The introduction of a midwife-led obstetric triage system into a regional referral hospital in Ghana

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Abstract

Objective: To introduce and embed a midwife-led obstetric triage system in a busy labour ward in Accra, Ghana to improve the quality of care and to reduce delay.

Design: The study utilized a participatory action research design. Local staff participated in baseline data collection, the triage training course design and delivery, and post-training monitoring and evaluation.

Setting: A regional referral hospital in Accra, Ghana undertaking 11,032 deliveries in 2012.

Participants: All midwives and medical staff.

Measurements: Measurements included maternal health outcomes, observations of labour ward activity, structured assessments of midwife actions during admission, waiting times, focus group discussions, and learning needs assessments which informed the course content. During training, two quality improvement tools were developed; coloured risk acuity wristbands and a one page triage assessment form. Participants measured compliance and accuracy in the use of these tools following course completion.

Findings: Initially, no formal triage system was in place. The environment was chaotic with poor compliance to existing protocols. Sixty-two midwives received triage training between 2013 and 2014. Two Triage Champions became responsible for triage implementation, monitoring and further training. Following training, the 'in-charge' midwives recorded a cumulative average of 83.4% of women wearing coloured wristbands. A separate audit by the Triage Champions found that 495/535 (93%) of the wristbands were correctly applied based on the diagnosis. Quarterly monitoring of the triage assessment forms by Kybele trainers, showed that 92% recorded the risk acuity colour, 85% a "working diagnosis" and 82% a "plan." Median (interquartile range) waiting times were reduced from 40 (15-100) to 29 (11-60) minutes (p=007). Twenty of 25 of the staff reported that the wristbands were helpful.

Conclusions: An interactive triage training course led to the development of a triage assessment form and the use of coloured patient wristbands which resulted in delay reduction and improved quality of maternity care.

Keywords: delay; Ghana; labour; midwifery; obstetric; triage; low income country

Introduction

This paper describes the introduction of obstetric triage to a busy labour ward at a major referral hospital in Accra, Ghana between 2012 and 2014, in order to improve the assessment, problem identification and first line management of women when they arrive. In 2012, the maternal mortality ratio for this hospital was 499/100,000 live births compared to the Ghana national average of 380 and the Millennium Development Goal of 185 (United Nations Development Programme, 2015). The subsequent Sustainable Development Goal (SDG) 3.1 seeks to reduce global maternal mortality to <70 per 100,000 live births by 2030 (United Nations, 2014). Many maternal deaths are avoidable with prompt recognition of complications and timely intervention, therefore delivery in health facilities by skilled birth attendants has been promoted for all women (Campbell & Graham, 2006; World Health Organisation, 2014). Improvements in the recognition of pregnancy related complications as well as improved transport procedures have resulted in a higher number of women with complicated pregnancies being referred to referral centres. Most referral hospitals have been unprepared for the additional influx of patients this has created.

Attendance at a health facility does not guarantee high quality maternity care. A recent systematic review defined quality maternity care as the provision of preventive and supportive care with effective treatments for problems when they arise and optimisation of biological, physiological and sociocultural processes (Renfrew et al., 2014). This review describes a framework and essential components for quality maternal and newborn care, including the need for the effective and timely first line management of complications. To deliver high quality maternity care it is necessary to create an environment where these effective midwifery interventions are consistently implemented. However health care facilities in low-income countries (LIC) are frequently characterised by overcrowding, delays, insufficient drugs, equipment and staff, as well as inadequate knowledge and skills. A

systematic review of the "third delay," i.e. delays that occur within the hospital system, cited human resource weakness as a major cause of hospital-based delay, specifically overcrowding, inadequate staff numbers with insufficient training and poor motivation (Knight et al., 2013).

In LIC pregnant women may wait for hours, even days, for evaluation and treatment when they arrive at the hospital. This delay can be deadly for conditions such as haemorrhage, eclampsia, obstructed labour, and fetal distress. Problems are compounded by lack of drugs, equipment, and resources such as water and electricity. The concept of "triage" is uncommon and many hospitals in LIC operate on a "first come, first served" basis (Rosedale et al., 2011). In high resource settings, triage has been used in emergency medicine, paediatrics and more recently in obstetrics, to ensure timely and high quality care (Molyneux et al., 2006; Iserson & Moskop, 2007; Angelini & Howard, 2014). In obstetrics, triage is frequently performed by midwives or obstetric nurses and is defined as "the brief, thorough and systematic maternal and fetal assessment performed when a woman presents for care" (Ruhl, 2014).

