Teamwork Approach in Labor and Delivery: Method to Improve Maternal and Neonatal Outcomes at Orotta Maternity Hospital

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Abstract

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Background: Top global priorities in maternal and neonatal health along with health systems strengthening provide a framework for incorporating quality improvement measures into a new teaching hospital environment.

Objective: Assess impact of in-service continuing medical education on improved teamwork, communication, and maternal and neonatal outcomes.

Methods: A 3-month pilot study with a pre-train/post-train research design. Hospital medical staff (n=45) participated in Ob/Gyn resident taught course within the National Referral Maternity Hospital in Asmara, Eritrea. A standardized Safety Attitudes Questionnaire (SAQ) along with a needs assessment questionnaire to identify educational gaps and team attitudes were given before the course and the SAQ along with a follow up questionnaire for CME effectiveness were given after. Outcome measures were changes in the mean score of the teamwork survey and relative risk estimates of specific maternal and neonatal indicators. Data were analyzed with t-test, alpha 0.05, 2-sided p-value using Stata IC10. Neonatal outcomes were also assessed with a set of quality indicators: the adverse score index, weighted score index and severity score index.

Results: SAQ response rate was 77.6% (45/58) pre-CME and 95.6% (43/45) post-CME. Eight out of forty questions met statistical significance ($p<0.05$) in all domains except stress reduction. Continuation of CME was desired by 94.7% at 2x/year. When domain specific questions were pooled, four of six domains met statistical significance, as did the overall pooled questions. The educational intervention did not show statistically significant change in relative risk estimates of maternal (maternal death, RR 1.08 (0.20-5.84) and blood transfusion, 0.90 (0.74-1.09)) or neonatal outcomes (intrapartum death, 1.24 (0.57-2.75), neonatal death, RR 0.93 (0.26-3.24), neonatal transfer, RR 1.02 (0.81-1.27) and Apgar<7 at 5 minutes, RR 1.20 (0.83-1.73)).

Conclusion: Utilizing Ob/Gyn residents to implement staff developed continuing medical education within a hospital setting is effective and may be a method to create improved communication and teamwork amongst ward staff. The impact on improving maternal and neonatal outcomes in the short-term is not evident and continued follow-up is important. This project may be a method for MOH to provide sustainable, low-cost education for their healthcare workers while improving work environment and possible quality of care.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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DEDICATION

To the Women and Children of Eritrea

SECTION I. INTRODUCTION

Maternal and neonatal morbidity and mortality are top priorities for many developing countries. The time of birth is critical for both mother and infant with estimates of 3 million early neonatal deaths (first week of life), 1 million intrapartum-related neonatal deaths, and 358,000 maternal deaths worldwide per year (Lawn, Lee et al. 2009; Wilmoth 2010; Spector, Agrawal et al. 2012). With the upcoming deadline for the Millennium Development Goals (MDG) in 2015, many countries have actively engaged in country-wide programs to encourage women to deliver in a health care setting with trained healthcare workers. As access to healthcare improves, it is also important to maintain and evaluate the quality of care within the hospital setting; especially high risk wards such as Labor and Delivery (L&D).

In 2007, the World Health Organization (WHO) recognized the importance of quality health care as a key mediator in the process of developing a framework for health systems strengthening (Leatherman, Ferris et al. 2010; WHO 2007). Though quality of care can have multiple contextual definitions and various methods of measurement and evaluation, a primary focus must be at the service provider level in their respective work environments (Leatherman, Ferris et al. 2010; Adleyi and Morrow 1996). Audit studies conducted in both Malawi and Nigeria have noted that 40-50% of maternal deaths occurring in their hospital system could be attributable to suboptimal quality of care (Hunyinbo, Fawole et al. 2008; Kongnyuy, Mlava et al. 2009). Similar statistics are noted in developed countries such as the United Kingdom (UK) where an audit of intrapartum-related stillbirths noted suboptimal care in over 75% of the cases and that an educational training course in obstetric emergencies could improve perinatal outcomes (Draycott, Sibanda et al. 2006). Therefore, this focus on the service provider should include

concerted efforts for local hospital and government ownership to sustain efforts for continuous education of its providers along with quality assessments of its service (Leatherman, Ferris et al. 2010; WHO 2007).

Within reproductive health programs in low resource settings, *education and training* is a key component of maintaining and supporting quality health care (Kwast 1998). It is vital that this component be supported at multiple levels within the health organization and Ministry of Health (MOH). One example of a successful educational program was the implementation of the *Life Saving Skills curriculum* (*LSS*) (Kwast 1998; Grady, Ameh et al. 2011). This program has a 'systems-based' approach and allows MOH to provide national level training for their health service providers. In addition, LSS and other short-course trainings have shown decreases in maternal and neonatal morbidity and mortality (Leatherman, Ferris et al. 2010; Grady, Ameh et al. 2011); but there continues to be a paucity of continuing medical education and quality assurance following these programs. Another concern at the hospital level is the limited number of staff who attended LSS or other educational courses. These short courses can be expensive, remove health workers from their work environment, and require continued reinforcement of knowledge and skills gained in order to improve maternal and neonatal outcomes (Leow, Groen et al. 2011). Thus efforts to create a system within the hospital environment to develop and implement continuing medical education is imperative (Leow, Groen et al. 2011).

As development of a strong health system requires human and resource capacity building, efforts to utilize local health professionals is necessary for a sustainable system towards quality health care (Leow, Groen et al. 2011). When evaluating various work environments particularly high

risk and emergency areas, effective and proficient communication and teamwork between service providers at all levels of hierarchy must occur in order to avert adverse events (Kilday 2012; Charney 2011; Siassakos, Crofts et al. 2009; Salas, Almeida et al. 2009; Hall and Weaver 2001). What is more difficult to define is an evidence-based approach to accomplish effective communication and team training. If one evaluates research performed in high resource settings, the literature supports a teamwork approach for L&D based on consistent reports of adverse events related to both lack of communication and lack of teamwork in the hospital setting. One review of obstetric malpractice claims in the United States of America (USA) noted that 31% of adverse events were attributed to communication problems (White, Pichert et al. 2005). In addition, both in the UK and USA, reviews of perinatal and maternal deaths and injuries have shown that more than 50% of these outcomes have resulted from both communication and teamwork issues (Guise and Segel 2008; Charney 2011). As a "high-hazard" industry, as are aviation, nuclear power plants, and the military, L&D wards are especially prone to poor outcomes within a short period of time and thus improving joint responsibility and identifying patient care gaps are of vital importance. In fact, it is estimated that 30% of intrapartum-related neonatal deaths could be averted by only improving the method of resuscitation at delivery (Goldenberg and McClure 2009). Reports from the Joint Commission on Accreditation of Healthcare Organizations (JACHO) in the USA note that poor communication was associated with 80% of perinatal deaths and injuries and poor teamwork was attributed to 40% of maternal deaths and 45% of near miss morbidities (Sexton, Holzmueller et al. 2006). Thus it is critical to have effective teamwork and communication during obstetric emergencies. Though teamwork training is new for obstetrics, studies to date suggest that teamwork not only improves patient outcomes but it also positively affects job satisfaction and staff retention (Guise and Segel 2008).

Most of these studies have been conducted in developed countries with non-clinical 'team-focused' specialized training programs. In a developing country setting, particularly where both human and non-human resources are scarce or absent, remuneration is limited, and infrastructure is not well coordinated, alternatives to 'team-focused' specialized training to improve teamwork and communication should be considered that are low cost, avoid travel and loss of work time, and utilize local hospital staff for sustainability. A recent systematic review article by Nyamtema et al. (Nyamtema, Urassa et al. 2011) on maternal health interventions in resource limited countries noted that insufficient implementation of the trainings were attributed to three main issues: 1) leadership not committed to sufficient funding of health systems, 2) lack of effective use of available resources, and 3) service provider issues due to lack of enabling policies to improve maternal and neonatal care. Another systematic review by L. van Lonkhuijzen et al. 2010, (van Lonkhuijzen, Dijkman et al. 2010) assessed effectiveness of training programs aimed at improving emergency obstetric care in low-resource environments; and they also had a similar result, though inadequate study designs hampered their review. Similar to other reviews, they did note positive reactions to short and long course trainings with improved knowledge and skills but limited evaluations of objective outcomes. In comparison, successful educational training programs in South Africa and Guatemala noted improved objective outcomes that were thought to be due to incorporation of team related communication strategies. A similar strategy was implemented in Bangladesh and India (Raven, Utz et al. 2011) that incorporated all cadres of medical staff including nurses, midwives, general physicians and obstetrics and gynecology (Ob/Gyn) specialists in a 3-day intensive short course training with the opportunity to build/rebuild teams and lasting work relationships. Their program aimed to engage all levels of medical staff to improve their health services. Another important strategy

that was associated with success was peer review and continuing education after formal skills training in Indonesia (McDermott, Beck et al. 2001). Finally, a key component linked to improved outcomes and is increasingly being recognized as an important marker in program evaluations is measuring the trust and the respect that occurs between participants and between hospital systems with the goal of improving the sense of teamwork and sustained collaboration (Dynes, Buffington et al. 2012).

The importance of increasing human capacity cannot be understated but effective communication and teamwork among the additional personnel could be of vital importance for safe and successful patient management, especially in critical conditions. Since L&D is unique among different healthcare wards such that the loss of a young mother and/or infant may occur in short notice, there is potential for high rates of staff burnout, staff turnover, and general malaise. This ultimately translates into sub-optimal patient care. Therefore, by incorporating improved communication and teamwork among all levels of L&D staff, along with continuing medical education and staff empowerment, the opportunity to provide support to each team member, despite limited resources, will translate into improved maternal and neonatal outcomes.

We hypothesized that by implementing a hospital-based continuing medical education (CME) course whose topics are driven by the maternity staff and taught by Ob/Gyn residents utilizing different teaching methods, we would improve teamwork and communication within the ward setting and breakdown hierarchical barriers that may exist and that this link would improve maternal and neonatal outcomes. The purpose of this study would fulfill two goals: one for Ob/Gyn residents to fulfill a curricular objective of 'formal group teaching' and the second for

hospital midwives and nurses to upgrade and/or share their skills and knowledge with the Ob/Gyn residents; thus fulfilling a needed gap for an in-hospital sustainable continuing medical education program.

