Mapping the quality of basic and comprehensive emergency obstetric care services in Haiti.

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Abstract

Objective

To investigate geographical inequalities and changes in the quality of emergency obstetric care services available in Haiti over time.

Methods

We utilised data from the Service Provision Assessment (SPA) survey of all health facilities in Haiti in 2013 and 2017. We developed a quality index for Basic and Comprehensive Emergency Obstetric Care (BEmOC and CEmOC) based on the items in the signal functions of emergency obstetric care framework, using a structure, process and outcome framework. We measured the quality index of all facilities in 2013 and 2017. We also assessed geographical trends and changes in quality between 2013 and 2017 using geospatial analysis.

Result

Our analysis showed that basic structure items such as connection to electricity grid, manual vacuum extractors, vacuum aspirators and dilation and curettage kits were widely unavailable at health care facilities. There was a significant improvement in indicators of structure ($p < 0.001$) and BEmOC ($p = 0.03$) in primary facilities, however there was no significant change

in quality of CEmOC in primary facilities ($p = 0.18$). Similarly, there was no significant change in any of the structure or process indicators at secondary care facilities structure items

Conclusion

The availability of basic emergency obstetric care at several Haitian facilities remains poor, however there was significant improvement at primary care facilities, with little to no change in overall quality at secondary health facilities.

Introduction

Despite remarkable improvement in obstetric care coverage in Low-and Middle-Income Countries (LMIC), there remains an unacceptable high number of pregnancy related deaths in these countries (1). Studies have shown that the increase in the number of health-care facility births in low-income countries, may not sufficiently translate into reduction in maternal or newborn mortality due to the poor quality of care (2,3).

Over the past few decades, efforts to monitor and evaluate Maternal, Newborn and Child Health (MNCH) care services in LMIC has been directed towards evaluating service coverage and utilisation, with very few studies exploring service quality (2). The few studies conducted have consistently shown that despite the increase in MNCH intervention coverage and increase in the availability of institutional care coverage, many avoidable deaths still occur during the perinatal period, many of which is due to poor quality of services (1,4).

Studies have shown that timely recognition of obstetric complications and effective treatment of these complications is critical for reducing maternal mortality (5–7). Significant work has been done over the past three decades to develop reliable and internationally comparable indicators for measuring progress in obstetric care service coverage and quality. One of such

important works, is the “guideline for monitoring availability and use of obstetric services”, published by UNICEF, WHO and UNFPA in 1997 (8). This guideline contained an organising framework, which encompasses interventions and services required for the management of common pregnancy and child birth related complications (8,9). These interventions and services were termed the signal functions of Basic Emergency Obstetric Care (BEmOC) and Comprehensive Emergency Obstetric Care CEmOC (9). The signal functions of BEmOC and CEmOC are an easier approach for measuring progress towards reduction of maternal mortality, when compared to other indicators such as maternal mortality rates or ratio (8,9).

Significant gaps remain in the existing body of evidence on the quality of obstetric care services in LMIC. Many of the previous studies have focused on exploring a broad range of issues such as: cross-sectional analysis of quality and service readiness in LMIC (3); linking quality of MNCH services to the level of utilisation of delivery care (4,5); developing summary indices for measuring quality of care (12) ; investigating association between service quality and client satisfaction (13).

Furthermore, previous studies have also explored the coverage and access to BEmOC and CEmOC in different countries: a recent systematic review identified twenty-seven of such studies (14). Bosomprah et al. conducted an analysis of the spatial distribution of emergency obstetric and newborn care in Ghana, and compared existing coverage with the minimum acceptable coverage level, showing that the country was below acceptable international standards (15). Gabrysch et al. explored geographical access to emergency obstetric care in Zambia (16). Hirose et al. conducted a spatial modelling of factors contributing to delays in reaching an emergency obstetric facility in Afghanistan (17). A number of studies have also conducted a snap-shot analysis of the quality of emergency obstetric care at a given point in time in various countries (13,18,19).

