REVIEW ARTICLE

Facility-based delivery and maternal and early neonatal mortality in sub-Saharan Africa: A regional review of the literature

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Abstract

Regional variability in facility-based delivery (FBD) rates in sub-Saharan Africa (SSA) is not well understood, nor is the relationship between FBD and national maternal and early neonatal mortality rates. A systematic literature review identified studies documenting the factors associated with FBD, stratified by region. Rates of skilled birth attendance, facility delivery, maternal mortality, and early neonatal mortality were compared across nations and regions. 70 articles met inclusion criteria, reflecting wide variability in the number, type, and quality of studies by region. Within-country differences were most pronounced in nations where multiple studies were conducted. Correlation between FBD and maternal mortality rates throughout SSA was -0.69 (p=.008), and the correlation between facility delivery rates and early neonatal mortality rates was -0.41 (p=0.08). This study demonstrates the need to attend to regional differences both across and within SSA nations if facility delivery rates are to be improved to reduce maternal and early neonatal mortality. (*Afr J Reprod Health 2013; 17[3]: 30-43*)

Résumé

L'on comprend mal le taux de variabilité régionale dans l'accouchement dans des établissements de santé (AES) en Afrique sub-saharienne (ASS), pas plus que la relation entre AES et les taux national de mortalité maternelle et néonatale précoce. Une révision systématique de la documentation a identifié les études qui documentent les facteurs associés à AES, stratifiées selon les régions. Les taux d'accouchement assurés par des accoucheuses qualifiées, l'accouchement dans des établissements, la mortalité maternelle et la mortalité néonatale précoce ont été comparés auprès des nations et des régions. 70 articles répondaient aux critères d'inclusion, ce qui reflète une grande variabilité dans le nombre, le type et la qualité des études selon les régions. Les différences au sein des pays ont été plus remarquables dans les pays où de multiples études ont été menées. Les corrélations entre les taux de mortalité maternelle dans l'ensemble AES et SSA était de -0.69 (p = .008), et la corrélation entre les taux d'accouchement dans des établissements et les taux de mortalité néonatale précoce était de -0.41 (p = 0,08). Cette étude démontre la nécessité de s'occuper des différences régionales à la fois à travers et au sein des pays d'Afrique subsaharienne si les taux d'accouchement doivent être améliorés pour réduire la mortalité maternelle et néonatale précoce. (*Afr J Reprod Health 2013; 17[3]: 30-43*)

Introduction

The United Nations Millennium Development Goals (MDGs) seek to reduce the under-5 child mortality by two-thirds and maternal mortality by three-quarters between 1990 and 2015[1]. These goals, known as MDG 4 (child health) and MDG 5 (maternal health) have become critical targets for developing countries as they prioritize interventions and national health spending, and as the estimated time (2015) for achieving the MDGs

approaches. Yet meeting MDGs 4 and 5 is proving challenging: mortality rates are decreasing, but not rapidly enough to meet the MDGs in most countries[2,3].

Approximately 275,000 women each year die worldwide during and shortly after pregnancy[4]. While such numbers are encouraging in comparison to previous estimates that were nearly twice as high[5], it is noteworthy that 60% of the

reductions in maternal mortality can be attributable to improvements in 7 countries: India, Ethiopia, Pakistan, Nigeria, Indonesia, China, and Afghanistan[4]. Much of these improvements can be attributed to reductions in HIV-related deaths with the widespread roll-out of antiretroviral medications[4], but additional efforts to boost skilled birth attendance, increase access to emergency obstetric care, and improve quality of care have also led to reductions in maternal mortality worldwide. However, at the present pace, an estimated 96 countries in the world will take more than 20 years to reach MDG 5. According to estimates from 2010, no country in sub-Saharan Africa is on track to meet MDG 5 by 2015, and only six are likely to meet the MDG targets for maternal mortality before 2040 (Central African Republic, Equatorial Guinea, Namibia, the former Sudan, Uganda, and Rwanda)[4].

