travel unaccompanied by a male relative (Penney, 2000; EMRO, 2006) and consent from the husband must be provided for an operation to be conducted. It is also the cultural norm for husbands to be absent during labour and birth. In the main, there are no records of the course of labour, which makes accurate cause of mortality and morbidity

difficult to assess. In relation to mortality, there is no nationwide databank of perinatal data and registration of births and deaths is not compulsory.

Consequently, the stated neonatal mortality figures of 12% in Yemen have been estimated by the WHO (WHO,2010b) and are open to bias (EMRO, 2006; Al Serouri et al., 2009). The WHO acknowledges this quandary by classifying the maternal and neonatal mortality rates as estimates (WHO, 2010a).

Further demographic, cultural and political obstructions to hospital access are the tribal conflicts that regularly restrict transport links (Al-Salami and Hoots, 2003). Since 2004, one particular rebel movement have brought about several outbreaks of war in North Yemen. Transport links in the south are also often disrupted by political groups demanding separation from the central government (IRIN, 2011 a & b). These political conflicts present further danger to childbearing women and support the proposition that midwives should be educated to conduct vacuum delivery in the home. Such early intervention would expedite birth and markedly reduce mortality and morbidity caused by long delays on disrupted transport links to hospital.

(2) Community midwives performing vacuum extraction versus referral to hospital

A review by Hofmeyr et al. (2009) concluded that while instrumental delivery clearly has the potential to save lives, there is a dearth of evidence that compares outcomes from instrumental birth mode against caesarean delivery, other intervention, or non-intervention. In contrast, Contag (2007) found no significant difference in fetal outcomes between vacuum assisted delivery and caesarean section when failure of descent and non-reassuring fetal heart rate

had been diagnosed. Alexander et al. (2009) also found no difference in adverse neonatal outcomes between vacuum assisted delivery and caesarian section after exclusion of cases with non-reassuring fetal heart rate. He therefore concludes that the reason leading up to the operational delivery may effect outcome more than mode of delivery itself (e.g., fetal hypoxia caused by cord compression or premature placental separation).

In relation to vacuum delivery, evidence supports that when the intervention is performed according to acceptable standards, there are minimal measured adverse long-term outcomes for either childbearing women or neonates (Alexander et al., 2009; Bailey, 2005; Contag, 2007; Hofmeyr et al., 2009).

Leeman and Leeman (2002) found no difference in outcomes between hospitals without caesarean services, where instead vaginal operative deliveries are performed, compared to units where section's are conducted. To date, there is a dearth of evidence about the effects of vacuum delivery on perinatal outcomes, yet the literature indicates no worse long-term results compared to birth by caesarean section. Relative to caesarian section, for a low resource setting like Yemen, vacuum extraction requires less qualified staff, fewer and less expensive equipment and materials (Campell and Graham, 2006; Leone et al., 2008). From an economic perspective, a competent community midwife conducting vacuum delivery in the woman's home is significantly more cost effective than engaging a medical doctor (Campell and Graham, 2006; Yarnall et

al., 2009; Koblinsky et al., 1999; ten Hoop-Bender et al. 2006; Kowaleski & Jahn, 2001).

Some papers identify risks for future pregnancies and delivery from conducting caesarian section, e.g., infection, anaesthetic reactions and scar rupture (Bailey, 2005; Hofmeyr et al., 2009; Belizan et al., 2007; Bahl et al., 2004; Leone et al., 2008; Darmstadt et al., 2009). Yet thus far, vaginal operative delivery has been excluded from many medical curriculums (Ameh & Weeks, 2009; ten Hoop-Bender et al., 2006; Bailey et al., 2006). Also of interest is that the 6th component of Basic Emergency Obstetric Care (BEmoC) is to provide vaginal operative delivery, with this option essentially absent in many health facilities in Yemen (Al Serouri, 2009; Mbonye et al., 2007; Bailey et al., 2006; Ameh and Weeks, 2009).

