Measuring delay in high-risk obstetric referrals in Accra, Ghana: How long does it really take?

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Abstract

Background

In Ghana, inefficient referral systems for managing obstetric emergencies is an obstacle to receiving optimal care. The timeliness of referral for comprehensive emergency obstetric care (CEmOC) from district or sub-district facilities to referral hospitals is unknown. The Greater Accra Regional Hospital (GARH) conducts approximately 8,000 deliveries per year that includes 70% high-risk referrals. Our aim was to characterize referrals for obstetric patients seeking care at the GARH in Accra, Ghana.

Methods

Data was collected on obstetric patients referred to the GARH from September 1 to November 30, 2017. A descriptive analysis was conducted on the following variables: location of referring facility, time from referral to arrival at GARH, mode of transport, referring diagnosis and members accompanying the patient. Data are presented as number, percent or median (IQR).

Results

Data were collected for 652 obstetric patient referrals to the GARH from 123 surrounding facilities. Transportation modes included: taxi (76.4%), ambulance (8.1%), private car (8.0%), public van (5.5%) and unknown (2.0%). Of 652 referrals, 303 (46.5%) were received during labour. The median time (IQR) from referral to arrival at GARH for 280 labouring patients was 307 (170, 1778) minutes. Midwives accompanied patients in only 71 (10.9%) of referrals; however, in these, median (IQR) referral times were 73 (34, 268) minutes. The leading referral indications included: Arrest of labour (26.3%), prior uterine scar (11.6%) and hypertensive disorders of pregnancy (11.5%). There were seven (1%) maternal deaths; four died the day of arrival. For 110 (17%) pregnancies, prolonged hospitalization was required for complications. There were 32 stillbirths (5%), including six intrapartum deaths.

Conclusions

The obstetric referral process for CEmOC is suboptimal. Most intrapartum referrals relied on public transport to reach the CEmOC facility and were unaccompanied by healthcare personnel. There is significant delay in the referral process, even in an urban setting. Delay may contribute to poor maternal and newborn outcomes.

Background

There has been a rapid increase in the institutional delivery rate in Ghana over the past decade. Currently, 79% of patients deliver in health facilities assisted by skilled birth attendants, an increase from 54% ten years ago [1]. Despite this improvement, significant gaps remain in the provision of quality care for high-risk obstetric patients, particularly along the referral pathway [2–6]. It is known that at least 15% of all pregnancies will develop complications that require advanced care, including surgery, in hospitals capable of performing comprehensive emergency obstetric care (CEmOC) [7]. Delays in reaching the appropriate health facilities contribute to poor maternal and newborn outcomes [8–11]. Inefficient referral processes can result in death during transport or soon

after arrival at secondary and tertiary institutions [2, 3, 11]. As such, referral and teaching hospitals have maternal mortality rates that far exceed the national average [3, 12, 13]. In Ghana, the country action plan for the Millennium Development Goal (MDG) Acceleration Framework identified weak referral systems, particularly for managing obstetric emergencies, as one of the leading challenges to achieving the MDG for maternal mortality [14].

Numerous measures have been undertaken to strengthen Ghana's referral system. In 2012, the Ministry of Health deployed a national policy to address delays in accessing emergency care for referred patients [15]. Other measures have included a National Health Insurance Scheme with free access to maternity care; a national ambulance service; implementation of maternal death audits and the use of audit findings to inform referral institutions; the establishment of referral ledgers; and policies to ensure that health staff accompany referred emergencies [2–4, 15, 16]. In addition, the Greater Accra Region has established a “call centre” to facilitate linkages between the source institutions and receiving hospitals. In spite of these interventions, the referral system remains challenged [2]. There are many recent reports in the lay press on the “no bed syndrome” whereby referred emergencies are denied admission and care at one institution and are repeatedly referred elsewhere [2].

The World Health Organization currently recommends that emergency obstetric services should be available within two hours of seeking care [17]. Similarly, the Lancet Commission on Global Surgery recently adopted six quality of care indicators to assess surgical readiness, among which is access to care within two hours to facilities capable of performing emergency surgery [18]. Despite these guidelines and indicators being adopted, there is limited data measuring the timeliness of access to appropriate care in Ghana, as well as in other low resource areas [2]. This descriptive study was undertaken to characterize qualitative and quantitative aspects of obstetric referrals to a large regional hospital in Accra, Ghana.