Child health indicators have also improved substantially since the MDGs were originally developed. Yet currently, 7.2 million children under the age of 5 die each year globally, 40.3% in the first 28 days of life. In Ghana, for example, for every 1000 live births, 25 infants do not survive past the first 28 days. That compares to only 4 infants for every 1000 in the United States who do not survive 28 days after birth[4]. In sub-Saharan Africa, one country (Madagascar) is projected to meet MDG 4 by 2015, an additional 8 (Eritrea, Ethiopia, Ghana, Liberia, Malawi, Rwanda, São Tomé and Príncipe, and Sierra Leone) are likely to achieve it by 2025, and 23 are unlikely to meet it before 2040[4].

Maternal mortality (deaths associated with pregnancy) and neonatal mortality (infant deaths within the first 28 days after birth) have many causes. Two primary causes of maternal mortality include sepsis, a severe infection associated with non-sterile delivery, and hemorrhage, or unabated severe bleeding. Severe bleeding after birth can kill even a healthy woman within two hours if she is unattended[5]. The main direct causes of early neonatal deaths – or deaths that occur within the first 7 days – are preterm birth, severe infections, and asphyxia[6]. Such conditions, if treated rapidly and appropriately by knowledgeable health care providers, do not have to result in death.

One of the most important ways to address some of the key factors associated with both maternal and neonatal mortality is ensuring skilled obstetric care at the time of delivery, which is often achieved in sub-Saharan Africa by encouraging pregnant women to deliver their infants in healthcare facilities[7,8]. In the event of unexpected birth complications, which occur in approximately one out of every 10 deliveries[9], every moment of delay in receiving skilled care significantly increases the risks of stillbirth, neonatal death and maternal death[10]. It is estimated that having universal skilled birth attendance could reduce maternal mortality by 13-33% and neonatal mortality 20-30% globally[11,12].

Yet numerous barriers to skilled birth attendance and facility-based delivery exist, including such things as cost, distance to facilities, perceived need, perceived quality of care, and availability of providers. There have been previous reviews of the literature surrounding facility-based delivery[13–15], but none has focused on sub-Saharan Africa, and none has attempted to unpack some of the regional differences that may differentially impact facility delivery rates throughout the continent.

In light of these issues, this study aimed to: 1) Conduct a systematic review of the literature surrounding facility-based delivery in sub-Saharan Africa with the goal of comparing the volume, types, and findings of research conducted in western, eastern, central, and southern sub-Saharan Africa; and 2) Utilize published percentages and ratios of skilled birth attendance, facility delivery, maternal mortality, and early neonatal mortality to demonstrate the relationship between skilled birth attendance (SBA), FBD and maternal and early neonatal mortality by region.

Methods

Search Strategy

A systematic search of the peer-reviewed, published literature from 1995 – 2011 was conducted to identify the published research surrounding the factors associated with delivery care in sub-Saharan Africa. Searches were conducted using the following databases: Ovid

MEDLINE (1948 to December 2011), Ovid MEDLINE In-Process & Other Non-Indexed Citations (January 4, 2012), EBM Reviews (1991 – December, 2011) (including ACP Journal Club, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, Health Technology Assessment, and NHS Economic Evaluation Database), International Pharmaceutical Abstracts (1970 to December 2011), Journals@Ovid Full Text, CINAHL Plus with Full Text (EBSCO), PubMed, Africa-Wide Info, Psych Info, Global Health, Social Science Full Text, Google Scholar, BioMed Central, and African Journals Online. Initial searches were conducted on August 14 and September 5, 2011, and searches were repeated on January 5, 2012.

The following key search terms were used in various combinations: maternal health services/utilization, developing country/ies, Africa, determinants or predictors, delivery services, facility-based delivery, facility delivery, institutional delivery, skilled birth attendance, skilled attendance, pregnancy. (Search strategy available upon request.) Additional hand searching was conducted by reviewing the references of all retrieved studies.

Study Selection and Data Extraction

Studies were included in the review if they were published in English between January 1995 and December 2011, were conducted entirely or in part in sub-Saharan Africa, reported on the results of original research, and included a focus on or primary outcome variable of facility-based delivery, delivery location, or skilled birth attendance. The timeframe (1995-2011) was selected for three reasons. First, the most comprehensive review of the topic was conducted in 1994[13], suggesting that 1995 would be logical year to begin this new systematic review; second, beginning with 1995 allowed us to maximize the ability to retrieve articles electronically; and third, 1995-2011 includes several years before the implementation of MDGs 4 and 5 and the years since their implementation. Selected articles needed to address determinants, predictors, or factors associated with women's delivery location.