We identified 24 items that are associated with the signal function of BEmOC and CEmOC (10,11). We stratified health facilities into primary facilities (non-hospitals) and secondary facilities (hospitals). We grouped these items into structures and processes based on a proxy of the Donabedian dimensions (12). This framework was then used to explore national and sub-national change in obstetric care quality in Haiti between 2013 and 2017. While our approach may serve to provide some context regarding the quality of obstetric care in Haiti and geographical differences. However, Donabedian’s work on the seven attributes that

defines health care highlights other parameters such as accessibility, cost and benefit, conformity to social preferences, provider-client relationship amongst other factors (21). Some of these more nuanced measures of quality may require a broader set of tools to assess them. Notably, there is no study till date that explored geographical change over time in emergency obstetric care quality in any given country. Our objective in this study, is to fill this gap in literature, by creating an index based on signal functions of BEmOC and CEmOC and using geospatial approach to monitor geographical disparity and changes in the quality of emergency obstetric care services in Haiti over time.

Method

Data source

We used two waves (2013 and 2017) of the Haiti Service Provision Assessment (SPA) survey, to explore change in the quality of emergency obstetric care over time. The SPA is a nationally representative facility-based cross-sectional survey, which is conducted periodically by the Demographic Health Survey (DHS) program. The survey includes data on healthcare service quality, which is derived through facility audits, healthcare worker survey, client observation and interviews. Further details on the SPA survey are available elsewhere (13). The facility coordinates were derived from the SPA GPS dataset, they represent the true location of the facility and are not displaced. The DHS program however states that the coordinates may not align precisely with the GIS data due to slight variations in shapefiles or generalisation of administrative boundaries. We derived the Haitian administrative boundary coordinates data from the Global Administrative Boundary Database (<https://gadm.org/data.html>).

Settings & survey design

The study sample is made up of all public and private health facilities in Haiti in 2013 and 2017. This sample was drawn from a cross-sectional survey of all facilities conducted by the Demographic and Health Survey (DHS) programme in 2013 and 2017, respectively. The SPA is designed to address four broad groups of questions as follows:

- (1). What is the availability of different health services in a country? Specifically, what proportions of the different facility types offer specific health services?
- (2). To what extent are facilities prepared to provide health services? Do facilities have the necessary infrastructure, resources, and support systems available?
- (3). To what extent does the service delivery process follow generally accepted standards of care? Does the process follow in service delivery meet standards of acceptable quality and content?
- (4). Are clients and service providers satisfied with the service delivery environment?

We selected Haiti for this study, due to readily available national facility data over two time periods (2013 and 2017). In addition, Haitian facilities provided an ideal setting for our study due to a number of contextual reasons. Firstly, Haiti has one of the highest maternal mortality levels globally and the highest in the western hemisphere with an estimate of 359 deaths for every 100,000 births (23). Secondly, the Haitian health setting provides insight into health system resilience and recovery from disaster. An earthquake in January 2010 significantly strained the Haitian health system, with several lives lost and 50 health facilities destroyed (24,25). Notable health gains have been recorded over the past decade since the earthquake (26), it is important to assess these gains, and to explore changes in health service quality.

Statistical analysis & Measures

Facility characteristics

A descriptive analysis was conducted, exploring facility characteristics such as whether a facility was located in an urban or rural area, facility level of care, management type, availability of normal delivery and laboratory services.

Facility quality index

A quality index was computed for facilities that performed normal delivery and newborn care in 2013 and 2017 respectively. We created a 24-item index comprising of structure and processes based on the signal functions of BEmOC and CEmOC services. The signal function

indicators are standardised and includes processes that are routinely carried out in facilities providing obstetric services. The survey also collected process data over a 3-month period, during which many of the routine processes would have been performed.