Methods

Study setting

The Greater Accra Region of Ghana comprises 3,245 km² and serves a population of approximately 4 million inhabitants, accounting for 16% of Ghana's population [19]. The region is predominately urban, and represents the most educated and wealthiest segment of the population [1]. The government health system is organized within a three-tier model, whereby care is escalated via referral from primary care and community health centers, to district hospitals, to regional and teaching hospitals [2, 3, 15]. Additionally, there are numerous smaller private facilities with varying capabilities. The Greater Accra Regional Hospital (GARH) is a major obstetric referral facility in the capital city and one of the largest regional hospitals in Ghana. The hospital conducts approximately 8,000 deliveries per year, with 70% high-risk referrals [20]. The GARH receives obstetric patients from private hospitals, health centers, district hospitals, and secondary and teaching hospitals across the metropolitan area, including 37 Military Hospital and Korle Bu Teaching Hospital (KBTH), which also provide CEmOC within the catchment area.

Data collection and analysis

Data were collected on obstetric patients that were referred to the GARH from September 1 to November 30, 2017. A data collection template was created and two data collectors were hired and trained to manually extract information from patient charts and logbooks during the three-month period. Data were subsequently entered into Microsoft Excel (Microsoft, Redmond, WA) and cross-checked for accuracy by separate members of the research team. Patient data included maternal age, gravida, parity, gestational age, educational status, labour

characteristics, time of arrival, delivery mode, and maternal and fetal outcomes. Referral data included the name of referring institution, reason for referral, mode of transport, members accompanying the patient and the time interval from referral to arrival. Global Positioning System (GPS) coordinates were gathered for the referring facilities using Google Maps software (Google, Seattle, WA) that is publicly available. Care was taken to identify each facility either through Google search on the software or by finding the location on a map with the help of an author with local expertise (EKS). The GPS information was mapped using Tableau Public Version 9.1 software (Tableau, Seattle, WA). Data are presented as average $\pm$ SD, number (percent) or median (IQR). Ethical approval for this work was granted by the Ghana Health Service (Ref. No. GHS/DGS/K-6) and Wake Forest School of Medicine (IRB00047565). Due to the nature of this study addressing delay within the healthcare system, the risks of anticipated harm were not greater than those ordinarily encountered by the patient population, qualifying it for expedited review and meeting criteria for a waiver of informed consent by the review board.

Results

There were 1634 deliveries at the GARH between September 1 and November 30, 2017 which included 1266 (77.5%) referrals. Data were obtainable for 652 patients which reflect (51.5%) of the referrals. Patient demographic information is shown in Table 1.

Catchment Area and Transport

The dataset included referrals from 123 facilities peripheral to GARH during the study period. Figure 1 shows the distribution of the ten highest volume referral sites. These sites accounted for 55.5% of the referrals to GARH. There was a wide array of referring facilities including: 442 (64.6%) health centers and clinics, 105 (16.1%) district hospitals, 6 (0.9%) tertiary or teaching hospitals, 119 (18.2%) private hospitals, and 1 (0.2%) unknown. Nine (1.4%) patients had two points of referral.

The distance traveled, mode of transportation and accompanying personnel are shown in Table 2. The most distant referral site was 145.8 km from GARH. Arrival times for referrals were distributed fairly evenly across the daily work shifts: the day shift (8:00–14:00) received 202 (31.5%), the afternoon shift (14:01–20:00) received 185 (28.8%) referrals, and the night shift (20:01–07:59) received 255 (39.7%) of referrals, respectively. In 10 (1.5%) referrals, the arrival time was not noted.

Labour Characteristics and Referral Indications

There were 335 (51.4%) antenatal referrals, nearly half of which (152) were referred with emergency complications, 303 (46.5%) intrapartum, and 1 post-partum referral. Thirteen (2.0%) had no data available. The reasons for referral are shown in Table 3. In 455 (69.7%) of referrals, the admitting diagnosis agreed with the referral indication. One hundred thirty (19.9%) of referrals arrived within 2 hours. Of these, the leading referral indications were labor or failed progress of labor (35.4%), hypertensive disorders of pregnancy (16.2%), and fetal prematurity (10.8%) and 31 (52.1%) were accompanied by a midwife. An advance phone call to GARH was made in 220 (33.7%) of referrals and only 126 (19.3%) of all patients had some form of documented treatment initiated prior to referral, however, 456 (70.1%) patients arrived with a referral slip.

