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Safe Motherhood Studies—Results from Jamaica

- Competency of Skilled Birth Attendants
- The Enabling Environment for Skilled Attendance at Delivery
- In-Hospital Delays in Obstetric Care (Documenting the Third Delay)

Affette McCaw-Binns, Barton R. Burkhalter, Wendy Edson, Steven A. Harvey, Cathy Antonakos

April 2004

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Abstract

More than 500,000 women worldwide die each year from complications related to childbirth. With good quality obstetric care, approximately 90% of these deaths could be averted. The assistance of a skilled birth attendant during labor, delivery, and the immediate postpartum period is one important component of quality obstetric (OB) care. Other key factors are an enabling environment for skilled attendance at delivery and prompt attention at a medical facility for women arriving with an OB complication. However, little is known about the competence of skilled birth attendants (SBAs), the elements that contribute to an enabling environment, and the causes of what is commonly known as the "third delay": the delay in receiving medical attention after a woman with an OB complication arrives at a healthcare facility.

Through its Safe Motherhood Research Program, the Quality Assurance Project implemented three studies to explore these issues in countries with high maternal mortality ratios. The first study examined the competency of SBAs. The second measured SBA performance and the relative contribution to performance of different enabling factors in the work environment. The last examined causes of in-hospital delays in providing OB care. All three occurred between September 2001 and July 2002 in Benin, Rwanda, Ecuador, and Jamaica. This report presents the results from Jamaica.

The Competency Study measured knowledge with a 55-question test covering six subject areas. It also tested skills in several key areas, including neonatal resuscitation, manual removal of placenta, bimanual uterine compression, and insertion of an intravenous needle. Third, it asked participants to assess their own ability to carry out common obstetric procedures. The knowledge and skills tests were completed by providers from the four hospitals in the study plus a representative sample of community-based midwives. Results yielded a mean score of only 58% correct for the knowledge test and 46% on the skills test. Hospital-based provider scores were higher than the community-based providers in both tests, and in all topics except asepsis in the knowledge test and mouth-to-mouth and resuscitation in the skills test, which were slightly higher in the community-based group. Knowledge scores related to pregnancy-induced hypertension were higher for both hospital-based and community-based providers than for any other topic. Community-based providers' knowledge about sepsis and active management of third stage labor was low. In the skills test, manual removal of placenta and bimanual uterine compression mean scores were low for all types of providers—only about 38% for hospital-based and 14% for community-based providers. There was little correlation between providers' self-assessment and their competency as measured by the knowledge and skills tests.

The Enabling Environment Study addressed the contribution of enabling factors and essential elements to health worker performance. We used an observation checklist to evaluate performance during labor, delivery, and the immediate postpartum period and reviewed medical records to evaluate performance in managing OB complications. We also surveyed providers in each facility about supervision, training, and motivation, and, finally, we inventoried the availability of essential drugs, equipment, and supplies in each study hospital. Labor monitoring, including checking fetal heart rate and the mother's blood pressure, was inadequate in most observed cases. Key tasks for intrapartum and postpartum care for the mother were performed adequately in most observed cases, although use of sterile drapes and clothing was done in far less than half the cases. Most administered oxytocin to the mother after delivery. However, some key tasks for postpartum care for the newborn in the first two hours after birth were frequently not done, including suctioning, putting the baby into skin-to-skin contact with the mother, checking baby's temperature, checking the umbilical cord, and keeping baby under constant supervision

The Third Delay Study used direct observation to analyze patient flow in all four study hospitals. In addition, three physicians reviewed medical records to identify any delays at different points in patient care: Most of the delays they found occurred during diagnosis, especially for obstructed labor. For women who were not in labor, waiting times after arrival at the OB department to initial exam averaged 19 minutes, and to exam by a professional averaged 43 minutes, although these times differed

substantially by hospital. Waits were significantly longer on weekdays than weekends at all hospitals, but whether wait times were different during the day or night differed by hospital. Delays in treatment were documented for all types of emergencies, with many resulting from delays in C-sections, which average 102 minutes from order to beginning of surgery. Sepsis was the emergency with the longest time from order to its administration: 205 minutes on average.