In addition, the structure indicator included in our analysis are linked to the process indicator, such that the structure indicators explore whether a facility has the basic equipment required for the routine processes comprising the signal functions of BEmOC and CEmOC. For example, a manual vacuum extractor is often used for assisted vaginal delivery: which is part of the BEmOC. Similarly, suture material with needles may be required for both assisted vaginal delivery, if episiotomy was provided (BEmOC) as well as for Caesarean section (CEmOC). Vacuum aspirator or dilation and curettage (D&C) kit will be necessary for the removal of retained products. As there is no consensus on the structure indicator items for obstetric facilities, we relied on evidence from previous literature to determine the composition of items that were included.

Furthermore, some of the indicators are also mutually exclusive, if a facility has performed one process indicator, it also suggests that delivery care has taken place during this time frame.

The availability of each indicator of structure was determined by both provider responses and verification by the interviewer as to whether an item was observed or not. The availability of each process indicator was determined from the response given by providers to questions regarding whether a service has been performed over the past 3 months (See Table 2).

We stratified by facility types into primary or secondary. Primary facilities are health centers, while secondary facilities are hospitals. Theoretically, primary care facilities in many LMICs are expected to provide BEmOC and promptly identify complications and refer to higher level facilities. This however may not be the reality in practice in many LMICs settings, wherein complications may not be identified on time, or providers may choose not to refer complicated cases. Indeed, some authors have now called for a service redesign, such that deliveries only take place in facilities with the highest quality (7). On the basis of these realities, we also assessed CEmOC in primary care facilities.

Composite measures

Two indices were computed using a simple additive calculation analysis as follows:

National quality score

The national quality score is an aggregative measure for each indicator. Each facility was allocated a score of 0 for each indicator of structure that was not observed or for a process indicator that has not been performed over the past 3 months. A score of 1 is allocated to each observed structure indicator or process indicator performed in the past 3 months. We calculated a quality score for all facilities in Haiti, by aggregating the percentage number of facilities where an indicator is observed, or a process was performed in the last 3 months. A

Mean facility quality score

The mean quality score is a facility-level composite score, this was required for sub-national geographical comparison. We calculated a score for each Haitian facility by computing a mean score of all observed structure or process indicator at each facility

Statistical test

We calculated percentage point difference in the structure and process indicators between 2013 and 2017 for facilities that have conducted normal delivery and newborn care during this period. A Wilcoxon Signed rank test was conducted to assess for significant difference in the indicators of structure, BEmOC and CEmOC processes respectively (see Table 3).

Geospatial analysis

Using the 2013 and 2017 survey data, we computed a mean quality score for each facility by estimating the mean number of structure items observed or process items in each health care facility over the past 3 months. We thereafter performed a geospatial analysis by joining the geospatial coordinate data for each facility with the mean quality score for each facility. A sub-national analysis of obstetric care quality and change in quality over time was conducted and illustrated using choropleth maps. The maps were based on the official administrative boundary derived from GADM.

Results

In 2013, a total of N= 907 facilities were surveyed. With regards to facility location, less than half (42.7%) of the facilities located in urban area had normal delivery services available, similarly less than half (43.2%) of those in rural areas had normal delivery service. Just over

one-third (37.6%) of primary care facilities had delivery services present, in contrast majority (77.7%) of secondary care facilities had delivery services. More than half (57.0%) of government/public facilities had normal delivery services present, less than one-third of NGO and private facilities (28.3% and 30.4% respectively) had normal delivery services. Less than half (47.4%) of facilities with laboratory services had normal delivery services. (See Table 1).

In 2017, a total of N= 1,033 facilities were surveyed. In terms of facility location, just over one-third (38.4%) of the facilities located in urban area had normal delivery services available, similarly only about one-third (34.3%) of those in rural areas had normal delivery service. Less than one-third (28.8%) of primary care facilities had delivery services present, in contrast majority (83.2%) of secondary care facilities had delivery services. Less than half (45.3%) of government/public facilities had normal delivery services present, less than one-third of NGO and private facilities (29.9% and 29.3% respectively) had normal delivery services. Less than half (45.2%) of facilities with laboratory services had normal delivery services. (See Table 1).