Obstetric triage includes labour assessment, monitoring of fetal well-being and laboratory assessment of complications. International guidelines recommend that the initial assessment should begin within 10 min of arrival (Paisley, 2011). Results of a recent systematic review found that obstetric triage enabled more rapid response to emergencies, improved maternal and fetal surveillance, prevented unnecessary admissions, improved utilization of beds and reduced waiting times (Angelini & Howard, 2014). Obstetric triage has also been shown to ensure that labour onset is correctly diagnosed so that unnecessary interventions including syntocinon augmentation and caesarean section are prevented (Lauzon & Hodnett, 2001). Misdiagnosis of labour contributes to congestion and increases workload on the labour ward (Cheyne et al., 2006).

Most of the literature describes triage in sophisticated health settings and suggests that its effectiveness is strongly dependent on the provider's ability to assess, triage, treat, and discharge patients effectively (Zocco et al., 2007). Several studies describe emergency triage, assessment, and treatment (ETAT) in LIC with the development of guidelines for appropriate paediatric triage (Gove et al., 1999; Molyneux et al., 2006). A systematic review of critical care in LIC revealed that emergency care and triage are often the weakest parts of the health system but if these are well organized they can be life-saving and cost effective (Baker, 2009). However, in general, there is a paucity of literature describing methods and outcomes regarding obstetric triage in low-resource settings.

Women are referred to Ridge Regional Hospital (RRH) from nearly 100 maternity polyclinics across Greater Accra. Although new building is in progress, the maternity unit currently operates in the original part of the hospital built in the 1920's. The labour ward is situated on the first floor and consists of a corridor with a bench and examination room, eight delivery beds plus two beds in the corridor, and a small room for newly delivered mothers. The recently refurbished maternity theatre is a 10 minute walk away. In 2007, Kybele (a non-governmental organisation dedicated to improving childbirth) partnered with the Ghana Health Service (GHS) to conduct a five year quality improvement project to improve processes and practices to reduce maternal and neonatal mortality at RRH (Engmann et al., 2010; Srofenyoh et al., 2012). Part of the initial project involved improving patient and delivery data collection including mortality figures. This phase of the project also identified significant delays that were occurring following the arrival of patients to the labour ward. Seventy percent of patient admissions were referrals from other facilities with complications, and many of these women were transferred intra partum.

Congestion became more severe, due to an increase in the number of women admitted, all with worsening complications and conditions. Obstetric admissions increased

from 4,793 in 2006 to 11,032 in 2012. During this period of time there was no increase in space or in staff numbers and the department was close to the breaking point (Srofenyoh et al., 2016). Data on waiting times were collected between September and November 2012 as part of a separate study (Goodman et al., 2017). This showed a median (IQR) waiting time from arrival to assessment of 40 (15-100) minutes with a maximum wait time of 1 day 2.5 hours. Approximately 35% of deliveries were by caesarean section and by 2012, an average of 11 were performed each day. In Ghana, individual institutions collect mortality statistics, and maternal mortality is higher in referral hospitals than the national average (Lee et al., 2012). In 2012 there were 55 maternal deaths at RRH, equivalent to a maternal mortality ratio of 499/100,000 live births.

The objective of this study was to establish whether it was possible to introduce and embed a midwife-led obstetric triage system to a busy labour ward in a LIC to improve the quality of care and to reduce delay.

Methods

Stage 1 - Study setting and design

This project utilized a participatory action research approach to establish whether it was possible to introduce triage principles to improve the identification, assessment and first-line management of women arriving on the labour ward and reduce congestion and delay in the admission process at RRH, Accra. Action research is an interactive enquiry process that consists of a spiral of steps, each of which is composed of planning, action and fact-finding (Loewnson et al., 2014). It has been used in developing countries to improve health programmes and to address health inequalities (Baum et al., 2006; Rhodes et al., 2007). The approach aims to solve problems within an environment by actively participating in the situation while simultaneously conducting research. It consists of a process of organising and validating experience, analysing and reflecting on patterns and collecting data, before agreeing on a course of action, and requires those being researched to be actively involved in the process (Baum et al., 2006). The collaborative nature of the relationship that already existed between RRH and Kybele, as well as trust in the partnership, provided the structure for this process. The overall structure for the project is outlined in Figure 1.

In 2012, baseline data was collected to describe and understand the operational processes and to identify system weaknesses. Several Kybele team members (experienced midwives and obstetricians) spent several weeks on the labour ward observing the care of mothers and babies. This observation consisted of familiarisation with written policies and records, as well as talking to staff and patients. Meetings and focus groups were held with midwives, nurses, orderlies, managers, medical officers, and senior obstetricians to identify their views about the reasons for delays. Fifty three individual observations were made of admissions of women on the labour ward (September and November 2012) to assess compliance with the written hospital triage protocol. Finally, 25 members of the medical and

midwifery staff completed a “learning needs assessment” to identify their knowledge gaps and to suggest topics about which they would like further training.