Reviews of the literature were also included. Studies were excluded from this review if they were not published in the peer-reviewed literature (e.g. master's theses and dissertations were not included unless they were subsequently published in a peer-reviewed journal), if they did not include original data (e.g. editorials and commentaries were excluded), and if the focus was not explicitly on place of delivery or skilled birth attendance as an outcome. For example, many studies focus on maternal mortality as an outcome but include facility-based delivery as one determinant. Studies were not included in this review unless at least one of the primary outcomes of interest was facility-based delivery, place of delivery, or skilled birth attendance. Qualitative studies were included in this review if they explicitly explored factors associated with facility-based delivery.

Study inclusion was determined in a multi-step procedure. First, the bibliographic data and abstracts of studies identified through the systematic searches were evaluated for concordance with formal inclusion rules. Studies that clearly did not meet inclusion criteria were discarded at this stage. The remaining studies were selected for full-text retrieval and were reviewed more closely to determine eligibility for inclusion. At this stage, publications that did not present original data or otherwise did not meet inclusion criteria were discarded, but not before hand-searching the references. Full texts of the additional studies identified from the references were retrieved. In a final step, the remaining studies were examined in detail to identify the final sample of studies meeting all inclusion criteria.

From all remaining studies, the following data were extracted: author, year of publication, country of focus, data source, year data were collected, study design, sample size and description, main predictor variables assessed, main outcomes variables assessed, analysis method, main findings per delivery location, and whether a conceptual framework was utilized.

Analysis and Synthesis Strategy

Given the variety of types of studies included in this systematic review – including descriptive and

evaluative studies that ranged from simple bivariate analyses to complex multivariate modeling – a meta-analysis was neither possible nor appropriate. Separate tables were created by region (Western Africa, Central Africa, Eastern Africa, and Southern Africa) and by countries within those regions to summarize the evidence in each country regarding correlates of facility-based delivery.

Qualitative findings – especially those considered "outliers" when compared to commonly reported quantitative findings – were addressed explicitly in the analysis of these findings. Although qualitative findings (by virtue of the difficulty of quantifying them) and outliers (by definition) may be unlikely to appear in summary tables, their presence in the research literature is important to note as potential avenues for further research or as mechanisms to help contextualize the quantitative literature.

Identifying Regional Rates

The Measure DHS website (home of all Demographic and Health Survey Data, www.measuredhs.com) and the published research literature were examined for national percentages of skilled birth attendance and percent of women reporting facility delivery[4, 16]. In most cases, percent of SBA and FBD utilization were very similar, and percentages were combined to be categorized as "very low, low, medium, high, and very high" based upon the percentage quintile reported (0-20% = very low; 21-40% = low; 41-60% = medium; 61-80% = high; 81-100% = very high). Maternal mortality ratios and early neonatal mortality ratios were identified as well. The distribution of maternal and early neonatal mortality ratios for the nations of sub-Saharan Africa was compared to the distribution of maternal and early neonatal mortality ratios for nations around the globe as identified through the published research literature[4,16]. Given that the lowest quintile for both maternal and early neonatal mortality in sub-Saharan Africa overlapped with the second highest quintile for maternal and early neonatal mortality globally, further analysis focused on the mortality quintiles within the nations of sub-Saharan Africa.

Cut points were developed by creating a distribution of mortality percentages (both maternal and early neonatal) from across sub-Saharan Africa that was then divided into quintiles. Cut points are illustrated in Table 4. Quintiles were then labeled as very low, low, medium, high, and very high. Note, however, that "very low" in sub-Saharan Africa is equivalent to "high" in a global context.

Finally, quintiles were then re-labeled numerically 1-5 and a Pearson correlation coefficient was calculated comparing facility delivery rates against both maternal mortality rates and neonatal mortality rates.