[Insert Table 1]

Table 2 shows the BEmOC and CEmOC quality index in 2013 and 2017 at primary and secondary care facilities. A higher proportion of secondary care facilities had basic infrastructures and equipment when compared to primary care facilities. However, some basic structure items were lacking in most facilities.

In 2013, only 2.7% and 17% of primary and secondary facilities respectively were connected to the electricity grid. Only a few facilities had vacuum extractor [primary facilities (4.1%); Secondary facilities (28.7%)]. Vacuum aspirators, dilation and curettage kits were also available in only a few facilities [primary facilities (14.6%); Secondary facilities (35.1%)]. Only 14.6 % of primary facilities used partographs routinely, while one-third (34%) of secondary care facilities routinely used partographs. Medical mask was available in only 37.6 % of primary care facilities and in just over half (53.2%) of secondary facilities. Medical gowns and suture materials such as needles, scissors or blades were available in most primary and secondary facilities. Regarding the availability of essential medications, less than half (47.1%) of primary care facilities had injectable uretronic (oxytocin), only 19% of primary

facilities had injectable diazepam. In contrast, over three quarter (77.7%) of secondary care facilities had injectable uretronic (oxytocin), less than half (48.9%) of secondary care facilities had injectable diazepam. In terms of newborn care, resuscitation bags, mask or tube were available in only 23.4% and 75.5% of primary care facilities and secondary care facilities respectively, incubators were available in 6.8% and 29.8% of primary care and secondary care facilities respectively.

Regarding basic emergency obstetric care, primary facilities had performed less BEmOC related services compared to secondary facilities during the preceding 3 months. Only 44.7% of primary facilities had administered parenteral antibiotics, compared to 90.4% of secondary care facilities. Just 18.0% of primary care facilities had administered parenteral anticonvulsants in the past 3 months preceding the audit. In contrast 71.3% of secondary facilities have administered parenteral anticonvulsant during the same time frame.

Comprehensive emergency obstetric care services were not routinely performed in majority of primary care facilities, with only 1 % performing blood transfusion; in contrast, just less than half of secondary facilities (47.9%) had performed blood transfusion during the same time frame. Only 2.7% of primary care facilities provided Caesarean section in the past 3 months, whereas over three-quarter (77.9%) of secondary care facilities had performed caesarean surgery in the past 3 months.

In 2017, there was a modest improvement in many of the indicators when compared to 2013. Some basic infrastructures such as electricity and other basic equipment were still widely lacking. Only a few health facilities were connected to the electricity grid [primary facilities (3.6%); Secondary facilities (6.5 %)]. Similarly, very few facilities had a manual vacuum extractor [primary facilities (8.3%); Secondary facilities (27.5%)]. Vacuum aspirators, dilation and curettage kits were equally only available in few facilities [primary facilities (23%); Secondary facilities (38.5%)]. Just over a third of both primary and secondary facilities routinely used partographs (33.7% and 37.6% respectively). Medical mask was available in 61.6% and 67.1% of primary and secondary facilities respectively. Medical gowns and suture materials such as needles, scissors or blades were available in most primary and secondary facilities. Regarding the availability of essential medications, about two-third (67.1%) of primary care facilities had injectable uretronics (oxytocin), majority (80.7%) of secondary facilities had injectable uretronics. Only 24.6% and 45.9% of primary facilities and secondary facilities respectively had injectable diazepam. In terms of newborn care,

resuscitation bags, mask or tube were available in only 46.8% and 81.7% of primary care facilities and secondary care facilities respectively, incubators were available in 9.1% and 33% of primary care and secondary care facilities respectively.

Regarding basic emergency obstetric care, a higher proportion of secondary facilities had performed BEmOC related indicators over the preceding 3 months compared to primary facilities. Only 27.4% of primary facilities had administered parenteral anticonvulsants, compared to 68.8% of secondary care facilities over the past 3 months. Similarly, 46.8% of primary care facilities had performed removal of retained products in the 3 months preceding the audit, compared to 65.1% of secondary care facilities.