SECTION II. METHODS

Study Setting

This study was a 3- month pilot pre-train/post-train study conducted in Asmara, Eritrea from April 2011 to June 2011 at the Orotta National Referral Maternity Hospital, which has the largest obstetric delivery service within the capital city of Asmara and is the primary referral site for peripheral regional hospitals and health centers for complicated pregnancies. It serves a population of 500,000 with almost 9000 deliveries per year. In addition, over the past 2 years, a medical educational training program for medical students, interns and residents has been implemented within the hospital setting. Though this has increased the medical staff, the L&D ward, which previously only functioned with midwives and Ob/Gyn specialists, has now absorbed additional workforce with a new agenda of teaching that puts a strain on an already busy system

Selection of Study Subjects

The study participants were all hospital based, full time clinical staff who were directly or indirectly involved in maternity care at the Orotta National Referral Maternity Hospital. Potential participants included midwives, associate nurses and Ob/Gyn specialists whose names were provided by the hospital matron and totaled 64.

Description of Intervention Development and Evaluation

The educational curriculum intervention was developed and implemented utilizing the information provided by all verbally consented participants who filled out the pre-training questionnaire and a personal work diary. See Appendix A1, A2. A personal work diary was

offered as a method to stimulate topic ideas during a normal working day. This provided a baseline needs assessment tool and has been supported in the literature to help identify specific training needs for the trainee (Perol, Boissel et al. 2002). Thereby, we would implement a more targeted training program rather than arrange topics, which we felt, were important. The participants were asked to write daily notes for one week that address issues for improving patient care in L&D and specific educational topics that would complement their current knowledge. They could then utilize this personal reflection to fill in the second needs assessment questionnaire which was developed by the principal investigator with input from the Ob/Gyn residents and included both demographics of the participant and questions related to their educational gaps and desires. The questionnaire also included the participant's thoughts about improving teamwork and student teaching on the hospital wards.

The educational program occurred 4x/week for 5 weeks with an extension period of 4 weeks for participants who were unable to attend lectures but desired the opportunity to learn. (See list of topics in Appendix B) This extension program was computer-based, whereby the participants viewed all lectures from the lectures series and asked the residents questions on a one-to-one basis. A computer was placed in L&D with all lectures and other support materials for continued learning. There were a total of 10 – 2-hour lectures with each lecture repeated once during the 5 weeks to provide optimum opportunity for most participants. Teaching formats were chosen by the resident and included lectures, case studies, question-answer sessions, and hands on simulation for maternal and neonatal resuscitation. Participant feedback was requested and provided for resident evaluation. A third questionnaire was given after the educational intervention to evaluate participant's thoughts about continued medical education and its

effectiveness as a method to improve teamwork and communication in daily work (See Appendix C).

Measurement Tool

The Safety Attitudes Questionnaire (SAQ) developed by Sexton et al. (Sexton, Helmreich et al. 2006) has previously been validated for developed countries with several versions, including one for L&D. This survey is a psychometrically sound method to determine healthcare workers assessments of their work environment and the context of how they deliver care and to measure effectiveness of work environment interventions. The original survey had 57 questions but we chose to adapt the form to reflect the local situation of our setting with input and direction both from the Ob/Gyn residents and two midwives who worked in maternal health at outside hospitals. We understand that this may compromise the validity of the questionnaire but also felt that as a pilot project the local input was important. They provided input into clarity of the questions and local relevance of the questions. The final survey used included 40 adapted questions out of 57 original questions (See Appendix C). The SAQ elicits attitudes through 6 domains: teamwork, job satisfaction, perception of management, safety, working conditions, and stress recognition. The response to each of the items is a 5-point Likert scale. (1=disagree strongly, 2=disagree slightly, 3=neutral, 4=agree slightly, 5=agree strongly). The adapted version focused on teamwork and safety questions. Figure I outlines the six domain definitions, number of questions in each domain, and question examples.

Domain Definition	Number of Questions	Question Example
Teamwork (T): perceived quality of collaboration between personnel	12	I feel my input is well received in this clinical area
Job Satisfaction (J): positivity about the work experience	6	I like my job
Perceptions of Management (PM): approval of management action	3	The administration of this hospital is doing a good job
Safety (S): perceptions of a strong and proactive organizational commitment to safety	10	I would feel safe having myself or my family treated here as a patient
Working conditions (W): perceived quality of the work environment and support staff/resources	4	This hospital does a good job of training new personnel
Stress recognition (SR): acknowledgement of how performance is influenced by stressors	5	I am less effective at work when fatigued

Figure I. SAQ domain definition, number of questions and examples

Data Collection

Two methods of data collection were performed. For the primary teamwork and communication outcome, data were collected from three separate questionnaires. The first questionnaire provided participant demographic data, work experience, and thoughts about working in teams. This was given pre-educational curriculum. The second questionnaire was the verbally consented standardized teamwork and safety survey (SAQ) and was given both pre-training and post-training. The final questionnaire was distributed to the original verbally consented participants post-educational curriculum to reflect their perceived knowledge of skills and education gained from the resident taught curriculum. The Ob/Gyn residents distributed the questionnaires to consented participants and answered any questions.

For the secondary maternal and neonatal morbidity and mortality outcome, data were collected on forms developed to capture specified outcomes of maternal death and blood transfusion and

four neonatal outcomes: 1) neonatal mortality < 7days for infants >2000 grams (gm), 2) intrapartum neonatal death > 2000 gm, 3) APGAR < 7 at 5 minutes (>2000 gm), and 4) neonatal transfer to NICU (> 2000gm). All maternal outcome data were collected from hospital statistics department where total numbers of adverse events were tallied monthly. The maternal outcomes were only event counts and therefore we could not correlate with demographic delivery data collected from the maternity logbooks. Additional desired maternal outcomes of maternal transfer to the intensive care unit (ICU), uterine rupture in facility, and eclampsia in facility were unable to be collected due to inability to access a valid source for these outcomes. Maternal demographic data linked to neonatal adverse outcomes were collected from both the L&D logbook and the neonatal intensive care unit logbook. See Table I for variable definitions. Patient charts were utilized to clarify any data missing in the logbook or in need of further clarification. All patient names were removed from the data list once information was complete and the chart returned.

Adverse events as defined for teamwork studies were utilized and evaluated as previously described and validated (Mann, Pratt et al. 2006; Nielsen, Goldman et al. 2007). The adverse outcome index was developed (Mann, Pratt et al. 2006) to identify the proportion of all deliveries with at least one undesirable outcome and to serve as the primary response variable. This is defined as the number of patients with one or more adverse outcomes divided by the total number of deliveries per unit time. A second, weighted, index outcome measure, the weighted adverse outcome score, was used to assess not only the occurrences of adverse outcomes but also their relative severity. It was defined as the total weighted score of each adverse outcome divided by the total number of deliveries per unit time. The weighted score for a delivery was

the sum of the weights for each adverse outcome that occurred during that delivery, or zero if no adverse outcome occurred. Finally, a severity index was calculated by using the total weighted score of each adverse outcome divided by the total number of deliveries with one or more adverse outcomes. See Appendix E for adverse event scoring system and Table II for outcome measure definition and assigned weights.

Table I. Delivery Logbook Demographic Variable Definitions

Demographic Variable	Definition
Age	Recorded maternal age at time of delivery
Address	Zoba
Gravidity / Parity	Number of pregnancy / Number of delivery
Date	Date of Delivery
Weight	Birthweight of infant in grams at delivery
Gender	Sex of infant: male or female
Time	Time of delivery

Table II. Clinical Maternal and Neonatal Outcome Measure Definitions and Assigned Weights

Outcome Measure	Definition	Assigned Weight
Maternal Death	Any death identified in Maternity Hospital	750
Blood Transfusion	Any blood transfusion given in L&D for any reason	20
Neonatal Death	Any infant death whose 1-minute APGAR is > 0 but whose 5-minute APGAR is 0 or any infant that was transferred to the neonatal intensive care unit but had a recorded death < 7 days	400
Intrapartum Neonatal Death	Any infant admitted to L&D with positive heart beat but with APGAR 0 at delivery and birthweight > 2000 grams	400
Neonatal Transfer	Any neonate transferred to the neonatal intensive care unit (NICU) for any reason and whose birthweight was > 2000 grams	35
APGAR*	Assigned resuscitation score at one minute and 5-minutes with a 5-minute score < 7 but > 0	25

*APGAR: appearance, pulse, grimace, activity, respiration

Data were collected from three different time periods to reflect any identified differences in the time associated changes relative to new medical teaching programs: Interns only reflect 2009 time period and Ob/Gyn residents plus interns reflect 2010 time period. Thus the first two time periods, 2009 and 2010, are for baseline comparison pre-educational curriculum and the final timeline in 2011 reflects post-educational curriculum. Each time period totals 6-months. The time period with only medical interns is from January 2009- June 2009. The Ob/Gyn residents began in the hospital October 2009. In case there is a seasonal distribution of deliveries, the second time period chosen was from July 2010- December 2010 to reflect the time period where data were collected post-training, July2011-December2011 based on planned time to give the educational curriculum (April 2011-June2011). See Figure II for time periods.