Results

A total of 1,168 citations were identified through database searching, of which 123 were retrieved for full-text review. Of the 1,045 that were eliminated, most were eliminated due to failure to focus on place of delivery as a primary outcome measure, conduct of research in a western setting, or the lack of original data. Of the remaining 123 articles retrieved for full-text review, an additional 43 studies were identified by searching the references. The vast majority of those 43 additional studies were published in non-indexed, regional journals. Thus a total of 166 articles were identified for full text review. A total of 85 were removed including 22 that were conducted in developing countries outside sub-Saharan Africa, 20 whose focus was on an outcome aside from place of delivery, 35 that did not include original data, 4 that were not published in the peer-reviewed literature, and 4 that were unable to be located. This left a total of 81 published studies that met all inclusion criteria and for which data were extracted. Of those 81, 11 included a focus on too many countries to yield sufficient individual-country data. Thus 70 articles were formally included in this review, including three that were conducted in two or more sub-Saharan African nations and included adequate individual-country data[17–19].

Number of Types of Publication per Region

A total of 70 articles focusing on facility-based delivery, place of delivery, or skilled birth

attendance as an outcome were identified in the literature. Table 1 illustrates the number and type of studies. Note that 58 out of the 70 articles identified (82.9%) came from West and East Africa, and only 1 came from Central Africa. Seventy-nine percent of articles (55 out of 70) were quantitative in nature, 11% (8 out of 70) were qualitative, and 10% (7 out of 70) used mixed methods.

Table 1 also illustrates an assessment of the sophistication of the data analysis in the published studies, broken down by region. Overall, 62 out of 70 studies (89%) utilized quantitative data, either alone or in a mixed methods study. Of those 62, 39 (62.3%) included multivariate analysis. The remaining 23 studies (37.1%) limited their analysis to descriptive or bivariate statistics.

Table 1: Distribution and Methodology of Published Research Studies on Facility-Based Delivery in Sub-Saharan Africa

Region	Total Number of Published Studies (1995-2011) N (%)	Mixed Methods (Qualitative + Quantitative) N (%)	Qualitative Data Only N (%)	Quantitative Data Only N (%)	Quantitative: Descriptives / Bivariates Only N (%)	Quantitative: Multivariate N (%)
Western[1]	30 (42.2)	3 (43.0)	4 (50.0)	23 (41.8)	12 (53.0)	14 (35.9)
Eastern[2]	28 (39.4)	3 (43.0)	2 (25.0)	23 (41.8)	6 (24.0)	20 (51.3)
Central[3]	1 (1.0)	0	0	1 (1.8)	0	1 (2.5)
Southern[4]	11 (15.4)	1 (14.0)	2 (25.0)	8 (14.5)	5 (24.0)	4 (10.3)
TOTAL	70	7 (10.0*)	8 (11.4*)	55 (78.5*)	23 (37.1**)	39 (62.3**)

[1]Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo
[2]Djibouti, Eritrea, Ethiopia, Kenya, Somalia, Tanzania, Uganda
[3]Burundi, Central African Republic, Chad, Democratic Republic of Congo, Rwanda
[4]Angola, Botswana, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Zambia, Zimbabwe
* Percent of all studies
** Percent of studies that included quantitative data (N=62)

Facility-Based Delivery Rates Across Regions

Across the 30 articles published with data from West Africa (see Table 2), facility-based delivery percentages varied widely. De Allegri et al.[20] found only 7.2% of women in rural Burkina Faso delivered in a facility, and Oguntunde found only 11.7% of women in one region of Nigeria delivered in a facility[21]. However, Galaa and Daare[22] found that nearly two-thirds of women in Northern Ghana delivered in a facility (63%), and Faye et al[23]. found that 78% of women in Senegal delivered in a facility.

In Eastern Africa, the lowest rate of facility delivery reported was in Tanzania at 36%[24], whereas Tann et al.[25] reported nearly 83% of women delivering in a facility in Uganda. The majority of other studies cited percentages between 40 and 60%.

The one study in Central Africa reported a percentage of 29.3% of women delivering in a facility[26].

In the 11 published studies identified in Southern Africa, the lowest rate of facility delivery was found in Zambia at 32.5%[27], with the highest percent at 85% in Zimbabwe[28].