Stage 2 - Triage training course planning and execution

Baseline observations showed that there were significant delays and problems with the admission process to the labour ward and that the immediate care of women needed to be improved. It was agreed that an “Obstetric Triage Training Course” would be developed to improve patient care by reducing congestion and delay for sick women arriving at RRH. Through the course, knowledge and skill gaps would be addressed that were identified from the learning needs assessment and observations of poor compliance with admission protocols. The staff self-assessment of learning needs identified basic life support, managing eclampsia, haemorrhage, shock, infection, breech delivery, rapid assessment, referral and communication as useful topics for instruction. However as many staff had previously attended Life Saving Skills (LSS), Safe Motherhood and other equivalent workshops delivered by the GHS and other agencies, it was important not to replicate these courses. Instead, the triage training aimed to build on existing knowledge, emphasizing recognition of the seriously ill and deteriorating patient, problem identification, decision-making and communication in order to improve the care of sick women arriving on the labour ward. The training was also tailored to the local environment. A significant amount of “hands-on”, interactive and practical learning opportunities was incorporated into the design of the training. A literature search of evidence-based best practice guidelines also helped shape the course.

Because the aim was to improve the immediate care of women arriving on the labour ward, training was intended for labour ward staff. Each training group consisted of seven to ten midwives delivered over a period of time at separate intervals. This enabled as many staff

as possible to attend without depleting the labour ward of essential staff. Records were kept of dates, names, speciality, and test results of all participants.

Prior to training, all participants were expected to be familiar with the hospital policies and protocols. A short pre- and post- test consisting of twenty multiple choice questions assessed participants' basic knowledge of triage, as well as the recognition, physiology and management of maternal acute illness (example question "what is the normal resting respiratory rate in a healthy adult?").

Topics included the principles of triage, role of the midwife, professional accountability, international and local mortality statistics and presentation of the relevant local clinical observations, as well as lectures and practical sessions on recognizing and managing the care of acutely ill pregnant women. Training incorporated hands-on practice, group-work, role-play scenarios, and an innovative "table-top triage" simulation replicating the actual labour ward. In this exercise, the labour ward layout was drawn onto a large sheet of paper and dolls, representing patients, "presented" to the labour ward. Varying degrees of labour and pregnancy conditions were represented on laminated cards. An "assessment," a "working diagnosis," and a "plan" had to be made before the dolls were moved around the table-top to receive the appropriate care. Quality improvement techniques were also introduced in the training, to help participants identify practical solutions to common problems. This highly interactive format sought to foster the development of active problem-solving skills.

Stage 3 – Embedding the process by identifying improvement activities

Two midwives, identified during the first training, were designated as "Triage Champions." Both were experienced labour ward midwives enthusiastic about the concepts of triage and quality improvement. They worked alongside the Kybele trainers, as role models and coaches, to uphold high standards in the triage area, monitor the improvement projects and to

conduct training. The champions were later involved in the development of a Triage Protocol Handbook containing guidelines for practice.

Two significant improvement tools were generated from problem-solving exercises. In a chaotic environment where patient folders are separate from the patient, it was not clear how to identify the urgency of a woman's condition. After exploring various ideas, the midwives eventually decided on the following solutions. The first was a coloured band that would be applied to every woman's wrist to reflect her risk status and the severity of her condition. Every patient would be identified with a red, yellow or green wristband representing high, intermediate and low risk, respectively. It was agreed that this wristband should remain in place throughout the hospital stay and although it could be changed for a higher acuity band if the woman's condition worsened, it should never be changed for a less urgent colour.

The second improvement was to develop a one page Triage Assessment form (Figure 2) to replace the cumbersome, narrative charting activities. This was designed to follow the systematic assessment of the woman taught during the training, and to record all the relevant information in an easy to use format. This included a brief history, reason for referral, physical assessment and labour assessment with a space to record a "working diagnosis" alongside a brief "plan", both recorded in a box matching the coloured wristband (red, yellow, or green). The Triage Champions subsequently developed a colour-coded chart identifying key clinical situations to act as a visual prompt for staff performing triage (Figure 3).

In addition, several organisational and structural changes strengthened the triage process. A designated, senior and experienced midwife was allocated to triage for every shift. The triage room was set with the essential equipment, stationery and drugs required to conduct the initial triage assessment and to provide first line management for complications.

The Triage Champions and designated triage midwives were responsible for ensuring the room remained clean, organised and stocked. The room was also equipped with a patient transfer trolley and essential contact information.

Stage 4 – Evaluation of outcomes

Ongoing evaluation activities were incorporated into the study design to establish how well the improvement tools (the triage assessment form and coloured wristbands) were utilized in clinical practice. By completing the triage assessment form and recording a 'working diagnosis', the midwife needed to have examined and reviewed the woman to decide on the severity and priority of the woman's condition and wristband colour. Recording a plan meant that the midwife had made a decision about what should happen next. The wristband also provided a visual marker of the severity of the woman's condition and an alert for medical, obstetric and neonatal staffs.