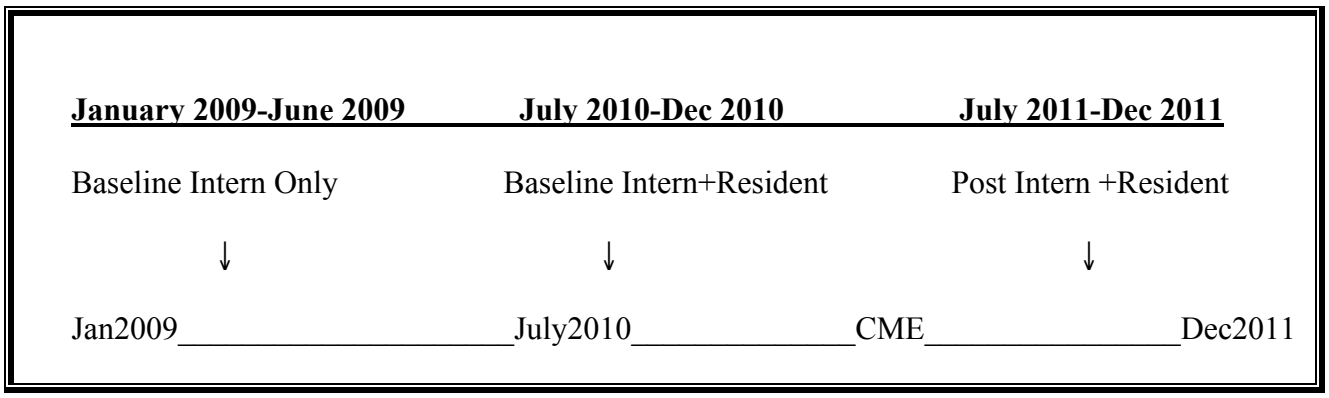

Figure II. Outcome data collection time periods

Analysis Plan

The primary outcome (improvement in teamwork and communication) was the mean score comparison from our adapted version of the validated SAQ for L&D. The t-test was used to assess whether the mean subgroup scores and total scores between the survey given before and after the educational curriculum were statistically significantly different. Values <0.05 were

considered significant and no adjustment for multiple comparisons was performed due to exploratory nature of our study.

The secondary outcome measures were the change in observed rates of maternal and neonatal events. They were first analyzed as a proportion: total number of specific events / total deliveries per unit time and comparisons are reported as a relative risk. Multiple pregnancies were counted as a single delivery. All neonates with anomalies, antepartum neonatal deaths and/or no recorded weight or 5-minute AGPAR were removed from analysis. Neonatal weight >2000 grams was chosen to reflect term/later preterm gestation and avoid adverse outcomes due to preterm status. Analyses were performed with STATA-IC 10 (StataCorp LP, College Station, Texas USA).

Human Subjects:

Recruitment for the educational program occurred initially via a "Recruitment Flier" notification that was posted on all wards in the hospital to attend an informational discussion on a date and time identified by the hospital Matron to be convenient for most staff (after their monthly hospital meeting). Those who attended were also requested to convey this educational opportunity to others who were unable to attend. The information about the training was provided by both the principal investigator and a research assistant who also translated any additional information in Tigrinya and answered questions accordingly. After the informational session, each of 5 Ob/Gyn residents were assigned 12-13 names out of the 64 total potential participants and verbally offered participation of the research portion of the educational program which included a copy of the oral consent written in both English and Tigrinya (see Appendix F),

a personal work diary, a pre-training questionnaire to identify staff educational gaps to be used to develop the educational program, and the standardized SAQ survey. The participation to fill in the questionnaires and survey was voluntary and did not affect formal participation in the educational series. If the staff agreed to participate in the research, then he/she were asked to complete the questionnaire packet with instructions to return it anonymously to a folder that each resident had in a locked cupboard. The study was approved by the UW-Seattle Research Committee and the Human Research and Development Department of the Ministry of Health in Eritrea.

SECTION III. RESULTS

Study Participants

Out of the original 64 potential participants, 58 were available for formal consent. Figure III outlines the participant recruitment. The overall response rate was 77.6% (45/58). The median age of participants was 25 (range 21-58). The median years in the field of obstetrics and gynecology was 2.5 (range 1-32) with a median of 2 years (range 1-25) working at Orotta Maternity Hospital and a median of 2 years (range 1-22) within the L&D ward. The majority of participants were female 74.4% (32/43), which reflects the hospital non-physician staff demographics. Only 26.8% (11/41) had previously attended other educational courses, 33.3% (13/39) had attended a specific LSS course and 47.6% (20/42) had attended at least one of these courses. The responder positions (n=43) were associate nurse 41.9% (18/43), midwife 53.5% (23/43), physician 4.7% (2/43), and medical administration 0%. See Table III for summary.

Table III. Safety Attitudes Questionnaire (SAQ) Participant Summary

Descriptive Variables (n=45)	Mean (SD)	Median	Range
Age	31.1 (11.2)	25	21 – 58
No. Years in Obstetrics	6.9 (8.5)	2.5	1 – 32
No. Years at OMH	5.5 (6.5)	2	1 – 25
No. Years Labor & Delivery	4.5 (6.3)	2	0 - 23
	No. / Total (%)		
Gender			
Male	11 / 43 (26)		
Female	32 / 43 (74)		
LSS Courses			
No LSS	26 / 39 (67)		
Yes LSS	13 / 39 (33)		
Other Education			
No	30 / 41 (73)		
Yes	11 / 41 (27)		
Position			
Associate Nurse	18 / 43 (42)		
Midwife	23 / 43 (53)		
Physicians	2 / 43 (4.7)		
Administrative Midwife	0 / 43 (0)		

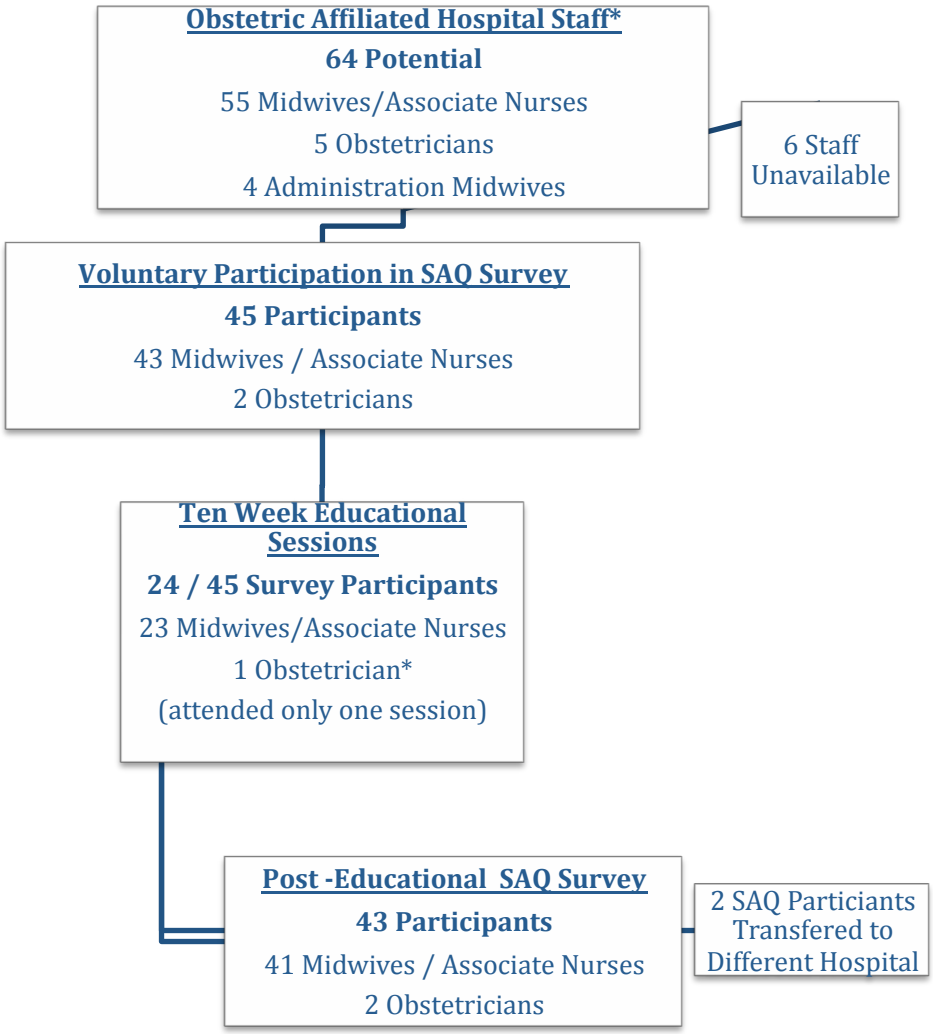

Figure III. Study Population Flowchart
*Educational sessions were voluntary and open to part-time and new medical staff who were not included in the study. An additional 17 midwives and associate nurses attended one or more educational sessions.

Educational Staff Chosen Topics—Needs Assessment from Midwives and Associate Nurses

The most frequent ten topics were chosen from the 82% (43/45) completed pre-intervention questionnaire but only 25.6% (11/43) utilized the personal work diary for educational or teamwork topic ideas. The personal work diary and questionnaire responses were all based on

specific educational topics that related to maternal and neonatal health and not per se to non-clinical team training. 97.6% (40/41) already felt that they worked well in a team but also felt that learning more about a teamwork approach to patient care would be helpful. In contrast, 54.1% (20/37) preferred an individual approach to patient care. Only 26.3% (10/38) were willing to be a team leader, though 59% (23/39) could identify another person they work with whom has leadership qualities. Finally, 90.5% (38/42) felt they would be willing to participate and learn about a teamwork system. Subsequently, a ten-week CME series was developed and implemented per schedule (See Appendix B for schedule and chosen topics).

Of the participants who took the initial SAQ survey, 53.3% (24/45) attended one or more lectures and 95.6% (43/45) took the post-CME SAQ survey. The post-CME follow-up questionnaire to determine effectiveness of resident taught CME showed that 97.5% (40/41) desired the CME series to continue and 100% (40/40) felt that the educational series improved how they worked in team. Table IV outlines the total number of participants/biweekly sessions.

Table IV. Lecture Session Attendance*

Attendance Range: 13-29, Mean=21.3

	BIWEEKY LECTURE SESSION NUMBER									
	1	2	3	4	5	6	7	8	9	10
Participant Totals	15	13	17	22	26	19	27	21	29	24

*Non-SAQ participants (n=17) also attended one or more sessions and are included in the above numbers

SAQ Domains

There were 8/40 questions (20.0%) that met statistical significance at the p-value, 0.05. Of the eight questions two were within each of the safety, job satisfaction and perception of

management domains and one was within each of the teamwork and the working conditions domains. Table V outlines the results of the SAQ and the statistically significant questions mean score responses before and after the educational intervention along with the respective p-values reflecting the change in mean score after the educational intervention. The domain for each question and whether the question was reversed scored are also noted. The analysis was based on complete cases, where the percentage missing per question ranged from 0% -13.3% in the pre-SAQ (mean=4.3%) and 0%-11.6% in the post-SAQ (mean=7.7%). See Appendix G for the missing values for each question at each time point.