For patients referred during labour, the time difference from referral to arrival at GARH was available for 280 of the 303 patients. For these, the median (IQR) referral time was 307 (170, 1778) min. Only 47 (16.3%) of the labouring patients arrived within 2 hours of referral, and 99 (32.6%) required cesarean delivery. For labouring patients, the

median transport times by various means of transport were: taxi or public van (324 min), ambulance (286 min), and private car (205 min). When a midwife accompanied the patient during transport, the leading referral indications were labour or failed progress of labour (36.6%), hypertensive disorders of pregnancy (31.0%) and fetal compromise (9.9%). In midwife accompanied referrals the median (IQR) time from referral to arrival was 73 (34, 268) min. Nearly all of the referred patients, 641 (98.5%), delivered at the GARH; 401 (61.6%) had spontaneous vaginal and 240 (36.9%) cesarean delivery. In 10 (1.5%) of patients, the mode of delivery was not recorded.

Patient Outcomes

There were 599 (93.2%) live births with average Apgar scores of 5.8 ± 2.1 at 1 minute and 7.1 ± 2.3 at 5 min. Fifty-eight patients (19%) had an Apgar score < 7 at ten minutes. The average newborn weighed 3.0 ± 0.8 kg (range 0.3-5.0 kg). In 26 (4.0%) referred patients, fetal heart tones were not heard on admission to GARH and 6 (0.9%) women experienced stillbirths that occurred after arriving to GARH. Additionally, there were 6 (0.9%) ectopic pregnancies, and 6 (0.9%) spontaneous abortions (< 28 week gestation). In 9 referrals, the newborn outcome was unknown.

There were 7 (1.1%) maternal deaths, four of which occurred within 24 hours of hospital arrival. Causes of maternal death were: pre-eclampsia (3) hemorrhage (2), heart failure (1) and complications of human immunodeficiency virus (1). In 545 (83.5%) referrals, the mother was discharged after delivery without complication, and 110 (16.4%) hospitalization was prolonged due to complications. In 7 patients, data were unavailable.

Discussion

In the urban setting of Accra, Ghana, we have shown that significant delay occurs in the obstetric referral process. Among the 303 (46.5%) patients referred intrapartum, the median time from referral decision to arrival was over five hours, confirming our earlier suspicions. Previously, we reported that of 1082 obstetric patients referred to GARH, 200 (18%) arrived in advanced labour (> 7 cm dilation) and 83 (8%) were completely dilated, suggesting that delay had occurred along the referral pathway [21]. These findings prompted us to conduct the current study. Research on emergency obstetric referrals in Ghana, and in other countries, is limited, particularly in the quantitative measure of delay in reaching secondary and tertiary levels of care. Many studies discuss the negative implications of referral delays, but few studies measure or quantitate it [9, 22, 23].

A study in Mozambique found that delay encountered during transport and referral accounted for 60% of the 712 maternal deaths [11]. The authors, however, did not define delay or provide detail on timeliness, although the times of arrival at the initial health facility, treatment initiation, arrival at the referral (secondary) facility and death were reportedly collected [11]. In Ghana, a questionnaire was administered to directors or in-charge maternity unit officers in 120 health facilities in the Upper East region on emergency obstetric interventions [4]. One hundred and four individuals responded to a question regarding travel time, but this was not measured quantitatively. The mean travel time to the nearest referral facility was stated to be 37 min (range 5 to 120 min) using various means of transport, including a car (52%), an ambulance (21%), or a motorbike (10%). Nearly 20% of these facilities had no standard procedures for transporting patients [4]. According to the 2017 Ghana Maternal Health Survey, of 107 pregnant women who died from direct obstetric complications, data from interviewed family members found that the median travel time to a health facility was 29.8 min [1]. It is important to note that data from interviews of either medical staff or family members remote from the occurrence are subject to recall bias, and as such, may be inaccurate. Twenty years ago, Nkyekyer assessed peripartum referrals to KBTH, Ghana's largest hospital [24]. He

described the indications for referral, modes of transport, who accompanied patients and referral sources but timeliness was inadequately assessed. Data were available for only 46 of 396 (11.6%) referred patients regarding transport timeliness and the average time needed to reach KBTH was 78 min. The decision time for referral until facility departure could only be determined for seven women and was not stated [24].