In order to monitor wristband usage, at the start of her shift, the "in-charge" midwife counted how many women were on the labour ward and how many of them were wearing coloured wristbands, recording the results in a ledger. The Triage Champions checked this ledger to monitor how frequently the check was performed. To evaluate the reliability of the wrist banding, every week they randomly selected 10 patient and folder combinations, to ensure the woman's wristband colour correlated with the severity of her condition. The Triage Champions also created a noticeboard and shared the results at clinical meetings.

Patient waiting times were re-measured at the end of the project. Data was collected from December 15th- 31st, 2014 to determine the length of time women waited from arrival to initial assessment. This was compared to the baseline established in 2012 as reported by Goodman, et al., (2017).

Institutional review board approval to collect data in association with this research was granted by Wake Forest School of Medicine and the GHS. Statistical analysis was done using STATA version 14.0 (StataCorp, College Station, TX). Time intervals were evaluated with the Kruskal-Wallis test. Results are presented as median (interquartile range) and a p-value less than 0.05 was considered statistically significant.

Results

Preliminary assessment

The baseline observations showed no formal triage system in place. Three midwives staffed the labour ward per shift, but this was reduced to two if one was needed to accompany a woman to theatre. Women presenting to the labour ward waited on "the bench" and were assessed as space became available. No specific staff member was responsible for attending to admissions or to individual women. A small examination room had been designated as a "triage room" but it was not properly used, was dirty and poorly supplied. Acute events such as eclamptic fits, haemorrhage, or second stage of labour often disrupted the queue.

The labour ward environment appeared overcrowded, with limited physical space, was visibly dirty and cluttered with broken or inappropriate equipment. Managing periods of high volume was difficult and women frequently delivered unexpectedly or on the floor. Observations revealed poor communication during hand over and emergencies, non-adherence to local protocols, lack of recognition of seriously ill patients and lack of accountability. Existing documentation was cumbersome with little meaningful information recorded, particularly when the labour ward was busy. No single place recorded a woman's pertinent information and women did not wear identification bands so it was difficult to establish vital information about the women or the treatment they had received.

Fifty-three structured observations of the admission procedure assessed the extent to which staff adhered to the existing triage protocol. These observations showed poor compliance with existing protocol and inadequate standards of care. In only one third of cases was the woman asked about her presenting complaint. In one third of cases the referral letter was not read, nor was the reason for the referral identified. In only one third of cases was a doctor informed of problems. These results are shown in Figure 4.

The Triage Training Course

In total, 62 midwives were trained over 8 sessions between January 2013 and September 2014. This represented all of the midwives working on the labour ward as well as most working in the theatre, antenatal, and postnatal wards. Although training was intended to be multidisciplinary, few medical staff participated.

Thirty midwives attended the first set of two-day triage training courses in January 2013. These midwives took pre-and post-course tests scoring 11.5/20 (range 6-17) and 14.6/20 (range 8-20), respectively. They also completed an extensive post-course workbook intended to reinforce the learning. With each subsequent iteration of the training, modifications were made to improve the content and delivery, based on evaluation and participant feedback. Although initially planned as a two-day training, the course was subsequently reduced to one day. Some clinical content, pre- and post-course tests and the workbook were eventually removed to focus on interactive, problem-solving exercises, quality improvement and communication in relation to the care of the seriously ill woman. Releasing clinical staff for a single day's training was also easier to manage. The final streamlined format was a one-day training that focused on understanding the importance of triage, accountability, recognizing the seriously ill and deteriorating woman, and process improvement. All the course materials including teaching aids and problem-solving activities were incorporated into a flip-chart manual, which would ultimately be used by the local trainers in future courses. All participants received a certificate of course completion.

Feedback was given to senior medical and midwifery managers immediately after the January 2013 training. Several of the midwifery managers had attended the course and were keen to maintain the momentum achieved during training. All were enthusiastic to introduce the identified improvement activities immediately.

Embedding Triage Practices - Monitoring and Evaluating the Use of Improvement Tools

Use of coloured wristbands began immediately after the first triage training course in January 2013. The frequency of monitoring improved over time (Figure 5a) as did the utilization of wristbands, with a cumulative mean of 83% (Figure 5b). Correlation of wristband colour with maternal condition was generally good. Out of 535 folder and wristband combinations, 495 (93%) were correct.

All labour ward staff were given a short questionnaire to ask whether "triage coloured wristbands have been helpful to you?" Twenty of 25 (80%) responded "yes," (the remaining 5/20 questionnaires were incomplete). Comments included "if you see a patient with a red band, you monitor her more frequently," "it helps me know who to attend first," and "it helps me act appropriately in high-risk cases." Staff genuinely appeared to appreciate the ability to quickly identify the most seriously ill women.