TABLE V. Mean Responses to SAQ Before and After CME

Survey Question			**PRE-SAQ RESPONSES** (n=45)	**POST-SAQ RESPONSES** (n=43)	
	Domain	**Reverse**	**Mean (SD*)**	**Mean (SD)**	**P-Value**
1. I like my job……	J	No	3.53 (1.38)	3.95 (1.02)	0.1088
2. I feel that my input is well received in this clinical area……	T	No	3.34 (1.06)	3.46 (1.07)	0.5975
3. I would feel safe having myself or my family treated here as a patient ……	S	No	3.42 (1.14)	3.60 (0.90)	0.4254
4. Medical errors* are handled appropriately in this clinical area……	S	No	2.74 (1.00)	2.95 (1.18)	0.3922
5. This hospital does a good job of training new personnel……	W	No	3.07 (1.32)	3.88 (1.14)	**0.0029**
6. All the necessary information for diagnostic and therapeutic decisions is routinely available to me…	W	No	3.07 (1.09)	3.10 (0.80)	0.8882
7. Working in this hospital is like being part of a large family……	J	No	3.62 (1.19)	4.07 (0.80)	**0.0429**
8. The administration of this hospital is doing a good job……	PM	No	1.82 (1.06)	2.60 (1.15)	**0.0016**
9. I receive appropriate feedback about my performance……	S	No	2.81 (1.17)	3.15 (0.96)	0.1574
10. In this clinical area, it is difficult to discuss errors……	S	Yes	2.77 (1.19)	3.00 (1.26)	0.3889
11. This hospital is a good place to work…….....	J	No	3.12 (1.26)	3.81 (0.89)	**0.0044**
12. Fatigue impairs my performance during emergency situations (emergency resuscitation/ hemorrhaging etc.)……	SR	No	2.88 (1.17)	2.87 (1.00)	0.9796
13. The level of staffing in this clinical area are sufficient to handle the number of patients.	PM	No	2.05 (1.40)	2.86 (0.91)	**0.0019**

(Table V: Continued)

TABLE V. Mean Responses to SAQ Before and After CME (Continued)

Survey Question	Domain	Reverse	PRE-SAQ RESPONSES (n=45) Mean (SD)	POST-SAQ RESPONSES(n=43) Mean (SD)	P-Value
14. I am encouraged by my colleagues to report any patient safety concerns I may have	S	No	3.57 (1.04)	3.81 (0.98)	0.2719
15. The culture in this clinical area makes it easy to learn from the errors of others……	S	No	3.29 (1.08)	3.68 (0.91)	0.0799
16. This hospital deals constructively with problem physicians and staff……	W	No	2.68 (1.05)	2.85 (1.01)	0.4459
17. In this clinical area, it is difficult to speak up if I perceive a problem with patient care..	T	Yes	3.05 (1.03)	3.40 (0.99)	0.1098
18. When my workload becomes excessive, my performance is impaired……	SR	No	3.58 (1.08)	3.33 (1.06)	0.2720
19. I am provided with adequate, timely information about events in the hospital that might affect my work……	PM	No	2.60 (1.10)	2.98 (0.81)	0.0738
20. I know the proper channels to direct questions regarding patient safety in this clinical area……	S	No	3.29 (1.05)	3.24 (0.99)	0.8299
21. I am proud to work at this hospital……	J	No	3.19 (1.30)	3.57 (1.06)	0.1381
22. Disagreements here are resolved appropriately (Not Who is right but What is best for the patient)..	T	No	3.18 (1.06)	3.49 (0.98)	0.1717
23. I am less effective at work when fatigued…	SR	No	3.20 (1.12)	3.03 (1.23)	0.4942
24. I am more likely to make errors in tense or hostile situations……	SR	No	2.86 (1.13)	2.98 (1.07)	0.6458
25. I have the support I need from other personnel to care for patient……	T	No	3.76 (1.25)	3.95 (0.49)	0.3332
26. It is easy for personnel in this clinical area to ask questions when there is something that they do not understand……	T	No	3.36 (1.21)	3.65 (1.04)	0.2238
27. Disruptions in the continuity of care (ie, shift changes,patient transfers) can be detrimental to patient safety……	T	No	3.11 (1.05)	3.12 (1.06)	0.9721
28. During emergencies, I can predict what other personnel are going to do next……	T	No	3.57 (0.94)	3.33 (0.99)	0.2475
29. Decision making in this clinical area utilizes input from relevant personnel…….	T	No	3.34 (0.80)	3.46 (0.79)	0.5917
30. Trainees in my discipline are adequately supervised……	W	No	2.79 (1.26)	3.23 (1.00)	0.0965
31. I feel burned out from my work……	SR	Yes	2.79 (0.98)	3.17 (1.10)	0.0975
32. Important issues are well communicated at shift changes……	T	No	4.02 (0.89)	3.95 (0.86)	0.7072
33. There is widespread adherence to clinical guidelines and evidence-based criteria regarding patient safety/care here……	S	No	3.52 (0.72)	3.13 (0.91)	**0.0360**
34. I feel frustrated by my job……	J	Yes	3.23 (1.27)	3.45 (1.04)	0.3847
35. I feel I am working too hard on my job..	J	Yes	2.14 (1.03)	1.83 (0.93)	0.1554

(Table V: Continued)

TABLE V. Mean Responses to SAQ Before and After CME (Continued)

Survey Question	Domain	Reverse	PRE-SAQ RESPONSES (n=45) Mean (SD)	POST-SAQ RESPONSES (n=43) Mean (SD)	P-Value
36. Personnel frequently disregard rules or guidelines (handwashing, treatment protocols/ clinical pathways, sterile field) that are established for this clinical area……	S	Yes	2.61 (1.04)	2.88 (0.99)	0.2259
37. Communication breakdowns which lead to delay in start surgical procedures are common……..	S	Yes	2.58 (1.03)	3.08 (1.07)	**0.0370**
38. The physicians, midwives, nurses, health associates and other affiliated staff in this clinical area work together in a well coordinated team……	T	No	3.41 (1.30)	3.68 (1.03)	0.2664
39. I am frequently unable to express disagreement with physicians……..……	T	Yes	3.02 (1.12)	3.16 (1.03)	0.5772
40. I know the first and last names of all the personnel I worked with during my last shift……..	T	No	3.20 (1.13)	3.74 (0.98)	**0.0197**

*SD: standard deviation

For an overall domain score, the mean score of all pooled domain questions was calculated and were compared before and after the educational intervention. See Table VI for summary.

Table VI. Summary of Pooled Domains: Mean Pooled Scores Before and After Education Intervention

SAQ Domain	Mean Score- Baseline (SD)	Mean Score- Follow up (SD)	P-Value
Management Perception *n=45 pre- *n=43 post-	2.13 (0.87)	2.76 (0.71)	0.0003
Work Conditions *n=45 pre- *n=43 post-	2.92 (0.66)	3.28 (0.62)	0.0113
Job Satisfaction *n=45 pre- *n=43 post-	3.11 (0.75)	3.46 (0.51)	0.0129
Safety *n=45 pre- *n=43 post-	3.04 (0.51)	3.26 (0.44)	0.0301
Teamwork *n=45 pre- *n=43 post-	3.36 (0.48)	3.54 (0.39)	0.0577
Stress Reduction *n=45 pre- *n=43 post-	3.07 (0.50)	3.07 (0.52)	0.9857

*Complete case analysis, see appendix G for % missing responses

Finally all SAQ question mean scores were pooled and compared before (mean 3.07, SD 0.38) and after (mean 3.32, SD 0.30) the educational intervention to evaluate the overall change in the SAQ. This overall mean change was statistically significant with p=0.0010. See Figure IV.

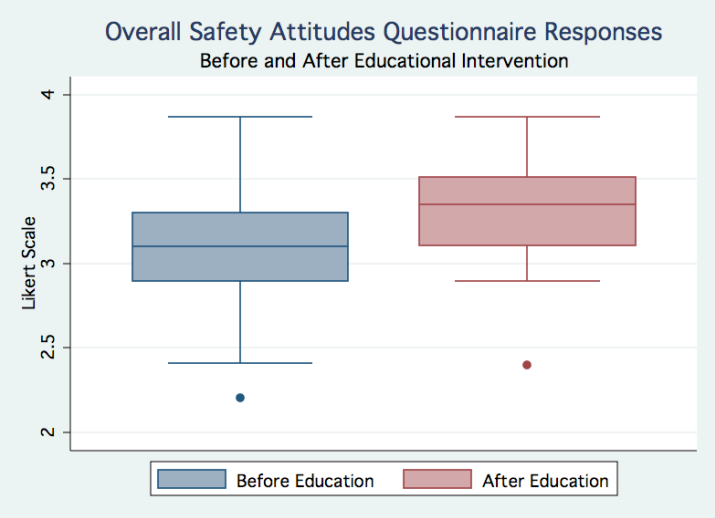

Figure IV. Mean score pooled SAQ before and after education intervention, p=0.0010

In order to evaluate whether the educational intervention affected neonatal outcomes, an adverse outcome index, weight outcome index and severity outcome index were calculated and compared over the three time periods. The maternal outcomes were compared as a maternal mortality rate and a total 6-month blood transfusion calculation. Table VII and Table VIII outline the descriptive delivery logs (Table VII) and the number of events per 6-months (Table VIII) for each neonatal outcome indicator available in the database. The final events shown reflect total delivery events including two types of cases with missing outcome information: 1) all infants born with APGAR of 0 and 2) all infants transferred but unknown final discharge diagnosis (died versus discharge home). A sensitivity analysis in which these cases were omitted did not reveal a difference in final results (data not shown, see Appendix H). An observation is a delivery with

one or more events. Total count events per month of maternal and neonatal outcomes are noted in Appendix I.