Comprehensive emergency obstetric care services were much less performed in primary care facilities, with only 5.6 % performing blood transfusion; in contrast, just less than half of secondary facilities (49.5%) have performed blood transfusion during the same time frame. Only 5.6 % of primary care facilities provided Caesarean section during this period, whereas nearly three-quarters (74.3%) of secondary care facilities had performed caesarean section.

[Insert Table 2]

Table 3 shows a Wilcoxon signed rank statistical test to test for significant difference in quality between 2013 and 2017 for primary and secondary facilities respectively.

Percentage point change for indicators at secondary facilities were mixed, with slight improvement in some indicators and a decline in others. Regarding infrastructure, staffing, delivery pack and running water were the most improved indicator at primary care facilities (14.7%, 24.1% & 21% respectively). The most improved infrastructure at secondary care facilities include: running water, staffing, tubing's and connectors for endotracheal tube (10.3%, 8.3% and 5.5% respectively). Basic structure items such as electricity connection and speculum became less available at secondary facilities in 2017, compared to 2013 (-10.5% and -7.3% respectively).

In terms of process indicators, there was improvement in primary care facilities, whereas availability either declined or slightly increased at secondary care facilities. Although only a very small number of primary care facilities conducted CEmOC related services in 2013 and

2017, however there was a slight increase during this period: blood transfusion (4.6%) and caesarean section (2.9%). Secondary care facilities had a decline in CEmOC: caesarean section (-3.4).

Overall, Wilcoxon signed rank test showed that primary care facilities witnessed significant improvements in indicators of structure ($p < 0.001$) and BEmOC ($p = 0.03$) between 2013 and 2017. There was no significant change in quality of CEmOC in primary facilities ($p = 0.18$). There was no significant change in any of the structure or process indicators at secondary care facilities (see Table 3).

[Insert Table 3]

Overall, Ouest and Nord-Ouest departments have the highest concentration of primary care facilities. In 2013, primary care facilities on the Gonave Island, Saint-Louis-du-Nord arrondissement, Cap-Haïtien, Dessalines arrondissement, and Corail arrondissement and some parts of Ouest department had the lowest mean quality. While facilities in Cerca-la-Source in Center department, certain parts of Ouest department, parts of Grand'Anse Department and Saint-Louis-du-sud had the best mean quality.

[Insert Figure 1]

The quality of care improved significantly between 2013 and 2017 in many primary care facilities. In 2017, facilities in Gonave Island, Port-de-paix arrondissement, Jacmel, Les Anglais, Torbeck commune had the lowest mean quality (See Figure 1).

[Insert Figure 2]

In 2013, the quality of secondary health facilities was mixed with some between (0.5-0.6) and others above average. Secondary facilities in Gros-Morne Arrondissement, Cerca-la-Source, Thiotte commune and Les-Anglais commune had the lowest mean quality, while facilities in some parts of Artibonite, Centre department and part of Ouest were of the highest quality.

In 2017, the quality of secondary facilities remained mostly unchanged, with slight decline in some regions compared to 2013. Facilities with the lowest quality were in parts of Nord Ouest department, Gros-Morne Arrondissement, Cerca-la-Source, Thiotte and Les-Anglais

communes. The facilities with highest quality remained concentrated around Centre and Artibonite departments (See Figure 2).

[Insert Figure 3]

Analysis of change in obstetric care quality in primary and secondary facilities between 2013 and 2017 shows that primary care facilities made the most significant improvement, while most secondary facilities declined, with only a few improving in quality.

Primary facilities located around Ouest, Nord Ouest and Sud departments did not improve in quality, while those in Artibonite and parts of Centre department as well as in Cap-Haitien and Pestel communes made the most significant improvement.

Many secondary facilities declined in quality or made no significant improvement, except very few facilities in Nord Ouest, Centre and Sud which made a slight improvement (see Figure 3).