Table 2: Studies published regarding facility-based delivery in by region since 1995

WEST AFRICA	
BURKINA FASO	De Allegri et al., 2011[20], Hounton et al., 2008[34], Stephenson et al., 2006[17]
GAMBIA	Telfer et al., 2002[81]
GHANA	Adanu, 2010[82], Addai, 2000[46], Akazili et al., 2011[83], Bazzano et al., 2008[67], Crissman et al., 2011[77], D'Ambruoso et al., 2005[73], Galaa and Daare, 2008[22], Gyimah et al., 2006[33], Jansen, 2006[66], Martey et al., 1995[84], Mills and Bertrand, 2005[63], Mills et al., 2008[79], Penfold et al., 2007[85], Smith and Sulzbach, 2008[18]
MALI	Gage, 2007[56], Smith and Sulzbach, 2008[18]
NIGERIA	Aremu et al., 2011[47], Asuquo et al., 2000[72], Babalola and Fatusi, 2009[30], Ejembi et al., 2004[55], Idris et al., 2006[86], Oguntunde et al., 2010[21], Olusanya et al., 2010[39], Onah et al., 2006[58], Osubor et al., 2006[74], Uzochukwu et al., 2004[45]
SENEGAL	Faye et al., 2011[23], Smith and Sulzbach, 2008[18]
CENTRAL AFRICA	
RWANDA	Hong et al., 2011[26]
EASTERN AFRICA	
ERITREA	Woldemicael, 2010[19]
ETHIOPIA	Mekonnen and Mekonnen, 2003[52], Woldemicael, 2010[19]
KENYA	Bazant et al., 2009[48], Cotter et al., 2006[87], Fotso et al., 2008[32], Fotso et al., 2009[31], Fotso et al., 2009A[88], Hodgkin, 1996[57], Magadi et al., 2000[49], Mwaniki et al., 2002[59], Ochako et al., 2011[38], Stephenson et al., 2006[17], Wanjira et al., 2011[54]
TANZANIA	Danforth et al., 2009[69], Kowalewski et al., 2000[76], Kruk et al., 2009[80], Kruk et al., 2010[89], Magoma et al., 2010 [71], Mpembeni et al., 2007[53], Rockers et al., 2009[24], Spangler and Bloom, 2010[40]
UGANDA	Amooti-Kaguna and Nuwaha, 2000[68], Ekirapa-Kiracho et al., 2011[90], Kyomuhendo, 2003[65], Mbonye and Asime, 2010[91], Mulogo et al., 2006[92], Nuwaha & Amooti-Kaguna, 1999[37], Tann et al., 2007[25]
SOUTHERN AFRICA	
BOTSWANA	Letamo and Rakgoasi, 2003[36]
MALAWI	Seljeskog et al., 2006[62], van den Broek et al, 2003[60]
SOUTH AFRICA	Cronje et al., 1995[93], Tlebere et al., 2007[75], Wilkinson et al., 1997[94]
SWAZILAND	Thwala et al., 2011[61], Uyirwoth et al., 1996[64]
ZAMBIA	Gabrysch et al., 2011[27]
ZIMBABWE	Nilses et al., 2002[28], van den Heuvel et al., 1999[95]

Findings Across the Regions

The most frequently cited factors associated with facility-based delivery in sub-Saharan Africa appear to be similar across regions. These include such well-documented predictors such as economic factors (including maternal socioeconomic status, household wealth quintile, household assets, health insurance)[26,29–45], maternal factors (such as maternal education and antenatal care attendance)[17,19,22,29–39,41,46–54], and logistical factors (such as distance to a facility or rural / urban residence)[20,22–25,27,34,40,49,53,55–60]. Also visible across the studies is the impact of culture on facility delivery rates, as well as the impact of women's trust in facilities. Cultural factors prominent in the literature include such things as issues surrounding traditional birth practices[61–63],

cultural beliefs about childbirth[55,64–67], and the importance of who is the ultimate decision-maker in matters of reproductive health[53,62,63,66–71]. Studies also cite a lack of trust in facilities, concerns about quality of care, or fear of maltreatment as prominent barriers to facility delivery[55,58,62–64,67,72–76].

Despite findings that generalize across sub-Saharan Africa, regional and local variability is also apparent across these studies.

In West Africa, Bazzano et al.[67] reported that home birth was described as preferable in some cases because it protects secrecy, avoids onlookers, and prevents other people talking about or gossiping about how well the woman does in labor. More recent research in another area of West Africa found that 100% of the women interviewed expressed a strong preference for facility-based delivery, as it was known to "keep them safe"[77,78]. Jansen[66] reported that the decision makers in one community in rural Ghana were the older women – not the women in labor. In Nigeria, Osubor et al.[74] reported that the perceived etiology

of pregnancy problems influences care seeking – with traditional or spiritual problems treated differently than normal or physical problems.