Evaluation of the use of the triage assessment forms commenced in December 2013, when 48/62 (77%) of the midwives had been trained. Kybele trainers randomly selected 100 charts for review and found that 88% of the women had a wristband applied, 74% had a "working diagnosis" recorded, and 56% had a "plan" documented on the chart. During each quarter of 2014, the Kybele trainers randomly selected 50 additional charts for review (Figure 6). The cumulative average found that 92% had a wristband applied, 85% had a diagnosis, and 82% had a "plan" documented in triage, representing sustained improvement. The improvements recorded by Kybele trainers was consistent with the wristband monitoring by the labour ward managers and Triage Champions. It is interesting to note that monitoring significantly improved after the Triage Champions spent two weeks with South Tees NHS Trust, experiencing UK midwifery practice.

Waiting Times

Waiting times from labour ward arrival to initial assessment also improved. Prior to the triage training, the median (IQR) patient waiting time from arrival to initial assessment was 40 (15-100) min, with a maximum wait time of 1 day 2.5 hrs (Goodman et al.,2017). Following training, a review of 203 admissions between December 15-31, 2014 found that waiting times were reduced to 29 (11-60) min ($p=0.007$), which achieved the institutional goal of 30 min. The maximum wait time was 8 hrs 50 min.

Discussion

This study reports on the introduction of a midwife-led triage system into a high volume, low-resource maternity referral unit in Accra, Ghana. An interactive educational programme was developed focusing on assessment, risk identification and first-line management of women arriving on the labour ward. The study evaluated the use of improvement tools generated through the programme and resulted in a significant reduction in patient waiting time.

The programme has improved the quality of care for women and is now sustained by local staff. The course challenged participants to reflect on their working environment and to produce tangible ideas that could be tested in practice. Introducing the colour-coded risk acuity wristbands was helpful. Even when an assessment was incomplete, the application of a wristband demonstrated that judgement had been made about the severity of a woman's condition and the urgency of her need for care. The triage assessment form was a significant improvement on the previous documentation and provided a one-page systematic assessment for high quality decision-making. Even when not fully completed, it provided essential data that was helpful for ongoing management.

It is not clear which specific activity has had the greatest impact on reducing delay and improving the quality of care. One benefit of the programme has been the engagement of staff to seek improvements in their working environment for the mothers and babies in their care. In busy and sometimes overwhelming clinical circumstances, this approach provided the staff with a degree of control that may have influenced their motivation. The action research approach ensured a continuous cycle of engagement and improvement that was accompanied by reflection and reassessment. The use of different monitoring and evaluation methods described in this project acted as a form of triangulation that strengthens the reliability of the findings, but cannot prove cause and effect.

Several other well established short courses for emergency obstetric care exist; Advanced Life Support in Obstetrics (ALSO), Managing Obstetric Emergencies and Trauma (MOET), and Life Saving Skills (LSS). Recently a Maternal-Acute Illness Management (M-AIM) course was delivered in a LIC (McCarthy et al., 2015). In reviewing these courses, only LSS covers "communication, triage, and referral" as a core course component.

The course described in this paper is unique in that it focuses solely on the triage process. The participatory elements built into the training increased the likelihood of engagement and sustained implementation. During the project, local Triage Champions were identified and empowered to lead the change effort and to maintain regular communication and support. Systems management and quality improvement principles were introduced, that enabled the midwives to approach their work with an improvement mind-set rather than accepting the status quo. The course ensured that previous education and skills were utilised and that the new principles introduced helped the midwives better apply their knowledge.

Midwives now fully maintain obstetric triage at RRH. They have taken responsibility for resources, standards, monitoring and evaluation, and for training new and updating existing staff. They have been involved in and have taken responsibility for developments including a newly designated Triage Pavilion located outside the cramped labour ward, and extending triage principles to include all emergency obstetric admissions. The Triage Champions have also sought to improve the referral process by liaising with staff in peripheral clinics to provide advice, support, and training.

A systematic review of studies from high-income countries (HIC) found that obstetric triage provided a more rapid response to emergencies, improved maternal and fetal care, prevented unnecessary admissions, improved bed utilisation, and reduced waiting time (Angelini & Howard, 2014). An obstetric "Triage Acuity Tool" described by Paisley et al. (2011) in the US, required patients to be assessed within 10 min of arrival and categorised by

specific symptoms, requiring immediate (within 15 min), semi-urgent (within 30 min) and less urgent (within 60 min) treatment. A Canadian study described a "Category Obstetric Acuity Scale" with a comprehensive set of obstetric criteria using time and colour-coded categories to prioritise urgency (Smithson et al., 2013). Griffin and Hyrkas (2014) described how the use of a colour-coded obstetric triage acuity tool, standardised guidelines, and the provision of interdisciplinary training improved the triage process and patient care and also reduced waiting times.