Discussion

Statement of principal findings

We have conducted a cross-sectional study exploring the quality of emergency obstetric care services available at Haitian health care facilities at two time-points (2013 and 2017). We found that the quality of obstetric care services available at primary care facilities were lower compared to those of secondary care facilities. This finding is consistent with previous studies (27). Kruk et al. assessed the quality of basic maternal care functions at health facilities in five African countries, and found that mean quality of care was about two-fold higher in secondary facilities compared to primary facilities (Mean(SD): 0.38(0.19) Versus 0.77(0.14) (3).

Furthermore, our study revealed that primary care facilities made significant improvement in quality during the five years period, whereas obstetric care quality in many secondary facilities either declined or remained the same. Sub-national analysis showed that a higher number of healthcare facilities are concentrated around Port-au-Prince arrondissement and other parts of Ouest department; this pattern of distribution has been corroborated by other studies conducted in Haiti (28).

Our analysis showed that despite the higher proportion of facilities concentrated in this region, the quality of some of these facilities were low. In contrast, Centre department has lesser concentration of health facilities, however the quality of the facilities in this area was relatively higher. Similarly, the quality of facilities in Nord Ouest were also among the lowest. The findings in this region is in line with a previous study investigating the quality of emergency health care at all facilities in North East Haiti (29).

We identified basic structure items such as connection to the electricity grid as a major problem across most facilities in Haiti, with little improvement over the five-year period. It is however notable that while the issue of electricity was highlighted in another study conducted in Haiti, the study mentioned that most health facilities relied on alternative electricity source from electric generators (29). We found that while basic structure items such as water improved at both primary and secondary facilities, basic equipment such as vacuum aspirators and vacuum extractors were widely unavailable at many facilities; this may be linked to the lack of electricity to run this equipment.

Comprehensive obstetric care was widely unavailable at primary care facilities, as shown by indicators such as blood transfusions and caesarean sections provided over the past 3 months; this trend has been shown in other LMIC (3). This trend underscores the need to prioritise effective referrals in primary facilities: by ensuring timely referral, optimal emergency transport, and good roads amongst other factors (3,14,15). Other authors have highlighted in their work that even though services such as blood transfusion and surgical care are considered part of comprehensive Emergency Obstetric Care (CEmOC), and are not required in every delivery, women must readily have access to them when complications arise (7).

Interpretation within the context of the wider literature

By conducting a sub-national analysis, we were able to identify the administrative regions with facilities most in need of quality improvement. It has been shown that the minimum acceptable level of obstetric care is four basic and one comprehensive emergency obstetric care facility per 500,000 women (8,9). All women with direct obstetric complications are to be treated in emergency obstetric care facilities (8,9). Our finding can be further enhanced by linking the population estimates in different communities to the quality of obstetric care available.

The quality of obstetric care service has also been shown to affect utilisation decision. A study conducted by Wang et al., showed that infrastructure quality at health care facilities in Haiti was directly associated with the utilisation of obstetric care services by members of the community (11). Contrarily, Gage et al., showed in their work that utilisation of facilities for childbirth was not associated with the service delivery quality, although they found that it was associated with utilisation of other services such as Antenatal care (25).

Our study showed that primary facilities made significant progress in quality improvement. This finding is a positive trend; hence policy makers and stakeholders must develop measures to consolidate on this trend for a number of reasons. Firstly, majority of obstetric care facilities in Haiti are primary care facilities, secondly majority of deliveries still take place in primary care facilities, to maximise access, the World Health Organization in partnership with policy makers in LMIC promotes the “close- to-client” first level maternal and newborn care approach to the provision of delivery and newborn care, wherein delivery for most women occur in primary care facilities and complications are referred to higher level facilities (7,32). Unfortunately, we found that secondary facilities made no progress in quality improvement. This is a negative trend, and this may easily hold back the overall progress in obstetric service quality improvement in Haiti, since the secondary facilities are supposed to serve as an important hub for referrals.