In East Africa, Kowalewski et al.[76] reported that in Tanzania, "going to a facility is seen as a failure of self-treatment." Also in Tanzania it was reported that there were widely held beliefs that 'normal' pregnancies (as defined at antenatal care) would result in normal deliveries and thus did not warrant facility delivery[71]. The same was found in Uganda[68]. In a different region in Tanzania, women reported a "desire to appear modern" as a driving force behind wanting to deliver in a facility[40]. Finally, in Uganda, Kyomuhendo[65] reported that a high value was placed upon stoicism. Even if symptoms become severe, "a proper woman" would not communicate that to just anyone.

In Southern Africa, Thwala et al.[61] cited the common engagement of a dual health belief system, allowing traditional and contemporary health views to coexist and thus each influence treatment decisions.

Table 3: SBA, FBD, MMR and ENMR by region in Africa

Country/Year	Percent of women reporting having a Skilled Birth Attendant	Percent of women reporting delivering in a health facility	Quintile* ranking of facility-based delivery	Maternal Mortality Ration (MMR) per 1000 Live Births	African MMR quintile* based on Lozano et al., 2011[4]	Early Neonatal Mortality Ratio (ENMR) per 1000 Live Births**	African ENMR quintile based on Lozano et al., 2011
WEST AFRICA							
Benin, 2006	76.2	80.5	Very high	329.0	Low	23.4	Medium
Burkina Faso, 2003	39.7	40.5	Medium	353.6	Medium	25.5	High
Ghana, 2008	57.8	60.1	Medium	328.3	Low	20.2	Medium
Guinea, 2005	30.5	31.8	Low	664.1	Very high	29.2	Very high
Mali, 2006	28.8	47.5	Medium	418.8	Medium	33.5	Very high
Niger, 2006	18.7	18.1	Very low	522.4	High	20.5	Medium
Nigeria, 2008	36.1	36.5	Low	487.1	High	28.7	Very high
Senegal, 2005	47.2	64.1	High	368.4	Medium	19.5	Low

EAST AFRICA							
Ethiopia	-	6.4	Very low	528.8	High	24.9	High
Kenya, 2008	48.0	46.8	Medium	294.2	Low	19.0	Low
Tanzania, 2204-05	45.5	50.2	Medium	417.5	Medium	18.5	Low
Uganda, 2006	45.2	45.3	Medium	274.2	Low	21.1	Medium
CENTRAL AFRICA							
Chad, 2004	2.6	13.3	Very low	608.3	Very high	31.7	Very high
Rwanda, 2007	50.7	49.6	Medium	335.0	Medium	19.8	Medium
SOUTHERN AFRICA							
Madagascar, 2008-09	47.2	37.6	Low	424.4	Medium	14.3	Very low
Malawi, 2004	56.8	69.7	High	421.6	Medium	20.6	Medium
Mozambique, 2003	50.2	50.2	Medium	509.8	High	27.9	High
Zambia,2007	48.0	50.5	Medium	293.0	Low	17.6	Low
Zimbabwe, 2005-06	70.1	69.5	High	329.2	Low	16.5	Very low

* See Table 4 for description and illustration of quintile cut points
**Early Neonatal mortality defined as mortality in first 0 to 6 days after birth
Source: Measure DHS, Wang et al., 2011; Lozano et al., 2011

Table 4: Maternal and early neonatal mortality quintiles globally and across sub-Saharan Africa

	Global* Maternal Mortality Ratio Quintile Cutpoint	**African* Maternal Mortality Ratio Quintile Cutpoint**	**Global Early Neonatal Mortality Ratio Quintile Cutpoint**	**African Early Neonatal Mortality Ratio Quintile Cutpoint**
Very Low (0-20%)	≤ 13.2	≤ 272.9	≤ 2.3	≤ 17.3
Low (20.1 – 40%)	13.3 – 35.2	273.0 – 334.9	2.4 – 5.5	17.4 – 20.0
Medium (40.1 – 60%)	35.3 -74.3	335.0 – 438.8	5.6 – 11.6	20.1 – 24.3
High (60.1 – 80%)	74.4 – 328.5	438.9 – 554.3	11.7 – 19.7	24.4 – 28.1
Very high (80.1 – 100%)	≥ 328.6	≥ 554.4	≥ 19.8	≥ 28.2