Transferring knowledge and practice from HIC to LIC is a complex process that goes beyond simple knowledge transfer. A systematic review of the effectiveness of such courses in LIC, questions how effectively knowledge and skills are retained following training (van Lonkhuizen et al., 2010). Interactive workshops, multifaceted and audit interventions have been shown to have some effects, but in all cases scaling-up and sustainability have been difficult to achieve (Althabe et al., 2008). It is necessary to develop methods to monitor and evaluate effectiveness and outcomes in the quality of care. These concepts have been incorporated into the development of this triage training course such that the programme is specifically designed for use in a LIC setting. However, it is equally important that the programme is tailored to each individual local environment. Therefore, in order to replicate this programme, it is important that appropriate observations are made and the necessary local data are collected so that the specific challenges and circumstances of each particular institution can be understood and incorporated into the content of the material.

Conclusion

In LIC, the adoption of contemporary obstetric practices has been poor, especially with regards to obstetric triage. The study was undertaken to introduce and embed an effective obstetric triage system at a busy low-resource referral hospital, to ultimately reduce delay and

improve the quality of care for women arriving on the labour ward. Experienced practitioners from the UK and the United States who were familiar with RRH and low resource settings developed the training programme and worked with local staff to incorporate triage principles and improvement tools.

This approach involved a preliminary assessment to understand the challenges in the environment, an interactive format, and joint discovery supported by monitoring and evaluation. A triage system has been developed that is locally driven and sustained. Direct consequences of the training included the number of midwives trained, adaptation and improvement to the clinical space, and the identification of Triage Champions. Early analysis demonstrated the successful and sustained use of colour-coded patient wristbands and a triage assessment form which documented a working diagnosis and care plan, and reduction in waiting times. Data are currently being collected to assess the patient outcomes, based on their wristband colour and their subsequent management that will form the basis for future reports. Ultimately it will be important to determine if the obstetric triage intervention results in maternal and newborn lives saved.

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Conflicts of Interest

None of the authors has conflicts of interest to declare, financial or otherwise.