(3) Time delays in transfer to hospital

It is argued that timely intervention is a key contributor to improving mortality and morbidity outcomes for both mother and infant in Yemen (Darmstadt et al., 2009). Increasing availability of vacuum extraction at home is far less expensive than transporting a labouring woman to a distant hospital and hours later conducting caesarean section (Paxton et al. 2006; Unicef, 2004). Thomas et al. (2004) evaluated decision to intervention intervals above 75 minutes, with adverse outcomes apparent when the time gap is greater.

A review of literature on aspects of referral identified the model of three delays (Thaddeus and Maine, 1994; Ronsmans and Graham, 2006; Unicef, 2004). The three delays identified include:

- (1) *Postponement of decision to seek medical help.*
- (2) *Poor transport links.*
- (3) *Time gap from diagnosis of difficulty to problem solving care.*

The *first delay* involves a holdup in deciding to seek medical help. Families often delay their decision to seek primary care because they do not expect to be helped towards a positive outcome. This is underpinned by a perception that care delivered will be of poor quality, which has led to under-utilization and bypassing of lower level facilities (Thaddaeus and Maine, 1994; Kiwanuka, 2008; Barnes-Joshia et al., 1998; Unicef, 2004; Paxton et al., 2006). Utilization of services also depends upon attitudes of staff towards childbearing women and 24 hour service provision.

The *second delay* describes obstructions to accessing care (EMRO, 2006; Unicef, 2004; Lee et al., 2009). Obstructions include the small proportion of paved roads, the inaccessible terrain, the fact that few families own a car and that cost of travel is high. The small number of functioning EmOC facilities in Yemen are a further restriction (Al Serouri, 2009). As a consequence, childbearing women are required to travel long distances to seek resolve for complications during labour.

The *third delay* is the gap in time from diagnosis of obstetric complication to being in receipt of problem solving care. The argument presented contends that community midwives educated to competently conduct vacuum extraction in the woman's home will remove this time delay (Paxton et al., 2005; MoHP, 2001; Darmstadt et al., 2009).

Having placed an argument that supports the idea of extending the community midwives role, contraindications for conducting vacuum extraction in the current social circumstances of Yemen are far outweighed by the benefits. Nevertheless, there may be some risks for the neonate that the midwife may be required to manage. For example, mechanical implementation of the ventouse itself increases incidence of neonatal cephalohematoma and retinal haemorrhage compared with forceps delivery (Johanson & Menon, 2000). These haemorrhages characteristically resolve without sequelae within 4 weeks postpartum, but cephalohematoma may lead to hyperbilirubinemia which the midwife may also be required to manage. Shoulder dystocia is also a risk factor, particularly if there is a macrosomic fetus (Demissie et al., 2004). A further complication is experiencing a failed vacuum delivery, neonatal brachial plexus and/or extensive soft tissue damage to either mother and/or fetus. In the event that any of these complications arise, organisational structures are required to ensure that the community midwife has support and legal safeguard. The standard of training and protection requires to be equivalent to that of a doctor placed in a similar situation in Yemen. Midwives with such responsibilities may at times feel vulnerable and isolated. Consequently, regular updates and community meetings should be organised to accolade their successes and critically discuss problematic deliveries.

Such skill transfer is recommended by the WHO (2004), although no paper to date has evaluated midwives performance at conducting the procedure. Herein, it is proposed that such an evaluation could follow delivery of an

education program to train community midwives how to proficiently perform vacuum extraction. Comparable similar implementations have in the past shown to improve outcome measures in other settings (Basnet et al., 2004). For example, prior skill transfer of post abortion treatment using Manual Vacuum Aspiration to midlevel providers (which includes midwives) have proved successful. Also in five South Asian countries and Nepal, non medical allied health care professionals have effectively administered anaesthesia and performed cesarean section (Rana et al., 2007; Hussein et al., 2010). These prior implementations by midlevel providers support that performance and outcomes from procedures conducted by midlevel providers can be profitable (Basnet et al., 2004; Yarnall et al., 2009; Bergstroem, 2005; Hoegberg, 2009; Kowaleski and Jahn, 2001).