Delay is influenced by more than just the physical distance to a health facility. In fact, women in the Greater Accra Region were least likely to report distance to a health facility as a barrier to care [1]. Simply, reaching any health facility is not good enough. Recently, a study of 119,244 pregnancies in the Brong Ahafo region of Ghana, found that facility delivery and shorter travel distance did not improve survival benefits for women or newborns, unless births occurred in high quality or CEmOC facilities [25]. Others have shown similar results [26–28]. It is imperative that high risk obstetric patients reach the right facility, in a timely manner. The geographic analysis shown in Fig. 1 reveals an expansive catchment area that is not well defined with respect to other CEmOC facilities in Accra. The longest travel distant in our patient sample was 145.8 km, a distance that would take several hours. Distance, however, is not the only factor, as many patients represented in our study arrived from facilities located in close proximity to GARH, yet had long referral to arrival times. Our study found that in patients accompanied by a midwife, the median referral time was shorter. We did not address which factors were responsible for the delay, which is a limitation of our study. Other studies, however, have described numerous barriers in accessing appropriate care beyond distance alone, including: delay in the recognition of a problem; needing to collect money for treatment or transport; waiting for relatives; needing permission; patient preferences for traditionalist and spiritual practices; refusal of referral due to fear of disrespectful care, medical procedures, or surgery; waiting for transport; and traffic congestion [1–3, 5, 6, 11, 22, 23, 26, 27, 29]. Also, in some cases, pregnant women are referred from one facility to another on the basis of no bed availability or lack of resources, until it is too late [28, 29]. Fortunately, in the present report, this occurred for only 9 (1.4%) patients. One advantage of the present study, is that we determined delay from the point in time the referral decision was made, which likely extends beyond the time required for transport alone.

In the present study, the leading referral indications were failure to progress (26.3), prior uterine scar (11.6%), and hypertensive disorders of pregnancy (11.5%). This is in agreement with other reports, which have similarly found obstructed labour to be the most common indication for referral [3, 11, 21, 24, 29]. In Nkyekyer's 2002 report, only 2% of patients were referred for prior uterine scar [24]. In 2012, we found that 9.1% of patients were referred for this indication and the trend continues to increase [21]. A rising cesarean delivery rate, particularly in Accra, may worsen the existing burden on CEmOC hospitals [1, 25, 29]. A better understanding of labour management practices in lower level facilities is needed to stem the tide of increasing surgical deliveries [11]. For example, Nkyekyer found that 37.6% of patients referred for failure to progress had intact membranes, similar to our previous study [21, 24]. Even more troubling was that only 17.9% of patients requiring an intravenous line actually had one, including 55.6% of bleeding patients. Similarly, we found that treatment was rendered in only 19.3% of patients prior to departure. In addition, high-risk obstetric referrals are frequently unaccompanied by healthcare staff, consistent with the current report [2, 6, 24, 29].

Nkyekyer found that 65.8% of referred patients utilized taxis or small public buses for transport [24]. Sadly, more than 20 years later, little has changed. In the current study, we found that 81.9% of referred patients arrived by means of public transport. This has been corroborated by others [2, 3, 6, 16, 29, 30]. Even when ambulances are utilized, delay is often encountered as patients may need wait for ambulances to arrive from other locations or are asked to provide funds to fuel the vehicle [2, 4–6, 24, 29]. Indeed, our results demonstrate that transport by

ambulance was only marginally better than by taxi and interestingly, even the general public has the perception that taxis are a faster form of transport than are ambulances, which needs to be addressed [30]. The facilities most likely to refer are least likely to have transport mechanisms and proper means of communication with the receiving hospital [3, 4, 6]. Lack of advance warning that a patient is coming and omitting a referral slip further hampers preparedness at the receiving hospital [2, 6]. Communication is frequently deficient between facilities, including feedback to the referring institution regarding patient outcome [2, 3, 6, 29]. Furthermore, patients have been shown to self-refer, bypassing the usual referral chain to seek higher levels of care [3, 6, 21, 24, 28]. They will travel farther and pay more for what they perceive to be better care [3, 6, 24, 28, 29].