* Global quintiles defined using country-specific data from 187 countries listed in Lozano et al., 2011.
** African quintiles defined using country-specific data from 48 African countries listed in Lozano et al., 2011

Relationship between SBA, FBD, and Maternal and Neonatal Mortality

Table 3 illustrates skilled birth attendance, facility-based delivery, and maternal and early neonatal mortality by regions of sub-Saharan Africa for every country for which recent data across all four categories were available. When quintiles were treated numerically and compared via correlation, facility delivery and maternal mortality had a

significantly inverse relationship (Pearson's correlation coefficient of -0.69, p=0.008). Facility delivery rates and rates of early neonatal mortality were also inversely correlated (Pearson's correlation coefficient of -0.41, p=0.08). (See Table 5)

Table 5: Correlation between facility delivery rates and rates of maternal and early neonatal mortality overall and by region in sub-Saharan Africa*

	Facility-based delivery ratio versus Maternal mortality ratio Pearson's correlation coefficient (p value)	Facility-based delivery ratio versus Early neonatal mortality ratio Pearson's correlation coefficient (p value)
Overall (across sub-Saharan Africa) (N=19)	-0.69 (0.008**)	-0.41 (0.08**)
Western Africa (N=8)	-0.74 (0.03**)	-0.41 (0.30)
Eastern Africa (N=4)	-0.87 (0.12)	-0.87 (0.12)
Central Africa (N=2)	-1.0 (-)	-1.0 (-)
Southern Africa (N=5)	-0.28 (0.64)	0.18 (0.76)

*Based on data presented in Table 4; quintiles were treated numerically (1=very low, 2=low, 3=medium, 4=high, 5=very high)
** Significant at $p<0.05$

Note that despite a trend indicating that areas of high SBA and FBD have generally lower maternal and neonatal mortality, this trend is not universal. In addition, within regions, there is enormous variability across of all four measures. Table 4 illustrates the source of categorizations of maternal and early neonatal mortality quintiles, looking both globally and within sub-Saharan Africa.

Discussion

This review of the published literature in sub-Saharan Africa pursuant to facility-based delivery has clearly demonstrated the complexity of the issue, as well as the regional variability in drivers and barriers to facility delivery that is likely to plague efforts to boost utilization. This review, unlike any published previously, highlights the quantity, quality, and types of research published by region in sub-Saharan Africa, emphasizing the gaps in knowledge associated with the regions where the least research has been conducted (e.g. Central Africa). Cultural factors and trust in facilities and providers can serve as significant deterrents to facility delivery throughout sub-Saharan Africa, yet local and regional differences are worthy of attention. Such differences are especially critical to understand given the association seen between skilled birth attendance and facility-based delivery utilization and ratios of both maternal and early neonatal mortality throughout sub-Saharan Africa. While such associations cannot be definitively determined as causative, the consistency of the inverse relationship between facility delivery and maternal and early neonatal mortality is highly supportive of the link – a link which has been demonstrated elsewhere as well[11].

This review demonstrates variability in the factors affecting facility-based delivery across regions and nations. Given enormous differences in economic development, government involvement in providing low-cost or free health coverage, and historical inclusion of traditional birth attendants in delivery practices, it is not surprising that the nations of Africa face different challenges from one another when encouraging women to deliver in facilities.

However, this review suggests that the nations of Africa also experience within-country variability. This point is perhaps the most critical – that even within nations there are substantial differences in the factors that appear to be driving facility delivery utilization. Yet it is only in those nations in which multiple researchers have conducted multiple studies that those differences become apparent. For example, in Ghana, where 14 separate studies have examined the issues

surrounding facility delivery, it is much easier to see regional differences than it is in Rwanda, where there is only one published study to date. To illustrate this point, one study in the Brong Ahafo region of Ghana cited home delivery as being preferred because of a lack of confidence in health staff at facilities[67], while another study in the Eastern Region reported 100% of respondents expressing a preference for delivering in a health facility[77,78], and a third study in the Upper East region reported that community perceptions of quality of care were not significantly related to FBD rates[79]. Region of residence appears to be strongly linked to likelihood of facility-based delivery in Ghana, with enormous variability across the 10 municipal regions.