Table VII. Delivery Log Descriptive Data

6-Month Time Periods	2009 January – June	2010 July - December	2011 July - December
Total 6-Month Deliveries	4252	4813	4426
Deliveries with one or more events	177	234	210
Age range (years)	16 – 45	17 – 45	15 – 45
Birthweight range (grams)	2000 – 5400	2000 – 4600	2000 – 4500
	N (%)	N (%)	N (%)
Gender			
Male	93 (53)	144 (81)	122 (58)
Female	83 (47)	90 (38)	88 (42)
Mode of Delivery			
Vaginal	135 (76)	160 (68)	160 (76)
Vaginal-operative	6 (3.4)	15 (6.4)	5 (2.4)
C-Section	36 (20)	59 (25)	56 (27)

Table VIII. Number of Neonatal Events / 6 Month Totals

Year	Delivery Events	No. Delivery	IP	NND	NNT	APGAR5	AOI	WOI	SI
2009	177	4252	24	9	105	79	4.2%	4.43	106.5
2010	234	4813	14	7	171	59	4.9%	3.30	67.7
2011	210	4426	16	6	160	65	4.7%	3.62	76.3

*IP, intrapartum neonatal death; NND, neonatal death<7days; NNT, neonatal transfer; APGAR5, APGAR at 5 min. <7; AOI, adverse outcome index; WOI, weighted outcome index; SI, severity index

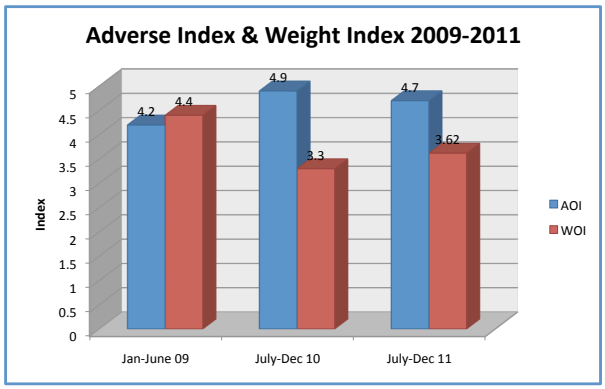

Figure V. Adverse Event and Weighted Index Measures of Neonatal Events 2009-2011

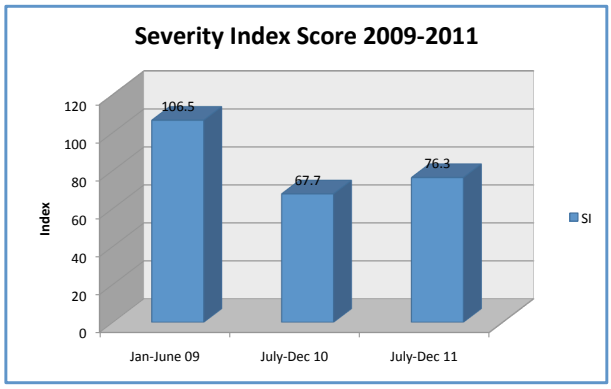

Figure VI. Severity Index of Neonatal Events 2009-2011

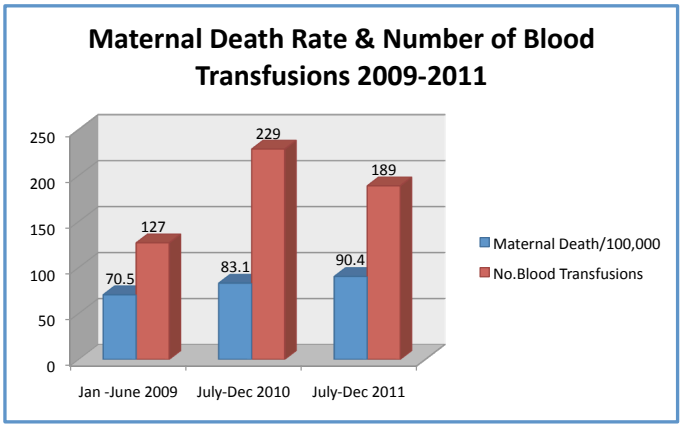

Figure VII. 6-month maternal mortality ratio and blood transfusions from 2009-2011

Figures V-VII graphically illustrate changes in the neonatal adverse event scores and maternal event outcomes. Between the first two time periods, 2009 and 2010, there were an increase in adverse events but an overall decrease in severity for neonatal outcomes. Likewise, there was an increase in the number of total maternal blood transfusions during this same time period. Between the new baseline time period, 2010 and the post-educational time period, 2011, the event counts are noted to be similar for both maternal and neonatal outcomes.

The adverse score index was only used to evaluate quality of care for neonatal outcomes as these were directly derived from total delivery events from the L&D logs. Since both maternal

mortality and blood transfusion events were not obtained from delivery logs, the link across delivery events was not possible and the maternal and neonatal events could not be aggregated events. Therefore, maternal outcomes are analyzed as proportional rates.

To analyze the proportion of all events per total delivery, event rates were calculated and compared over both time periods evaluated: 2009 – 2010 with the addition of Ob/Gyn residents and 2010 – 2011 with addition of the educational intervention in 2011. There is a statistically significant increase in both blood transfusions and neonatal transfer to the neonatal intensive care unit, though most of these neonates were discharged home, after the addition of Ob/Gyn residents. This trend did not continue and no significant changes were noted following the educational intervention. See Table IX and X for proportional rates and relative risk estimates.

Table IX. Maternal and Neonatal Outcome Time Trend Risk Estimates

	Ob/Gyn Resident					Educational Intervention			
Delivery Totals	N=4252	N=4813				N=4813	N=4426		
Event	2009	2010	RR	95% CI		2010	2011	RR	95% CI
Maternal Death (n/100,000)	3 (70.6)	4 (83.1)	1.18	0.20 – 8.04		4 (83.1)	4 (90.4)	1.08	0.20 – 5.84
Blood Transfusion (n/1000)	127 (29.9)	229 (47.6)	1.59	1.28 – 1.99		229 (47.6)	189 (42.7)	0.90	0.74 – 1.09
Intrapartum Death (n/1000)	24 (5.6)	14 (2.9)	0.52	0.25 – 1.04		14 (2.9)	16 (3.6)	1.24	0.57 – 2.75
Neonatal Death (n/1000)	9 (2.1)	7 (1.5)	0.69	0.22 – 2.07		7 (1.5)	6 (1.4)	0.93	0.26 – 3.24
NNT Total* (n/1000)	105 (24.7)	171 (35.6)	1.44	1.1 – 1.85		171 (35.6)	160 (36.2)	1.02	0.81-1.27
Apgar5 <7* (n/1000)	79 (18.6)	59 (12.3)	0.66	0.46-0.94		59 (12.3)	65 (14.7)	1.20	0.83-1.73
	2009	2010	RR	95% CI		2010	2011	RR	95% CI
NNT Total	105	171				171	160		
NND/NNT*	7	6	0.53	0.15 – 1.83		6	5	0.89	0.22 – 3.50

*NNT: neonatal transfer, NND: neonatal death, APGAR5: APGAR at 5 minutes < 7

Table X. Overall Maternal and Neonatal Outcomes Time Trend Risk Estimate

Delivery Totals	N=4252	N=4426		
Event	2009	2011	RR	95% CI
Maternal Death (n/100,000)	3 (70.6)	4 (90.4)	1.28	0.22 – 8.74
Blood Transfusion (n/1000)	127 (29.9)	189 (42.7)	1.43	1.14 – 1.80
Intrapartum Death (n/1000)	24 (5.6)	16 (3.6)	0.64	0.32 – 1.26
Neonatal Death (n/1000)	9 (2.1)	6 (1.4)	0.64	0.19 – 2.01
NNT Total* (n/1000)	105 (24.7)	160 (36.2)	1.46	1.14 – 1.89
Apgar5 <7* (n/1000)	79 (18.6)	65 (14.7)	0.79	0.56-1.11
	2009	2010	RR	95% CI
NNT Total	105	160		
NND/NNT*	7	5	0.47	0.12 – 1.72

*NNT: neonatal transfer, NND: neonatal death, APGAR5: APGAR at 5 minutes < 7

SECTION IV. DISCUSSION

This study evaluated the effectiveness of utilizing senior Ob/Gyn residents to teach and build teamwork with staff midwives and nurses in a busy national referral hospital in a developing country setting. The strength of the study was the willingness and desire on both the education side and the service provision side to learn together to improve the quality of patient care and the work environment. In addition, the study attempted to capture not only the objective aspect of using 'resident teaching' for staff to understand and improve teamwork but also the quantitative aspect of real life learning and working to measure specific indicators of quality.

At least one SAQ question in each domain met statistical significance except for stress reduction domain. Of interest is that 4/8 questions at the 0.01 level were related to management and staffing. Though question 5 (*This hospital does a good job of training new personnel*) may be a result of the training program, the other three are likely due to other changes within the hospital setting that occurred at the same time the teaching program was implemented. Two major changes within the hospital were change in hospital director, hospital supervisors and non-clinical administration along with the addition of 26 new graduate midwives and nurse associates. Thus, leading a respondent to answer in the affirmative to questions 8 (*The administration of this hospital is doing a good job*) and 13 (*The level of staffing in this clinical area are sufficient to handle the number of patients*). Question 11 (*This hospital is a good place to work*) could be important both from the teaching aspect and the active changes in administration. The other 4 questions likely reflect the educational program as they relate to improved surgery times (Q*37. Communication breakdowns which lead to delay in start of surgical procedures are common.)*, knowledge of protocols (evidence) *(*Q*33. There is widespread adherence to clinical guidelines and evidence-based criteria regarding patient*

safety/care here), knowing names of co-workers *(*Q*40. I know the first and last names of all the personnel I worked with during my last shift)* and feeling like a family *(*Q*7. Working in this hospital is like being part of a large family).* This is important especially with the new arrivals to the wards and an important step in forming improved teamwork along with understanding the benefit of evidenced based protocols.

When evaluating the pooled domain specific questions, four out of six domains showed statistical significance. As explained above, the most significant domain, perception of management, is probably not a reflection of the educational course but of other changes that occurred during this time. The other three domains, working conditions, job satisfaction, and safety may not have been fully affected by changes in management; and therefore, the educational intervention may have possibly had a positive effect. Within the teamwork domain, there was borderline significance at 0.0577. In light of the pre-questionnaire survey noting that 97.6% '*felt they already worked well in a team'*, it is perhaps not surprising that the participant 'perception of teamwork' didn't change from their baseline survey. Though it was encouraging that the post-CME survey noted 100% of respondents '*felt that they now worked better in a team*'. The overall pooled questions were statistically significant and therefore, our educational program showed that, as a whole, the overall hospital environment in these six domains improved.