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Table of Contents

List of Tables and Figures

Safe Motherhood Studies—Results from Jamaica

- **Competency of Skilled Birth Attendants**
- **The Enabling Environment for Skilled Attendance at Delivery**
- **In-Hospital Delays in Obstetric Care (Documenting the Third Delay)**

I. Introduction

A. Background

Each year over 500,000 women worldwide die from complications related to childbirth.[1,2] Maternal experts agree that skilled attendance "during labor, delivery and in the early postpartum period" is perhaps the most important key to reducing maternal mortality.[3–6] In fact, percentage of births assisted by a skilled attendant has become a proxy indicator for progress in reducing maternal mortality.[7]

However, consensus is lacking on how to define "skilled attendant." Absent a definition, many rely on Demographic and Health Survey (DHS) data reporting the percentage of deliveries assisted by "health personnel": typically doctors, nurses, and nurse midwives. Though the DHS program does not attempt to assess the knowledge or skills of the attendants it categorizes as "health personnel," others who extrapolate from DHS data use the terms "health personnel" and "skilled birth attendant" (SBA) interchangeably.[8] Unfortunately, we have limited information about the competence of SBAs at managing labor, delivery, and the immediate postpartum period. We also know little about their competence at managing the five most common life-threatening complications of childbirth: hemorrhage, pregnancy-induced hypertension, sepsis, obstructed labor, and post-abortion complications.[9]

Competent attendance can make an important contribution towards improving birth outcomes and reducing maternal morbidity and mortality. But even a highly competent attendant needs an enabling environment to perform optimally. The elements of an enabling environment include availability of essential drugs and equipment, leadership, supervision, job aids, policies, guidelines, and even the process used to develop and adopt standards. Also critical is the way services are organized to facilitate or impede the delivery of care. We know little about the presence or absence of specific environmental factors in high maternal mortality settings. Similarly, we know little about the relative contribution of these different factors to performance outcomes.

A key contributor to maternal death when an obstetric complication occurs is the delay in receiving care once a woman arrives at a health facility. This is the third in what has become widely known as the three delays model of maternal mortality.[10] Many factors contribute to

Abbreviations

ANOVA	Analysis of variance
CI	Confidence interval
CMW	Community-based midwife
C-section	Cesarean section
DHS	Demographic and Health Survey
EOC	Essential obstetric care
EE	Enabling environment
FHR	Fetal heart rate
IMPAC	Integrated Management of Pregnancy and Childbirth
IV	Intravenous
$MgSO_4$	Magnesium sulfate
MMR	Maternal mortality ratio
MNH	Maternal and Neonatal Health Program
MOH	Ministry of Health
N/A	Not applicable
NS	Not significant
OB	Obstetric
Ob/Gyn	Obstetrician/gynecologist
OR	Operating room
PIH	Pregnancy-induced hypertension
PP	Percentage point(s)
QAP	Quality Assurance Project
SBA	Skilled birth attendant
SD	Standard deviation
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

this delay: lack of personnel, supplies, and equipment; delay in reaching a diagnosis; inability of the patient or her family to pay for care, drugs, or supplies; and the time of day or day of the week when the patient arrives, among others.[11–17] While studies have examined different aspects of the third delay in different settings, there is a need to define this delay more clearly for the five major causes of maternal mortality mentioned above. There is also a need to specify acceptable time intervals between a woman's arrival at a facility with a particular obstetric complication and the start of treatment for that complication. Finally, different studies have attempted to measure time intervals—between arrival and treatment—by several different methods, but it is not clear which of these are most reliable and practical in high maternal mortality settings.

To address these issues, the Quality Assurance Project (QAP) implemented a safe motherhood research program of three studies in four countries with high maternal mortality ratios. The first study examined the competency of birth attendants, the second measured performance and gauged the relative contribution of different enabling factors in the work environment, and the last examined the third delay. The field portion of this research was carried out between September 2001 and July 2002 in Benin, Ecuador, Rwanda, and Jamaica. This report presents the results from Jamaica. Results from Benin, Ecuador, and Rwanda are presented in other documents.[18–20]

According to World Health Organization (WHO) estimates, the maternal mortality ratio (MMR) for Jamaica was 115 deaths for every 100,000 live births in 1995.[1] This compares to 195 per 100,000 for the Latin America and Caribbean region as a whole. A sequence of studies performing clinical audits of all maternal deaths in Jamaica in 1981–83, 1986–87, and 1993–95 yielded estimates of country-wide ratios of 107.5, 114.5, and 106.2 maternal deaths per 100,000 live births respectively.[21–23] The differences between these MMRs were not statistically significant, indicating that Jamaica's effort to reduce the rate of maternal deaths was not successful as of 1995.[21] In the 1993–95 data, the maternal deaths due to pregnancy-induced hypertension (PIH), infection, hemorrhage, and other causes (including indirect) accounted for 35.9, 32.3, 24.6, and 13.4 maternal deaths per 100,000 live births, respectively.[24] An estimated 89% of all deliveries in Jamaica are attended by a trained practitioner.[24] In 1993–95, 82% of all deliveries occurred in public hospitals, up from 70% in 1981–83.[24]

B. Research Design

We pilot tested all research instruments in Ecuador during November and December of 2001. Health facilities participating in the tests included one provincial level hospital, one church hospital in Quito, and one country-level hospital on the outskirts of Quito. All instruments were developed in Spanish. After the pilot test, the instruments were modified, translated into English, and then extensively reviewed and revised with the study team in Kingston.