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Figure Legends

Figure 1. The overall structure of the project

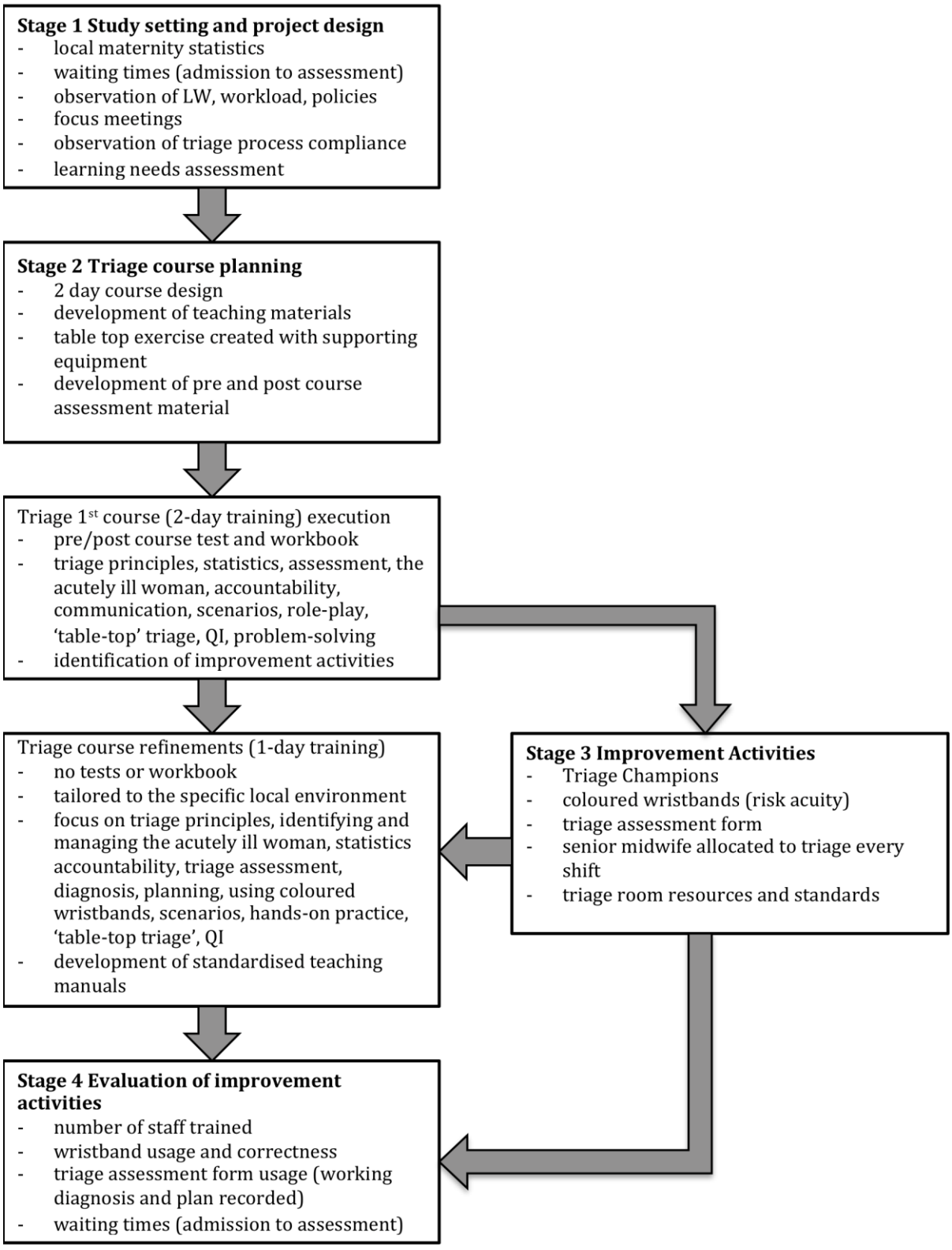

Fig. 2 Triage Assessment Form from Ridge Regional Hospital, Accra, Ghana

LABOUR TRIAGE FORM

ARRIVAL DATE:		ARRIVAL TIME:			MEANS OF TRANSPORT:		
NAME:				AGE:	PARITY:		
ADMISSION DATE:		ADMISSION TIME:					
ACCOMPANIED ☐YES ☐NO		BY:					
ATTENDANT AT:			REFERRED FROM:				
PRIMARY SURVEY							
VITAL SIGNS	Respiration	Pulse	Blood pressure	Pulse pressure	Temperature	SPO2	FHR
ASK	Losing liquor ☐yes☐no ROM Date:			ROM Time:			
REFERRAL REASON							
MEDICAL HISTORY							
SURGICAL HISTORY							
RISK FACTORS							
SECONDARY SURVEY				**S.S. Time:**			
EDD:	Gestational Age:		EFW:	HB(<2wks):	Urine protein:		
HbsAg:	HIV status:		Sickling Status:		HB Electrophoresis:		
ABDOMINAL EXAMINATION	SFH	Lie	Presentation	Head descent	FHR in **CST**	Contracting ☐ yes ☐ no	
VAGINAL EXAMINATION	Effacement	Dilatation	Membranes	Liquor colour	Head position	caput	Moulding
DIAGNOSIS AND CATEGORIZATION							
COLOUR CODE	**RED**		**YELLOW**		**GREEN**		
DIAGNOSIS							
PLAN							
Counselled on labour analgesia? Yes / No	**Accepted? Yes /No**		**Analgesia type:**				
NB: Give antibiotics if signs of sepsis, Give steroids if less than 36wks. ***Call House Officer if: Resp. is>25 or< 10, Pulse > 110, Systolic BP > 160 or< 90, SPO2 < 95.*** ***Call Senior Doctor if: Resp. is >35, Pulse > 120, Systolic BP >200 or < 80, SPO2 < 90.***							
ASSESSED BY: Name:				Rank:	Sign:		
TRANSFERRED OUT OF TRIAGE: To:				Date:	Time:		
Transferred out by: Name:				Rank:	Sign:		

Fig. 3 Visual acuity chart corresponding to wristband colour

RED	YELLOW	GREEN
Eclampsia/seizure	Sickle cell not in crisis	Generalised complaints
Haemorrhage/heavy vaginal bleeding	Decreased or no fetal movement	Normal labour
Antepartum/postpartum haemorrhage	Multiple pregnancy in labor	
Coma/unconscious	Pre-term labour	
Abnormal vital signs	Pre-term rupture of membranes	
Sickle cell crisis	Stable/managed hypertension	
2 or more previous c/s in active labour	Previous c/s	
	Diabetic	
	HIV Positive	

Fig. 4. Observations of midwives' actions during the admission of 53 women to the labour ward in 2012