In assessing the quality of emergency obstetric care in Haiti, we utilised the signal functions of emergency obstetric care indicators. In addition, a proxy of the structure, process and outcome model developed in the work of Donabedian, was used to explore quality (20). Further insights from Donabedian’s work reveals that improving the quality of obstetric care in health systems settings such as in Haiti may require a more robust and comprehensive approach, one that goes beyond simply improving basic infrastructure and processes. Other factors such as the cost of care, community preference, provider-client relationship, fair and equitable distribution of care needs to be closely addressed (21).

Strengths and limitations

The study has some strengths, most importantly, to the best of our knowledge, it represents the first attempt to explore changes in quality of obstetric care over time in a LMIC. In addition, the data we have utilised is robust, and is representative of all health facilities in Haiti.

There are a few limitations to our study. Firstly, our findings should be interpreted with caution, because each survey is a snapshot of EmOC in the most recent three months preceding the survey; annual reclassification has been recommended when measuring obstetric care status over time, for programmatic reasons (9). We only assessed change in the quality of facility infrastructure and availability of services. Measuring changes in service delivery through the analysis of indicators such as wait times, clients' perception, or care experience, was not within the scope of our study, however the importance of these service indicators have been highlighted elsewhere (25).

Implications for policy, practice, and research

Our findings have several implications for quality of obstetric care in Haiti. Firstly, measuring changes in indicators of emergency obstetric care services have been shown to be an important proxy in assessing progress in the reduction of maternal mortality (8). Hence, government authorities, policy makers, and other donor agencies can target resources more effectively, using the quality trends and patterns that we have enumerated. Secondly, some facilities, especially primary care facilities in certain administrative regions, have shown significant improvement in quality of care. It is important to identify facilities with optimal standards and the most improved facilities and to use them as a model or template for improvement elsewhere in Haiti. The need to improve healthcare quality using this approach, has also been highlighted in another study conducted in Haiti (28).

Conclusion

Our study can assist Haitian health authorities, program planners, donor agencies and policy makers in identifying areas of the country where obstetric care services require improvement and strengthening. This study may also serve as a guide for monitoring sub-national trends and change over time in the quality of obstetric care in other LMIC.

Contributorship

AEA conceptualised the study, developed the study design and protocol, extracted the data, contributed to the data analysis, and drafted the manuscript. JW contributed to the study protocol and conducted the Geospatial analysis. JS contributed to the study design and proof-read the article.

Ethics and other permissions

Permission to use the SPA survey data was granted by Measure DHS. Ethics approval exemption was granted for the analysis of the secondary data by the authors' institution.

Funding

No funding was received for this project.

Conflict of interest statement

None declared.

Acknowledgements

The authors would like to acknowledge the contributions of Professor Hong Zhou and the team at UNICEF China Office.

Data availability

The data is available upon reasonable request and permission from the Demographic and Health survey program. (<https://dhsprogram.com/Data/>)

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Table 1: Characteristic of health care facilities in Haiti in 2013 and 2017

	2013		2017	
	Delivery services present	No delivery service	Delivery services present	No delivery services
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Facility location				
<i>Urban</i>	151 (42.7)	203(57.3)	145(38.4)	233(61.6)
<i>Rural</i>	238(43.2)	313(56.8)	216(34.3)	413(65.7)
Facility level				
<i>Primary care</i>	295(37.6)	489(62.4)	252(28.8)	624(71.2)
<i>Secondary care</i>	94(77.7)	27(22.3)	109(83.2)	22(16.8)
Management type				
<i>Government/Public</i>	195(57.0)	147(43.0)	156(45.3)	188(54.7)
<i>NGO/not for profit</i>	47(28.3)	119(71.7)	52(29.9)	122(70.1)
<i>Private/profit</i>	65(30.4)	149(69.6)	88(29.3)	212(70.7)
<i>Faith-based/Mixed</i>	82(44.8)	101(55.2)	65(34.4)	124(65.6)
Laboratory services				
<i>Available</i>	312(47.4)	346(52.6)	290(45.2)	352(54.8)
<i>Not available</i>	75(30.9)	168(69.1)	361(35.8)	646(64.2)

In 2013 (N = 907); In 2017 (N = 1033)

Table 2: Quality of basic and comprehensive emergency obstetric care at primary and secondary care facilities providing normal delivery care.