Four study hospitals were selected purposively according to the following criteria:

- A range of levels of care, including two tertiary care referral hospitals, one a general hospital and the other a specialized women's hospital (gynecology and obstetrics) that manages a large number of maternal complications, one mid-sized secondary care referral hospital, and one smaller district hospital;
- An average of at least two births per day, sufficient to permit observation of at least five cases over a two- to three-day period;
- A geographic spread of hospitals from throughout the country; and
- Interested in participating in the studies.

The selected facilities were Victoria Jubilee Hospital, a referral facility in Kingston; Cornwall Regional Hospital in Montego Bay; St. Ann's Bay Hospital, a smaller hospital that serves as a regional maternity center in St. Ann's Bay; and Black River Hospital in Black River. Based on the criteria proposed by Maine et al., two of the selected hospitals (Victoria Jubilee and Cornwall Regional) qualified as

Comprehensive Essential Obstetric Care facilities.[25] A list of data collection instruments is in Appendix A, and the data collection schedule is in Appendix B.

The study country coordinator (McCaw-Binns) visited all study sites before beginning the data collection to brief the facility director on the studies. The facility's physical layout was mapped to help determine the optimal placement of observers for the patient flow analysis. The medical records department was contacted to coordinate the selection of the medical records for review, as was the maternity department to coordinate the start of observation of deliveries and identification of personnel. Finally, a location, date, and time for the competency testing of hospital personnel were determined.

Separate data collection instruments were developed for each study. The Competency Study required eight instruments (J1.1–J1.8); the Enabling Environment Study five (J2.1–J2.5); and the Third Delay Study three (J3.1–J3.3): There were two shared instruments (J4.1–J4.2): one for data about the site and the other was a chart review. The data collection instruments for the individual study methodologies are described in the text as part of each study.

Table 1 presents the number of study instruments completed by facility, and for community-based providers by region.

Table 1. Study instruments completed by facility for maternal health studies

		Competency Study			Enabling Environment (EE) Study				EE & 3rd Delay St.	Third Delay Study	
Hospital Type	**Name / Location**	Knowledge Surveys	Skills Stations	Provider Self-Evaluations	Births Observed	Essential Elements Checklists Completed	Enabling Factors Surveys Completed	Motivation Surveys	Medical Records Audited	Emergency Room Cases Observed	Obstetric Ward Cases Observed
Reference	Victoria Jubilee	7	6	7	34	0	10	10	36	0	45
Regional	Cornwall Reg.	5	4	4	23	1	5	5	26	0	24
Regional	St. Ann's Bay	2	0	2	18	1	4	5	29	0	25
District	Black River	4	4	4	7	1	4	4	14	0	8
Community-based providers:											
- Southeast Region		16	16	15	0	0	16	16	0	0	0
- Northeast Region		9	9	9	0	0	9	9	0	0	0
- Western Region		11	11	10	0	0	11	11	0	0	0
- Southern Region		7	7	7	0	0	7	7	0	0	0
Other	Other	5	5	5	0	0	2	2	0	0	0
Total		**66**	**62**	**63**	**82**	**3**	**68**	**69**	**105**	**0**	**102**

II. Competency Study

A. Objectives

Objectives for the Competency Study were to develop, test, and apply instruments to measure the competency of health personnel who attend women during labor, delivery, and in the immediate postpartum period. We specifically wanted to develop assessment methods that would be both valid measures of key competencies and "practical for program managers." By practical for program managers, we mean s*imple* to apply and evaluate locally without assembling a large study team or hiring outside consultants; *rapid* (testing applicable in a day or less) so as not to remove essential health personnel from their duties for a long period; and based on technology that is *affordable and applicable* in low-resource settings, such as Ministry of Health (MOH) facilities with no budget or personnel dedicated to research and evaluation.

B. Methods

Following quality improvement literature, we defined competence as having sufficient knowledge and skills to comply with predefined clinical standards.[26] Since cross-country comparisons were a key study goal, we used the WHO's IMPAC guidelines as a benchmark for our measurements.[27] To measure knowledge, we developed a 55-question multiple-choice and fill-in-the blank test with six topic areas: aseptic procedure; labor and delivery; immediate newborn care; and management of hemorrhage, PIH (pre-eclampsia and eclampsia), and sepsis. Questions were adapted from training evaluation instruments developed by MotherCare and the Maternal and Neonatal Health (MNH) Program.[28–30] Additional sources of information included the IMPAC guidelines, Ecuadorian MOH guidelines, the list of basic SBA competencies developed by the Safe Motherhood Interagency Group, and consultation with experts both internationally and in Jamaica.[4, 27, 31] One exam question (#8) related to knowledge of the partograph was made optional in Jamaica, where guidelines do not call for the use of the partograph. We also removed two questions (38a and 38b) on pre-eclampsia, since these questions proved not to be valid indicators of clinically relevant knowledge about how to manage pre-eclampsia. At the request of the Jamaican study team members, we added 11 questions related to HIV/AIDS. These questions were not included in the overall knowledge score since they were not used in the other study countries. Instead, we scored these questions separately and present them in the results section immediately below.