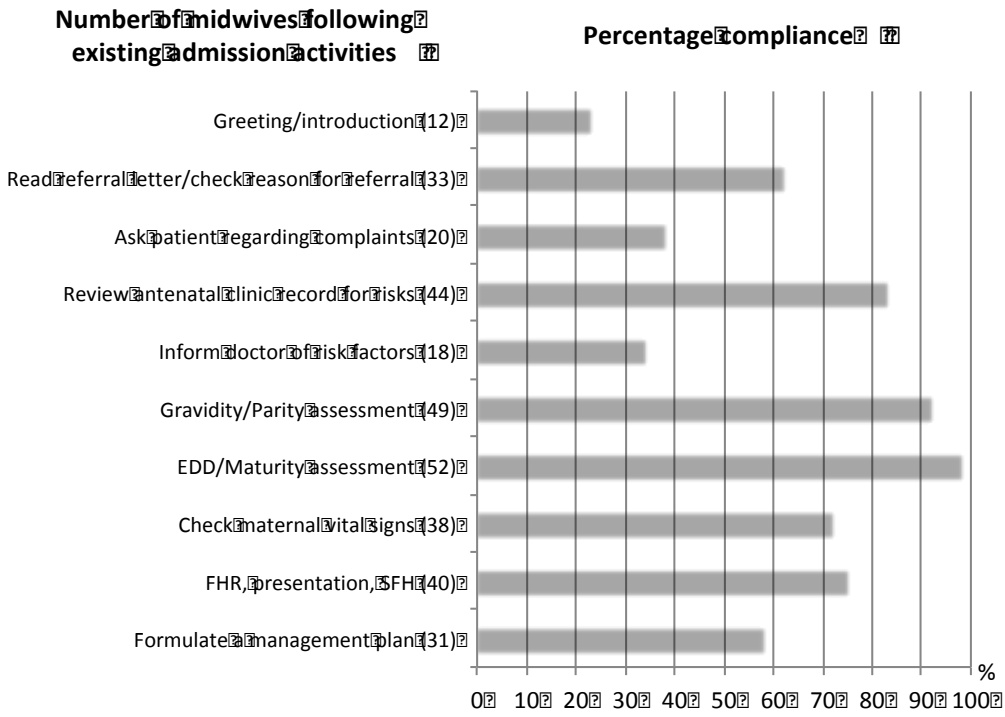

Fig. 5. A) The percentage of shifts monitored for wristband use over time (June 2013-December 2014).

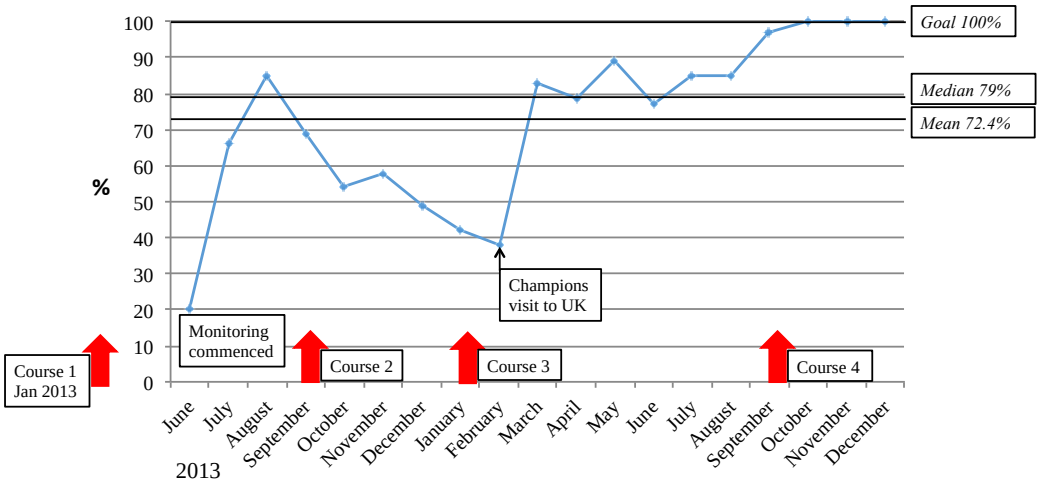

Fig. 5 B) Wristband use over time (June 2013 – December 2014)

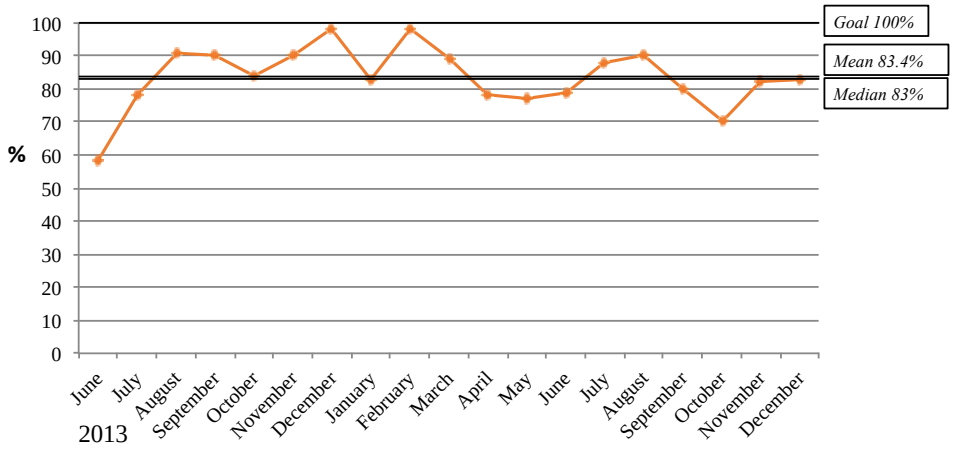

Fig. 6 Results of Triage Assessment Form audit 2013 – 2014