Discussion

This debate has considered causal dynamics towards elevating mortality and morbidity figures in Yemen. To view a summary of geographical, cultural, political and economic contributors see *Table 1*.

TABLE 1 HERE

In Yemen, doctors are in scarce supply in rural areas and currently they are the only health professionals permitted to conduct vacuum extraction (MoPHP, 2009; WHO, 2010a). To fill this gap in EmOC, it is recommended that the community midwives role be extended to include education about how to safely perform vacuum extraction. Additional rationale for why community

midwives should perform vacuum extraction during second stage in rural areas of Yemen include:

- (1) Community midwives already provide primary maternity care within the majority of rural health facilities.
- (2) The geographical, political, cultural and economical issues summarized in *Table 1* contribute to delays in accessing EmOC.
- (3) Community midwives live comparatively close to their clients, which reduces costs in terms of travel-time and expense.

Within this context, widening the community midwives role to include vacuum delivery could have significant impact upon maternal and infant mortality and morbidity figures in Yemen.

Educating community midwives to high levels of skill acquisition requires careful selection of cadres. Firstly, the education program and skills competencies require to be written into the community midwives training. Second, practitioners require to be recruited from health facilities with a high enough pool of clients to maintain their skills (Paxton et al., 2006). Success can only be claimed when midwives have proven their effectiveness in the specified skill acquisition (Paxton et al., 2006), with the number of childbearing women who subsequently elect to utilize services of the community midwife an indicator of acceptance of the quality of their work (Thaddaeus and Maine, 1994; Kiwanuka, 2008; Unicef, 2004). It is proposed that educating midwives to perform vacuum extraction should be incorporated into specialized postgraduate midwifery education programs and that the specified preparation requires to be of high

quality (Ameh and Weeks, 2009). Post implementation, this extension to the midwives role should be monitored closely and evaluated in terms of quality and maternal and neonatal outcomes within the specified geographical areas of Yemen.

The debate overwhelmingly supports that within the current circumstances in Yemen that community midwives should conduct ventouse extraction. Accordingly key points for an education program have been suggested. To view suggested learning objectives that could be used to underpin a vacuum extraction (ventouse) education program for midwives (see *Table 2*).

TABLE 2 HERE

Conclusion

Including vacuum delivery into the educational curriculum and job description of community midwives requires a Yemen government directive and change to current policy. With advocacy, technical help and funding, strategies could be implemented to bring maternity service provision in line with WHO recommendations. High quality training in performance of vacuum extraction of carefully selected candidates is crucial for successful implementation of this recommendation. Each step of the suggested skill transfer requires to be observed, assessed and evaluated both short and long term. Health ministers dedicated to improving mortality and morbidity statistics and consumer satisfaction with maternity service provision, require to pay attention to what has been proposed. This entails overcoming barriers and taking advantage of

opportunities that work towards improving the environment. Policy changes are driven by initiatives that reinforce strengths of current specification and recognise weaknesses.

Conflicts of interest

The authors have no conflicts of interest to declare.

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From 1992- 2012 the first author of this paper worked in Yemen as a midwife. During these years she witnessed the development of the profession “community midwife”. She was involved in the education and practical training of many community midwives, some of whom she could follow up after graduation and attain knowledge of their work in the rural areas.