Maternal and Neonatal outcome data were revealing in that they did not show any statistically significant change after the educational intervention, though there were two indicators that showed statistical significance with implementation of the Ob/Gyn residency program October

2009. These were an increase in blood transfusions (p=0.000) and an increase in neonatal transfer to NICU (p=0.000) in 2010. It is difficult to determine the etiology of the increase in blood transfusion but one may speculate that in-hospital Ob/Gyn residents may be more likely to transfuse a patient and/or increased referrals from regional hospitals. Further audit studies are required to determine the exact etiology. In terms of the increase in neonatal referrals, there was a new protocol developed by the Pediatric Department that identified specific reasons for the midwives to refer neonates and this was actively implemented in 2010 by the Maternity Hospital. Despite the increase in neonatal transfers, there was a decreasing trend in severity of neonatal indicator across time from 106.5 (2009) to 67.7 (2010) but minimal change after educational intervention in 2011 at 76.3 (See Figure VI). This suggests that the implementation of the obgyn residency program had a stronger association with improved neonatal outcomes than did our educational intervention. Neonatal data may be a reasonable quantitative measure of quality, though. Draycott et. al. has documented this measure of quality in previous studies where obstetric training did improve neonatal outcomes (Draycott, Sibanda et al. 2006). Continued follow up along with continued training may show an effect in the near future along with audit studies to clarify specific maternal indicators.

Training programs in low resource settings are not new and include both short and long courses, but their ultimate long-term effectiveness is less well known due to failure to follow up with outcome based results (van Lonkhuijzen, Dijkman et al. 2010). Another limitation of many training programs is their requirement for participants to be away from their work environment while the course is taking place and in areas where human resources are already stretched, this alone puts patients at risk (Grady, Ameh et al. 2011; Raven, Utz et al. 2011). Some programs,

though, are working to be effective yet keep the course short to 2-3 days (Raven, Utz et al. 2011). A common denominator with the training programs is that transfer of knowledge and skills does occur with an overall positive response to the training and are linked with supervision and monitoring at the work site (McDermott, Beck et al. 2001; Leow, Groen et al. 2011; Raven, Utz et al. 2011)

WHO is actively aligned with programs that have mechanisms of sustainability and local ownership (WHO 2008). Our project fits into their goal whereby, the major stakeholders are the midwife and nursing staff along with the Ob/Gyn residents who too are working to build up their knowledge, skills, and teaching ability. A study by Revel and Yusseuf in 2003, also demonstrated a similar result utilizing staff chosen educational topics to develop an in-country CME program for staff working in rural areas of United Arab Emirates (Revel and Yussuf 2003). Their program also noted improved themes of teamwork and communication, though it did not have an outcomes based evaluation.

When obstetric emergency training programs were reviewed for the most effective components of training, Siassakos et al. noted that all units that implemented their 'own' in-hospital training were more effective than outside training (Siassakos, Crofts et al. 2009). They were also more likely to have 100% of staff trained and to maintain continued training. This aspect of in-hospital training is important to understand as our study noted that 33% of participants had ever taken the national level LSS course and supports our in-hospital continued medical education intervention. A common theme in many study results were that improved teamwork does improve maternal and neonatal outcomes, but that multi-professional 'in-house' clinical training

alone might improve 'team working', without the need for non-clinical teamwork specific training as the team members bond and train together (Siassakos, Crofts et al. 2009). Though our study did not show objective change in maternal and neonatal outcomes in the first 6 months after the training, the overall improved SAQ suggests that conducting CME within a hospital setting with local staff is a feasible and viable option to complement the larger strategies of countrywide programs. It is possible that with time and repetition, the quality indicators of maternal and neonatal outcomes may improve. When evaluating neonatal outcomes following training, reduced perinatal mortality was noted following essential newborn care (ENC) training of birth attendants in the Democratic Republic of Congo that was associated with a time trend from training (Carlo, Goudar et al. 2010; Matendo, Engmann et al. 2011). Their explanation was that the benefit from ENC training occurred due to repeated experience and/or reinforcement of the education for optimal improvements. This supports the continued medical education approach within our study and others.

As in other research (Grady, Ameh et al. 2011; Reynolds, Ayres-de-Campos et al. 2011; Kilday 2012), perceived teamwork and safety climate improved in our study with strongest significance in domains of management perception, safety, job satisfaction, and working conditions. A similar conclusion was noted in the study by Revel and Yussuf in 2003 where continued medical education was incorporated into rural health centers (Revel and Yussuf 2003). Ultimately as health systems continue to strengthen, quality of care must mirror the buildup and efforts to measure and implement quality improvement with the involvement of all levels of health care workers and top leadership in order to create a culture of teamwork and communication (Raven, Hofman et al. 2011).

Though our study adds an important component of health systems strengthening through in-service training, there were some limitations that affect the ability to generalize the results. One limitation was the absence of medical midwife administrators (0%) and senior physician (4.7%) input into the survey response; thus the training and results are not applicable for physicians or midwife administrators within this hospital setting. There was also a lack of active, didactic lecture attendance of the respondents with attendance of at most 53.3%. This lack of attendance, though, wasn't due to lack of willingness but managing work, family, and daily living in a developing country. Ninety-seven percent of respondents would like to continue the educational sessions at least 2x/year. There was also no remuneration, thus it was encouraging that >50% attendance occurred and attests to the fact that continued education is desirable and feasible in a hospital setting. The computer option provided a backup system for continued learning but was not meant to be a replacement for active learning between residents and staff. Another possible limitation of this study was the small sample size limited to one maternity unit. Therefore the results may not be applicable to other maternity units, only for midwives and associate nurses in a large, referral teaching hospital.

Therefore as developing countries work towards decreasing maternal and neonatal morbidity and mortality, improving the quality of care within a hospital setting is imperative. The results of this study address the potential 'human factor' that can contribute to maternal and neonatal morbidity and mortality. Though short-term expert training courses have value, efforts to develop an in-hospital clinical and education-training course will complement the other programs and allow for constant training throughout the year along with continued reinforcement of knowledge and skills. This method may also be a tool to further develop more formal

teamwork specific training in the future. In a new medical education training system trying to integrate into a service provision hospital, the opportunity for both the educators and the service providers to learn from each other and improve quality of care should be valued. This project has successfully shown that utilizing senior Ob/Gyn residents to implement hospital staff developed continued medical education within a hospital setting is feasible and may be a mechanism to create improved communication and teamwork amongst ward staff. As the medical system develops, the Ob/Gyn graduates can then be the teachers in their assigned regional hospitals, and extend the continued learning to a non-teaching hospital. Such a strategy will complement the larger strategies of improving access to and encouraging deliveries at health facilities along with improving the work environment with readily accessible supplies and resources.

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APPENDIX A1:

Personal Work Diary

Thank you for your willingness to participate in developing a sustainable educational and teamwork training program that is specific for Labor and Delivery medical health care professionals. In order to develop an improved understanding of your specific educational and work related needs, we would appreciate if you would write daily notes for one week that address issues for improving patient care in L&D (required resources, barriers to efficient work flow, work assistance from students) and specific educational topics to complement current knowledge (shoulder dystocia, postpartum hemorrhage, etc.). This personal diary will be utilized as an assistance tool for you alone to more specifically fill out the L&D educational and teamwork questionnaire where the results will be used to formulate the CME training program.

Patient Care Thoughts:

Educational Topic Thoughts:

APPENDIX A2:

Labor and Delivery Questionnaire

Date: Variables

Serial # _____ _____ _____

#Years of experience in Ob/Gyn: _____ _____ ____

Years worked at OMH (any ward): _____ _____ _____

#Years worked OMH/MCH1 _____ _____ _____

Have you taken any LLS courses YES NO

If YES, how many _____

Have you taken other educational courses relevant to L&D care YES NO

If YES, how many _____

Gender: Male Female

Position: Associate Nurse Midwife Physician Management

What are your top three recommendations for improving patient care in MCH1 (for example, what do you feel would make your work more efficient, safe, and enjoyable):

1.
2.
3.

What are your top three recommendations/Topic Ideas for Continuing Medical Education (CME) related to MCH1 (for example, what additional education would make your work more efficient, safe, and enjoyable):

1.
2.
3.

In order to make the CME courses convenient for you, please indicate the most optimal schedule for CME teaching/training (one hour):

Choose One	Choose Day and Time		
Before Duty Shift	Monday	AM	PM
After Duty Shift	Tuesday	AM	PM
Day Off	Wednesday	AM	PM
	Thursday	AM	PM
	Friday	AM	PM
	Saturday	AM	

Please identify up to three barriers in the current working environment of MCH1 that you feel are barriers to improving the work environment and patient care:

1.
2.
3.

(Appendix A2 Continued)

(Appendix A2 Continued)

Please provide up to three recommendations for incorporating students into patient care while also accomplishing the goal of teaching and of quality patient care:

1.
2.
3.