	2013		2017	
	Primary care (%)	Secondary care (%)	Primary care (%)	Secondary care(%)
Indicators of structure				
Schedule 24h staffing observed	33.8	73.6	48.5	76.4
Connected to electricity grid	2.7	17.0	3.6	6.5
Running water observed	50.8	85.1	71.8	95.4
Sharps container observed	84.7	93.6	92.1	94.5
Skin disinfectant	68.5	85.1	81.7	87.2
Delivery bed	92.2	97.9	93.3	99.1
Delivery pack	52.5	88.3	76.6	82.6
Cord clamp	75.9	93.6	84.1	93.6
Speculum	57.3	92.6	71.8	85.3
Episiotomy scissors	83.7	90.4	88.9	89.0
Suture material with needle	84.4	90.4	86.9	84.4
Manual vacuum extractor	4.1	28.7	8.3	27.5
Vacuum aspirator or D&C kit	14.6	35.1	23.0	38.5
Anaesthesia giving set observed functioning	80.0	83.3	82.4	88.8
Tubings and connectors for endotracheal tube	90.0	87.2	88.2	95.5
Partograph availability and routine use	14.6	34.0	33.7	37.6
Single use syringes	78.0	86.2	87.2	84.2
Medical Mask	37.6	53.2	61.6	67.1
Medical gowns	79.7	96.8	93.6	96.1
Suture material with needle	84.4	90.4	86.9	84.4
Sterile scissors or blade	84.4	90.4	89.7	90.8
Injectable uretronic (oxytocin)	47.1	77.7	67.1	80.7
Injectable diazepam	19.0	48.9	24.6	45.9
Injectable magnesium sulfate	29.5	72.3	40.1	65.1
Injectable antibiotic (ceftriaxone)	25.8	47.9	41.3	68.8
Infant resuscitation bag/mask or tube	23.4	75.5	46.8	81.7
Incubator	6.8	29.8	9.1	33.0
Indicators of process of BEmOC				
Assisted vaginal delivery past 3 months	67.5	94.7	80.2	98.2
Parenteral antibiotics administered past 3 mnths	44.7	90.4	68.3	96.3
Parenteral oxytocic drugs administered past 3 mnths	58.6	98.9	82.5	97.5
Use of parenteral anticonvulsant past 3 months	18.0	71.3	27.4	68.8
Removal of retained product past 3 months	40.7	72.3	46.8	65.1
Manual removal of placenta	44.4	70.2	54.4	73.4
Indicators of process of CEmOC				
Blood transfusion in the past 3 months	1.0	47.9	5.6	49.5
Caesarean section provided past 3 months	2.7	77.7	5.6	74.3

In 2013 (N = 389); In 2017 (N = 361)

Table 3: Wilcoxon signed rank test of emergency obstetric care service quality between 2013 and 2017 at facilities providing normal delivery care.

	Primary Facilities		Secondary facilities	
	Mean	<i>p</i>	Mean	<i>p</i>
Indicators of structure				
2013	52.00	<0.001**	72.00	0.45
2017	62.30		73.30	
Indicators of process (BEmOC)				
2013	45.65	0.03*	70.20	0.75
2017	59.93		65.10	
Indicators of Process (CEmOC)				
2013	1.85	0.18	21.07	0.65
2017	5.60		17.54	

In 2013 (N = 389); In 2017 (N = 361)

Figure 1: Sub-national analysis of mean obstetric care quality in Haitian primary facilities

Figure 2: Sub-national analysis of mean obstetric care quality in Haitian secondary facilities.

Figure 3

Figure 3: Change in mean facility quality between 2014 and 2017