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Table 1: Summary of geographical, cultural, political and economic contributors to the high mortality figures in Yemen

- (1) Insufficient practicing doctors in rural areas.
 - (a) *Political climate does not attract doctors to work in remote health centers.*
 - (b) *Cultural restrictions inhibit childbearing women from attending male doctors.*
 - (c) *Cultural restrictions prevent female doctors from living away from their families without a male companion.*
 - (d) *Doctors, who for the above reasons, are in scarce supply in rural areas and are the only health care professionals currently permitted to conduct vacuum extraction.*

- (2) Transport problems.
 - (a) *Time delays in transporting women to hospital (often 4-6 hours).*
 - (b) *Impoverished road infrastructure.*
 - (c) *Few people own a car, with the expense of renting one to transport the woman to hospital high.*
 - (d) *Tribal conflicts regularly restrict transport links to hospital.*
 - (e) *Women are not allowed to travel unaccompanied by a male relative.*

- (3) Current job description of community midwives is restricted to support provision only during labour.

- (4) The majority of families only call the midwife when the woman has become majorly distressed or they have assessed the situation as an emergency, underpinned by:
 - (a) *Belief that home is better.*
 - (b) *Lack of readily available services.*
 - (c) *Required to pay and services are expensive.*
 - (d) *Place of service too far to travel in established labour.*
 - (e) *Travelling is dangerous due to tribal conflicts.*

- (5) Consent from the husband must be provided for a caesarian section to be conducted and he may be absent.

Table 2: Proposed learning objectives for a vacuum extraction (ventouse) educational program for community midwives in Yemen

- (1) Present a case study and critically discuss why community midwives are being trained to provide a vacuum extraction service in rural areas of Yemen.
- (2) Provide a definition of vacuum extraction and show a video of procedure.
- (3) Critically discuss positive and negative aspects of conducting vacuum extraction compared with other forms of assisted delivery.
- (4) Discuss and example techniques of vacuum extraction.
- (5) Critically discuss indications and contraindications for use of vacuum extraction.
- (6) Discuss suitable fetal and maternal position for vacuum-assisted vaginal delivery.
- (7) Teach the ABCDEFGHIJ mnemonic (Damos et al., 2003):
 - A** = **A**ddress the patient and discuss the risks and benefits of operative vaginal delivery.
Assistants should be on hand for delivery and for neonatal resuscitation, and should be made aware of the use of instruments
 - A**nalgesics should be administered, if needed.
 - B** = **B**ladder should be emptied to avoid risk of injury.
 - C** = **C**ervix should be completely dilated.
 - D** = The position of the fetal head should be **D**etermined.
 - E** = The physician should check the vacuum **E**quipment to ensure adequate suction.
 - F** = With the suction off, the center of the cup should be applied 3 cm anterior to the posterior fontanel, centering the sagittal suture under the vacuum. The edge of the cup will be over the posterior fontanel. This point, located in the midline along the sagittal suture, approximately 3 cm in front of the posterior fontanel and approximately 6 cm from the anterior fontanel, is called the **F**lexion point.
 - G** = Increase the vacuum suction with the manometer at the recommended range and apply **G**entle traction at right angles to the plane of the cup during the contraction.
 - H** = Use of vacuum should be **H**alted when there are 3 disengagements of the vacuum, more than 20 minutes have elapsed, or 3 consecutive pulls result in no progress or delivery.
 - I** = Although it is in the original "ABCDEFGHIJ" mnemonic, performing an **I**ncision for episiotomy increases the risk of perineal trauma and, therefore, is no longer recommended.
 - J** = The vacuum can be removed when the fetal **J**aw is reachable.
- (8) Practice techniques of operative vaginal delivery on mannequins until student is competent.
- (9) Discuss and rehearse management of potential intranatal and postnatal complications of vacuum extraction, e.g., neonatal resuscitation, maternal postpartum haemorrhage, suturing of soft tissue damage, management of neonatal cephalohematoma and hyperbilirubinemia etc.
- (10) Discuss legal implications, referral processes and management structures in place to support community midwife provision of vacuum extraction (these must be in situation).
- (11) Provide written and clinical examinations of procedures, with student demonstrating competence at 5 vacuum extractions in a hospital delivery suite before being certificated.
- (12) Explain essential elements required for documentation of vacuum extraction delivery.