	YES	NO
1. Do you feel you work well in a team? ……	____	____
2. Do you prefer an individual approach to patient care? ……	____	____
3. Are you willing to be a team leader?.....	____	____
4. Can you identify another person whom you work with who has leadership qualities?.....	____	____
5. Do you feel learning more about a teamwork approach to patient care would be helpful?.....	____	____
6. Are you willing to participate and learn about a teamwork system?.....	____	____
7. Have you taken this survey before?.....	____	____

APPENDIX B:

Continued Medical Education Schedule
For Midwives and Associate Nurses
LOCATION: OB/GYN CONFERENCE ROOM
TIME: 3:30 - 5:00 PM

DATE	TOPIC	RESIDENT INSTRUCTOR
April 18, MONDAY	Pregnancy Physiology & Medical Disorders (Asthma, Hypertension, Heart Disease, Epilepsy)	Dr. Kifleyesus
April 19, TUESDAY (repeat lecture)	Same lecture repeated	Dr. Kifleyesus
April 20, WEDNESDAY	Antepartum Hemorrhage (1^{st} – 3^{rd} trimesters), Ectopic & PostAB care/FP	Dr. Dawit Estifanos
April 21, THURSDAY (repeat lecture)	Same lecture repeated	Dr. Dawit Estifanos
April 25, MONDAY	Severe PIH/Eclampsia/Antenatal testing	Dr. Abraham→ Dr. Kifleyesus
April 26, TUESDAY (repeat lecture)	Same lecture repeated	Dr Abraham→Dr. Kifelyesus
April 27, WEDNESDAY	Normal/Abnormal L&D	Dr. Berhane
April 28, THURSDAY (repeat lecture)	Same lecture repeated	Dr. Berhane
May 2, MONDAY	Neonatal Resuscitation/Newborn Care/Breastfeed & family planning	Dr. Dawit Sereke
May 3, TUESDAY (repeat lecture)	Same lecture repeated	Dr. Dawit Sereke
May 4, WEDNESDAY	Teratology & Basic Ultrasound	Dr. Kifleyesus
May 5, THURSDAY (repeat lecture)	Same lecture repeated	Dr. Kifleyesus
May 9, MONDAY	Reproductive tumors and Pregnancy/ Infection precaution/Anatomy basics	Dr. Dawit Estifanos
May 10, TUESDAY (repeat lecture)	Same lecture repeated	Dr. Dawit Estifanos
May 11, WEDNESDAY	PPROM/PROM & Postterm Pregnancy	Dr. Abraham→Dr. Berhane
May 12, THURSDAY (repeat lecture)	Same lecture repeated	Dr Abraham→Dr. Berhane
May 16, MONDAY	Labor Monitoring (CTG) & EmOC	Dr. Berhane
May 17, TUESDAY (repeat lecture)	Same lecture repeated	Dr. Berhane
May 18, WEDNESDAY	Postpartum Hemorrhage/ Postoperative Care/Postpartum Care- Patient Assessment Technique	Dr. Dawit Sereke
May 19, THURSDAY (repeat lecture)	Same lecture repeated	Dr. Dawit Sereke
June 20 FINAL Day to Complete Educational Program for Certificate		

APPENDIX C: Post-educational Questionnaire

Post Educational Series Labor and Delivery Questionnaire
Date: _____

	Variables
Serial #	_____
#Years of experience in Ob/Gyn:	_____ _____ _____
# Years worked at OMH (any ward):	_____ _____ _____
#Years worked OMH/MCH1	_____ _____ _____
Have you taken any LLS courses	YES NO
If YES, how many _____	
Have you taken other educational courses relevant to L&D care	YES NO
If YES, how many _____	

Gender: Male Female
Age: _____
Position: Associate Nurse Midwife Physician Management

Do you feel that this educational series assisted in improving patient care in MCH1? Y N
Would you like this educational series to continue? Y N

If this educational series were to continue, how many times per year would it be helpful? Once Two or More

Were the time and dates convenient to attend the educational series? Y N

Do you feel more empowered to teach and incorporate students in the workflow of patient care in MCH1? Y N

Do you feel the educational series improved how you work in a team? Y N

Do you feel the educational series improved the work environment of MCH1? Y N

Do you feel confident in the skills taught during the educational series? Y N

In your opinion, what are two continued concerns in providing quality labor and delivery obstetric care? In your opinion, what are possible solutions to these problems?

Concern	Solution
a)	
b)	

Have you taken the Teamwork survey before? Yes No

Thank you for participating in this educational series and for providing information to improve the care of the women in the Orotta Maternity Hospital.

Appendix D: Labor and Delivery Teamwork & Safety Questionnaire(SAQ)

Instructions: This survey asks for your opinions about teamwork and patient care safety in labor and delivery. It will take you about 15 minutes to complete. Any question that you would like further explained, please feel free to ask Dr. Susan or a Resident. If you do not wish to answer a question, or if a question does not apply to you, you may leave your answer blank. This survey is anonymous and not linked to any individual person.

*"Medical Error" is defined as any type of error, mistake, incident, accident, or deviation, regardless of whether or not it results in patient harm

Please answer the following questions by circling one number on a 1-5 scale where:

1=Disagree strongly 2=Disagree 3=Neutral 4=Agree 5=Agree strongly

	Scale 1- 5
1. I like my job……	1 2 3 4 5
2. I feel that my input is well received in this clinical area……	1 2 3 4 5
3. I would feel safe having myself or my family treated here as a patient	1 2 3 4 5
4. Medical errors* are handled appropriately in this clinical area……	1 2 3 4 5
5. This hospital does a good job of training new personnel……	1 2 3 4 5
6. All the necessary information for diagnostic and therapeutic decisions is routinely available to me……	1 2 3 4 5
7. Working in this hospital is like being part of a large family……	1 2 3 4 5
8. The administration of this hospital is doing a good job……	1 2 3 4 5
9. I receive appropriate feedback about my performance……..	1 2 3 4 5
10. In this clinical area, it is difficult to discuss errors……	1 2 3 4 5
11. This hospital is a good place to work……...	1 2 3 4 5
12. Fatigue impairs my performance during emergency situations (emergency resuscitation/ hemorrhaging etc.)……	1 2 3 4 5
13. The level of staffing in this clinical area are sufficient to handle the number of patients……..……	1 2 3 4 5
14. I am encouraged by my colleagues to report any patient safety concerns I may have……	1 2 3 4 5
15. The culture in this clinical area makes it easy to learn from the errors of others……..	1 2 3 4 5
16. This hospital deals constructively with problem physicians and staff……	1 2 3 4 5
17. In this clinical area, it is difficult to speak up if I perceive a problem with patient care……	1 2 3 4 5
18. When my workload becomes excessive, my performance is impaired……...	1 2 3 4 5

(Survey Continued)

(Continued) **1=Disagree strongly 2=Disagree 3=Neutral 4=Agree 5=Agree strongly**

	Scale 1- 5
19. I am provided with adequate, timely information about events in the hospital that might affect my work……	1 2 3 4 5
20. I know the proper channels to direct questions regarding patient safety in this clinical area……	1 2 3 4 5
21. I am proud to work at this hospital……..	1 2 3 4 5
22. Disagreements here are resolved appropriately (ie. Not Who is right but What is best for the patient)……	1 2 3 4 5
23. I am less effective at work when fatigued……	1 2 3 4 5
24. I am more likely to make errors in tense or hostile situations……..	1 2 3 4 5
25. I have the support I need from other personnel to care for patients……..	1 2 3 4 5
26. It is easy for personnel in this clinical area to ask questions when there is something that they do not understand…….	1 2 3 4 5
27. Disruptions in the continuity of care (ie, shift changes, patient transfers) can be detrimental to patient safety…….	1 2 3 4 5
28. During emergencies, I can predict what other personnel are going to do next……...	1 2 3 4 5
29. Decision making in this clinical area utilizes input from relevant personnel…….	1 2 3 4 5
30. Trainees in my discipline are adequately supervised……..	1 2 3 4 5
31. I feel burned out from my work……...	1 2 3 4 5
32. Important issues are well communicated at shift changes……	1 2 3 4 5
33. There is widespread adherence to clinical guidelines and evidence-based criteria regarding patient safety/care here…….	1 2 3 4 5
34. I feel frustrated by my job……	1 2 3 4 5
35. I feel I am working too hard on my job……	1 2 3 4 5
36. Personnel frequently disregard rules or guidelines (ie handwashing, treatment protocols/clinical pathways, sterile field) that are established for this clinical area…….	1 2 3 4 5
37. Communication breakdowns which lead to delays in starting surgical procedures are common……...	1 2 3 4 5
38. The physicians, midwives, nurses, health associates and other affiliated staff in this clinical area work together in a well coordinated team……	1 2 3 4 5
39. I am frequently unable to express disagreement with physicians……	1 2 3 4 5
40. I know the first and last names of all the personnel I worked with during my last shift……..….	1 2 3 4 5

APPENDIX E: Adverse Event Score Analysis

Adverse Outcome Index: Total deliveries with one or more events per unit time / Total deliveries per unit time x 100 = AOI %

Weighted Outcome Index: Summation of total specific events x weight specific score / Total deliveries per unit time = WOI

Severity Index: Weighted Outcome Index / Total deliveries with one or more events per unit time = SI

APPENDIX F: Consent Form

Orotta's School of Postgraduation Medical Education / University of Washington
Oral Consent Form

"Teamwork Approach in Labor and Delivery: Method to Improve Maternal and Neonatal Outcomes at Orotta Maternity Hospital"

Researchers: Dr. Susan Marzolf, Dr. Berhane Zekarias, Dr. Abraham Yohannes, Dr. Kifleyesus Tedla, Dr. Dawit Stefanos, Dr. Dawit Sereke

Researcher's Statement

We are asking you to be in a research study. The purpose of this oral consent form is to give you the information you will need to help you decide whether to be in the study or not. You may ask any questions about the purpose of the research, what we would ask you to do, the possible risks and benefits, your rights as a volunteer, and anything else about the research that is not clear. When we have answered all your questions, you can decide if you want to be in the study or not. This process is called "informed oral consent."

Purpose of the Study

The primary purpose of the study is to develop a continuing medical educational program for midwives and medical staff affiliated with labor and delivery utilizing the Ob/Gyn residents as the primary teachers. The midwives and medical staff will choose the topics for discussion and then utilizing teamwork approach, a series of didactics and hands-on activities will be developed. This educational series will span 3 months with each educational seminar lasting 60 minutes, one time per week. Total time commitment will be about 12 hours. One week prior to the start of the program, each consented person will be asked to fill out a personal diary to catalogued issues that come up that one feels would be important to improve the care of the patient. For example, shoulder dystocia and no additional help available. The first session then will be a questionnaire to identify educational topics of importance for continued education and also identify issues that may improve the working conditions in labor and delivery, using the diary you developed for your personal use to bring attention to important topics of discussion/improvement. In addition a teamwork questionnaire will be given to assist in understanding current teamwork approach. Any questions that you may feel uncomfortable answering may be left unanswered.

Risks, Stress, or Discomfort

Since the educational series will require time commitment on your off duty hours, you may feel additional stress or discomfort as work plus normal daily activities will still occur. Please know that if you are unable to attend one or more session due to other personal issues, we will work with you to obtain the missed educational session information in paper format and/or soft copy format. In additional, please know that this educational series is voluntary and you may choose which sessions to attend or not attend.