There is controversy as to whether referral system barriers constitute Phase II or Phase III delays. Although some authors classify referral barriers as primarily transport-related and therefore Phase II delays, others consider these as Phase III barriers since the patient has already reported to a health facility [11, 26, 28]. It is important to identify and categorize referral related barriers, whether considered Phase II or Phase III delay, in the provision of timely CEmOC in low resource countries and this topic remains vastly under-researched [2, 6, 26, 27]. A strong referral system is characterized by communication and coordination along the referral pathway, with tailored referral protocols, patient support, protection against costs, and efficient transportation [2, 6, 16]. Having an effective and efficient referral system can reduce stillbirth, neonatal and maternal deaths [9, 31].

Conclusion

The inability of high-risk women to access CEmOC remains a major challenge in addressing the global burden of maternal mortality. Our analysis indicates that further study and planning is warranted to optimize obstetric referrals in Accra, Ghana. As countries seek to accelerate mortality reduction to meet the Sustainable Development Goal targets, service delivery and referral patterns need redesign in order to ensure quality and timeliness of care, in addition to access. Ensuring an effective referral system will require collaboration and coordination among policy makers, administrators and healthcare providers across the various levels of care.

Abbreviations

CEmCO, comprehensive emergency obstetric care

GARH, Great Accra Regional Hospital

GPS, global positioning system

IQR, interquartile range

KBTH, Korle Bu Teaching Hospital

MGD, Millennium Development Goal

Declarations

Ethics Approval and Consent to Participate: Ethical approval for this work was granted by the Ghana Health Service (Ref. No. GHS/DGS/K-6) and Wake Forest University Health Sciences (IRB00047565). Due to the nature of this study addressing systems delays, it qualified for expedited review and did not require informed consent.

Consent for Publication: Not applicable.

Availability of Data and Materials: The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request. Data is not appropriate for widespread dissemination due to the possibility of patient privacy infringement.

Competing Interests: MDO, YO and EKS report a sub-grant to Kybele-Ghana from USAID Systems for Health (FY16-CR05-6017).

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Authors' Contributions:

MO contributed to the study design, oversaw data entry and analysis, literature review and was responsible for writing the final draft

MB assisted with data entry, ensured data quality and wrote an initial manuscript draft

DG assisted with data analysis, geographic mapping and manuscript writing

SMK ensured data quality and conducted data analysis

AO contributed to the study design and execution, guided data entry and edited the manuscript

ES conceptualized the study design, oversaw the project execution and edited the manuscript

All authors have read and approved the manuscript.

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Tables

Table 1. Patient data and education of referred obstetric patients

Patient Data	N=653	Range
Age (years)	29.7±5.5	16-45
Gravida	3.0±1.7	1-9
Parity	1.5±1.4	0-8
Gestational age (weeks)	37.3±6.1	5-45
Education		
Primary	59 (9.0)	
Junior high school	243 (37.3)	
Senior high school	202 (31.0)	
Tertiary	124 (19.0)	
Uneducated	10 (1.5)	
Not available	14 (2.1)	

Data are presented as mean ± standard deviation or number (percent)

Table 2. Distance, mode of transportation and accompanying person

Distance from GARH (km)	Number	Percent (%)
<5	137	21.0
5-9.9	140	21.5
10-14.9	116	17.8
15-19.9	110	16.8
20-29.9	76	11.7
30-39.9	21	3.2
>40	4	0.6
Unknown	48	7.4
Mode of transportation		
Taxi	498	76.4
Public bus	36	5.5
Private car	52	8.0
Ambulance	53	8.1
Not available	13	2.0
Accompanying person		
Husband	326	50.1
Another relative	237	36.3
No one	75	11.5
Not available	14	2.1
Accompanying midwife	71	10.9

Table 3. Indications for referral

Indication	Number	Percent (%)
Fetal/pelvic size disproportion ^a	213	26.4
Prior uterine scar ^b	94	11.6
Hypertensive disorders ^c	93	11.5
Maternal miscellaneous ^d	64	7.9
Anemia ^e	47	5.8
Self-referral	45	5.6
Fetal compromise ^f	45	5.6
Labour	43	5.3
Prematurity ^g	39	4.8
Rupture of membranes ^h	28	3.5
Fetal malpresentation ⁱ	27	3.3
Acute hemorrhage ^j	18	2.2
Multiple gestation ^k	12	1.5
Lack of resources at referral site ^l	8	1.0
Maternal age extremes (> 35 years)	6	0.7
Intra-uterine fetal demise	6	0.7
Previous poor obstetric outcome ^m	6	0.7
Fetal miscellaneous ⁿ	5	0.6
Ectopic or miscarriage	4	0.5
Infectious causes ^o	3	0.4
No/poor prenatal care	1	0.1
Record illegible	1	0.1
Total	808	100%
One referral indication	651	80.6
Two referral indications	154	19.0
Three referral indications	3	0.4