Similarly, variability with regard to the drivers of facility delivery is more apparent across the regions of Eastern and Western Africa (where 28 and 30 studies have been published respectively) than it is in Southern and Central Africa (where 11 and 1 study have been published respectively). Future research is needed that begins to address the gaps in our knowledge by focusing efforts on those areas of sub-Saharan Africa that remain understudied and thus less well understood.

Nonetheless, this review highlights two relatively under-studied factors impeding the use of health facilities for delivery: lack of confidence in the healthcare system and cultural beliefs and norms.

Lack of confidence in the healthcare system and the quality of care provided was reported throughout sub-Saharan Africa and included such diverse concerns as whether a provider and supplies would be available when a woman arrived for delivery[80] to having multiple unrelated newborn babies sharing beds[73]. Studies also suggested that women's previous experiences with a facility – even those they have heard from others – may influence their delivery decisions. This is in keeping with anecdotal experiences that suggest women hear about bad experiences or poor outcomes at facilities and then are afraid to go to a facility for fear a similar outcome will happen to them. Then they wait until they are very ill before going to the facility, where in turn they have a poor outcome due to late presentation, thus feeding the cycle of concerns about quality of care.

Lack of confidence in the healthcare system also includes such factors as concerns about the skills of the provider and fear of maltreatment[62,67,75]. Taken together, this review suggests that providers, healthcare administrators, educators, and government agencies will be well-served to prioritize improving quality of care in future healthcare initiatives.

Throughout much of sub-Saharan Africa, cultural beliefs and norms may run counter to facility delivery. In Ghana, Jansen[66] and Bazzano et al.[67] published studies that showed home delivery raises a woman's status within her family. In addition, facility delivery may require women to forego traditional birth practices, including such things as drinking herbal concoctions to hasten delivery, squatting for delivery rather than laying supine, or being able to take home the placenta after delivery. In many facilities, family members are excluded from the labor and delivery ward – so an event that might normally include extended family and supportive lay helpers is transformed into a solitary experience for a young laboring woman if she opts for a facility delivery. Finally, several studies have described the important role of spouses and other key decision-makers in influencing facility delivery – suggesting that the beliefs of significant others in a woman's life are likely to impact where she delivers[53,62,63,66–71]. In many cases, the direction of influence is away from facility deliveries.

This study has several limitations worthy of comment. First, retrieved articles were limited to those published in English. It is possible that the inclusion of French- or Portuguese-language articles may have influenced the number and type of publications retrieved. Second, this study did not attempt to synthesize all published data on rates of facility delivery, maternal mortality, and early neonatal mortality in Africa, and instead relied upon a few of the most recent, most prominent published sources of data. Estimates of such percentages ratios are subject to variability, and it is possible that findings might be slightly different if a more diverse pool of data sources was used. However, we opted to err in favor of consistency of data sources, rather than broadening the number of countries that could be included while using less consistent sources of data. This

study also did not attempt to tease out the numerous causes of maternal mortality and neonatal mortality and juxtapose those causes against national and regional rates. For example, there are disparities in maternal and neonatal mortality ratios that may be explained by further analysis of the most likely proximate causes, however such analysis was beyond the scope of this inquiry. Finally, as with any cross-sectional analysis, correlation is not necessarily evidence of causation. The relationship found between facility delivery and maternal mortality and early neonatal mortality may indeed be reflective of other intervening variables not addressed in this analysis. For example, policies targeted at improving maternal and child health vary widely across the continent, as does the political will and the resources deployed to implement such policies. Thus situational factors may influence the relationship identified in these data.

Nonetheless, we believe this study provides a valuable contribution to the literature. Not only does it attempt to disaggregate the findings of research addressing FBD in Africa, but it also demonstrates the reason why FBD is important: it is inversely related to both maternal mortality and early neonatal mortality when examined on a nation-wide scale.

In conclusion, this study is a reminder that sub-Saharan Africa is not a monolithic unit, and the importance of remembering the local context when addressing health-related issues in the region is paramount. Researchers, clinicians and policy makers need to understand the unique factors facing women in their local context before they can be adequately addressed.

Contribution of Authors

All authors have contributed to the conceptualization, conduct, and analysis of this research, and all authors have participated in the manuscript drafting, editing, and revising. All authors have approved the final version of this manuscript.

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