Alternatives to taking part of Study

If you choose to not partake in this study, you may still attend any or all of the educational sessions except you will not be asked to fill out the diary or questionnaires.

Other Information

You may refuse to participate and you are free to withdraw from this study at any time without penalty or loss of benefits to which you are otherwise entitled. All data collected will be anonymous. Dr. Susan (07-25-33-52) or Dr. Berhane (07-12-13-86) may be reached for questions any time during the study.

Appendix G: Pre- and Post-SAQ Questions with % missing for each question.

Mean Responses to SAQ Before and After CME

			PRE-SAQ RESPONSES (n=45)	POST-SAQ RESPONSES (n=43)
	Domain	Reverse	%Missing	%Missing
1. I like my job……	J	No	0%	0%
2. I feel that my input is well received in this clinical area……..	T	No	2.2%	4.7%
3. I would feel safe having myself or my family treated here as a patient ……..	S	No	4.4%	7.0%
4. Medical errors* are handled appropriately in this clinical area……..	S	No	4.4%	7.0%
5. This hospital does a good job of training new personnel……	W	No	4.4%	0%
6. All the necessary information for diagnostic and therapeutic decisions is routinely available to me…	W	No	2.2%	4.7%
7. Working in this hospital is like being part of a large family……	J	No	6.7%	0%
8. The administration of this hospital is doing a good job……	PM	No	2.2%	2.3%
9. I receive appropriate feedback about my performance……	S	No	6.7%	4.7%
10. In this clinical area, it is difficult to discuss errors……	S	Yes	4.4%	4.7%
11. This hospital is a good place to work…….....	J	No	4.4%	2.3%
12. Fatigue impairs my performance during emergency situations (emergency resuscitation/ hemorrhaging etc.)……	SR	No	8.9%	9.0%
13. The level of staffing in this clinical area are sufficient to handle the number of patients.	PM	No	2.2%	0%
14. I am encouraged by my colleagues to report any patient safety concerns I may have……	S	No	6.7%	0%
15. The culture in this clinical area makes it easy to learn from the errors of others…….	S	No	8.9%	4.7%
16. This hospital deals constructively with problem physicians and staff……	W	No	2.2%	4.7%
17. In this clinical area, it is difficult to speak up if I perceive a problem with patient care..	T	Yes	6.7%	2.3%
18. When my workload becomes excessive, my performance is impaired……	SR	No	0%	0%
19. I am provided with adequate, timely information about events in the hospital that might affect my work…….	PM	No	0%	2.3%
20. I know the proper channels to direct questions regarding patient safety in this clinical area……	S	No	8.9%	4.7%
21. I am proud to work at this hospital……	J	No	4.4%	2.3%
22. Disagreements here are resolved appropriately (Not Who is right but What is best for the patient)..	T	No	2.2%	4.7%
23. I am less effective at work when fatigued…	SR	No	0%	7.0%

(Mean Responses Continued)

(Continued) **Mean Responses to SAQ Before and After CME**

			PRE-SAQ RESPONSES (n=45)	POST-SAQ RESPONSES: (n=43)
	Domain	Reverse	%Missing	%Missing
24. I am more likely to make errors in tense or hostile situations……..	SR	No	2.2%	7.0%
25. I have the support I need from other personnel to care for patients……	T	No	0%	0%
26. It is easy for personnel in this clinical area to ask questions when there is something that they do not understand……. …….	T	No	0%	0%
27. Disruptions in the continuity of care (ie, shift changes,patient transfers) can be detrimental to patient safety……..	T	No	0%	2.3%
28. During emergencies, I can predict what other personnel are going to do next……	T	No	2.2%	0%
29. Decision making in this clinical area utilizes input from relevant personnel……	T	No	8.9%	9.0%
30. Trainees in my discipline are adequately supervised……..	W	No	13.3%	7.0%
31. I feel burned out from my work…….	SR	Yes	6.7%	2.3%
32. Important issues are well communicated at shift changes……	T	No	4.4%	4.7%
33. There is widespread adherence to clinical guidelines and evidence-based criteria regarding patient safety/care here………. ……..	S	No	11.1%	11.6%
34. I feel frustrated by my job…….	J	Yes	4.4%	2.3%
35. I feel I am working too hard on my job……	J	Yes	2.2%	2.3%
36. Personnel frequently disregard rules or guidelines (handwashing, treatment protocols/ clinical pathways, sterile field) that are established for this clinical area……	S	Yes	2.2%	2.3%
37. Communication breakdowns which lead to delay in start surgical procedures are common.	S	Yes	11.1%	7.0%
38. The physicians, midwives, nurses, health associates and other affiliated staff in this clinical area work together in a well coordinated team……	T	No	2.2%	4.7%
39. I am frequently unable to express disagreement with physicians……..	T	Yes	6.7%	11.6%
40. I know the first and last names of all the personnel I worked with during my last shift……	T	No	2.2%	0%

Appendix H: Sensitivity Analysis:

DESCRIPTIVE TABLE Compare Missing Variables: 2009 (n=27 missing) (n=10 anomaly) (n=3 Both)

	Data Analysis	Missing	Anomaly
Age	18-45	16-36	20-39
BW (gm)	2000-5400	2100-4100	2300-3800
Gender	81- male	18 –male	6-male
	76-female	14- female	4-female
Mode of Delivery	DATA	Missing	Anomaly
*Vaginal	118	28	9
*OpVag	6	1	0
*CS	33	4	1

*BW miss= 4 removed (affects removal of 1 NND with low APGAR, affects 1 unknown SB, affects 2 NNT with low APGAR

DESCRIPTIVE TABLE Compare Missing Variables: 2010 (n= 63 missing) (n= 11 anomaly) (n= 7 Both)

	Data Analysis	Missing	Anomaly
Age	17-44	18-45	20-40
BW (gm)	2000-4700	2000-4500	2300-4700
Gender	108- male	45 –male	8-male
	74-female	28- female	10-female
Mode of Delivery	DATA	Missing	Anomaly
*Vaginal	121	54	13
*OpVag	13	2	0
*CS	48	18	5

*4 BW and 2 APGAR missing: affects one IP death with missing BW, one NNT with no APGAR, affects 2 NNT with low APGAR, affects one unknown SB,

DESCRIPTIVE TABLE Compare Missing Variables: 2011 (n= 52 missing) (n= 18 anomaly) (n= 8 Both)

	Data Analysis	Missing	Anomaly
Age	15-45	16-39	19 -43
BW (gm)	2000-4200	2000-4500	2200-4200
Gender	100- male	36 –male	14-male
	76-female	24- female	12-female
Mode of Delivery	DATA	Missing	Anomaly
*Vaginal	130	45	15
*OpVag	4	1	0
*CS	42	14	11

No missing BW or APGAR

(Appendix H: Continued)

(Appendix H: Continued)

Missing Data Summary (anomaly removed):

Year Missing/%
2009 27 /177 = 15.2%
2010 63/234 = 26.9%
2011 52 /210 = 24.7%

		Number/Total Event (%)
Stillbirth data missing:	2009	16/71= 22.5%
	2010	15/54= 27.7%
	2011	6/46= 13.0%
NNT Data Missing:	2009	11/105= 10.5%
	2010	47/171= 27.5% (most APGAR > 7: #38—reflect increase in NNT due to new protocol but not necessarily reflect worse outcomes for neonatal—likely infants transferred but not 'officially' admitted to NICU and therefore, final outcome not documented: Therefore only 9 missing with APGAR < 7)
	2011	46/160= 28.8% (Again, 35 of missing NNT had APGAR >7, indicating improved neonatal transfer per protocol but not necessarily poor outcomes. Only 11 true missing with APGAR < 7)
APGAR5 Missing:	2009	0/79 = 0%
	2010	1/60 = 1.7%
	2011	0/65 = 0%

Observation Total Delivery Log (Events analyzed with removal of anomaly & Removal of SB missing*)

YEAR	#Delivery	IP	NND	NNT	APGAR5	AOI	WOI	SI
2009 n=161*	4252	24	9	105	79	3.8%	4.43	117
2010 n= 219*	4813	14	7	171	59	4.5%	3.30	72.4
2011 n=206*	4426	16	6	160	65	4.7%	3.62	77.8

Observation Total Delivery Log (Events analyzed with removal of anomaly & **Removal of SB + NNT missing*)**

YEAR	#Delivery	IP	NND	NNT	APGAR5	AOI	WOI	SI
2009 n=150*	4252	24	9	94	79	3.5%	4.34	123.1
2010 n= 172*	4813	14	7	124	59	3.6%	2.95	82.6
2011 n=160*	4426	16	6	114	65	3.6%	3.26	90.1

*MD=Maternal Death
*BldTx=Blood Transfusions
*IP=Intrapartum fetal death
*NND=Neonatal death < 7 days
*NNT=Neonatal transfer from L&D to neonatal intensive care with birthweight > 2000 grams
*APGAR<7= 5-minute APGAR < 7
*DH=any neonatal transfer that was discharged home

Appendix I: Total Monthly Outcome Events for Maternal and Neonatal Outcomes

DESCRIPTIVE TABLE: 6- MONTHLY RECORDED EVENTS 2009-2011

Year	Del Total	Month	MD	Bldtx	IP	NND	NNtx	APGAR5
2009	655	Jan	2	14	1	0	9	4
	652	Feb	1	23	6	3	13	11
	711	March	0	19	5	3	22	17
	696	April	0	19	6	1	18	14
	727	May	0	28	1	2	22	15
	811	June	0	24	5	0	21	18
	4252		3	127	24	9	105	79
2010	800	July	1	27	6	1	26	7
	769	Aug	0	38	0	0	34	8
	748	Sept	0	29	3	0	32	8
	964	Oct	2	39	1	1	24	13
	806	Nov	0	46	2	3	30	15
	726	Dec	1	50	2	2	25	9
	4813		4	229	14	7	171	60
2011	686	July	1	25	3	0	15	3
	683	Aug	1	39	4	1	21	8
	695	Sept	0	18	1	0	29	7
	854	Oct	1	42	4	2	26	13
	788	Nov	1	37	2	2	29	19
	720	Dec	0	28	2	1	40	15
	4426		4	189	16	6	160	65