There were 652 referral records captured for deliveries occurring at the Greater Accra Regional Hospital from September 1, 2017 to November 30, 2017.

- a. Cephalopelvic disproportion, fetal macrosomia, large maternal abdomen, post-term pregnancy, over 40 weeks estimated gestational age, borderline pelvis, contracted pelvis, failure to progress (delayed or prolonged labour, arrest of labour, slow progress, failed induction, unfavorable cervix, high head in labour, obstructed labour).
- b. Previous cesarean delivery, prior myomectomy, or previous uterine rupture.
- c. Chronic hypertension, PIH, pre-eclampsia, severe pre-eclampsia, or eclampsia.
- d. Maternal asthma, diabetes, gestational diabetes, prior abdominal surgery, uterine fibroids, vaginal/vulvar growth or discharge, proteinuria, urinary tract infection, fever, generalized edema, short/long pregnancy interval, short maternal stature, maternal distress, sterilization request, grand multiparity, seizure disorder, mental illness, obesity, patient refusal for care, patient lacks labouratory or scan information, crippled, rhesus negative.
- e. Maternal anemia or sickle cell disease.
- f. Abnormal cardiotocography, fetal tachycardia, fetal distress, oligohydramnios, meconium stained amniotic fluid, decreased fetal movement, intrauterine growth restriction, umbilical cord prolapse.
- g. Gestation < 37 weeks, prematurity, preterm labour or preterm premature rupture of membranes.
- h. Rupture of membranes, prolonged rupture of membranes, losing liquor, gestations >37 weeks.
- i. Face/mentoposterior, brow, breech/footling breech, oblique, transverse, unstable lie, arm prolapse, leading twin breech, compound presentation.
- j. Placenta previa, placental abruption, placenta accreta, ante-, intra- and postpartum bleeding, uterine rupture, unclassified hemorrhage.
- k. Twin pregnancy, triplet pregnancy.
- l. No electricity, no bed, no gloves, no water, no doctor, no anesthetist.
- m. Bad obstetric history, prior stillbirth, prior ectopic pregnancy, unexplained history of intrauterine fetal death, previous failure to progress, prior cervical cerclage, previous peripartum hemorrhage.
- n. Anencephaly, severe hydrocephalus, polyhydramnios, fetal deformity.
- o. Hepatitis B, malaria, syphilis, human immunodeficiency virus.

Figures

Map #	Referring facility	Number of referrals	Percentage of referrals	Distance to Ridge (km)	1 referrals per site 100
1	Kaneshie Polyclinic	98	15.0%	7.1	<div style="display: flex; align-items: center;"> <div style="width: 100px; height: 15px; background: linear-gradient(to right, #f9a825, #d9534f, #c0392b);"></div> <div style="margin-left: 10px;"> <p>● 1-9 referrals</p> <p>● 10-19 referrals</p> <p>● 20-29 referrals</p> <p>● 30-50 referrals</p> <p>● >50 referrals</p> </div> </div>
2	Adabraka Polyclinic	63	9.7%	0.8	
3	Madina Polyclinic	49	7.5%	14.9	
4	Osu Government Hospital	37	5.7%	2.9	
5	Ga South Municipal Hospital	28	4.3%	14.7	
6	Amanfron Health Center	25	3.8%	24.4	
7	Pantang Hospital	18	2.8%	22.0	
8	Lapaz Community Hospital	18	2.8%	14.5	
9	Achimota Hospital	14	2.1%	11.3	
10	Mamprobi Polyclinic	12	1.8%	9.0	

Figure 1

Map of Accra, Ghana, demonstrating the location and volume of obstetric referrals from the ten leading referral facilities to the Greater Accra Regional Hospital. The figure was created using Tableau data software and the map was generated using Mapbox open source utilities.