In scoring the test, we awarded one point for each correct answer but did not deduct points for incorrect or blank answers. Since some questions had multiple answers and test-takers were asked to provide a total of 71 responses, a perfect score equaled 71 points. (This excludes the 11 questions on HIV/AIDS.) To calculate a provider's total score, we divided his or her points earned by the total number of points possible. We also calculated scores for each of the six topic areas in the same fashion.

To measure skills, we adapted five instruments developed by the MNH Program: (1) ability to use a partograph as a decision-making tool in labor and delivery; (2) neonatal resuscitation with an ambu bag; (3) neonatal resuscitation mouth-to-mouth and nose; (4) manual removal of placenta; and (5) bimanual uterine compression.[30] A similar approach was used by MotherCare in Indonesia.[28] We also developed a checklist for measuring skill at IV insertion, a critical aspect of managing pre-eclampsia and eclampsia, among many other complications of pregnancy and childbirth.

The knowledge test was administered in written form. The partograph exercise, completed by those who chose to do so, presented data from two different cases and asked participants to plot the data on a partograph and answer questions about management of the cases. However, since the partograph exercise was not officially part of the competency evaluation in Jamaica, results from those who completed it are not reported here.

Participants then rotated through five skills stations modeled on Objective Structured Clinical Evaluations similar to those described by McDermott.[28] At each station, participants performed a procedure on an anatomical model; evaluators instructed each participant to prepare for the procedure, carry it out, and then complete post-procedure tasks exactly as if treating a real patient. The evaluators scored participant competency at each station using a structured observation checklist.

Finally, the Competency Study asked participants to evaluate their own abilities in seven areas: (1) infection prevention and equipment sterilization; (2) active management of third-stage labor; (3) manual removal of placenta; (4) bimanual uterine compression; (5) neonatal resuscitation; (6) IV insertion; and (7) optionally, the use of the partograph. Participants ranked the difficulty of each task on a four-point scale: very easy, easy, a little bit difficult, and very difficult. Other options included "I never do this skill/procedure" and "don't know/not applicable." Participants completed this self-evaluation survey at the same time as the knowledge test.

The competency tests were given to two different groups of providers: providers at each study facility who had been observed attending one or more deliveries and community-based providers from the regions where the test was conducted. Facility-based providers were selected purposively: All who had been observed attending deliveries as part of the Enabling Environment study (see below) were invited to participate. The objective for this sampling approach was to compare competency with performance. Stratified random sampling by parish was used to select 56 providers from a national population of 201.

The knowledge test, skills test, and self-assessment were carried out during a one-day session at all four study hospitals. Two sessions were held at St. Ann's Bay due to low attendance. The skills test was administered by the same team of three persons (one obstetrician, one pediatrician, one general practitioner) in all four hospitals, while a study investigator explained and administered the knowledge test and other forms in each hospital. This fourth person varied from hospital to hospital. (Other information related to individual providers used in the Enabling Environment Study, including information on motivation and other enabling factors, was also obtained in these sessions, as noted in the Enabling Environment Methods section below.)

C. Results

1. Knowledge test

Eighteen providers from the four hospitals completed the knowledge test: one consultant obstetrician, four residents, two interns, eight nurse-midwives, two staff nurses, and one whose professional status was not reported. In addition, 43 of the 56 randomly selected community-based providers (77%) and five health providers from other areas completed the knowledge test. Of the five providers from other areas, one was a nurse-midwife; one was staff nurse, and the professional status of the others was not reported. Table 1 shows the distribution of the number of providers who took the knowledge and skills tests by hospital and, for community providers, by region.

The mean overall score for the knowledge test was 58.3% correct (95% CI 55.6–61.0%, SD 11.0%), excluding the 11 HIV/AIDS questions. Table 2 presents mean scores for the test as a whole, excluding HIV/AIDS, and for eight topic areas, including HIV/AIDS. All scores are reported as a percentage of questions answered correctly.

Table 2. Knowledge test scores (n=66)

Topic Area	Number of Possible Points	Mean Score	95% CI	SD
Total score [a]	71	58.3	55.6–61.0	11.0
Asepsia/antisepsia	7	48.7	43.0–54.5	23.4
Labor and delivery	23	57.7	54.1–61.3	14.6
Immediate newborn care	12	62.4	59.2–65.6	12.9
Postpartum hemorrhage	13	60.0	55.8–64.3	17.4
Pregnancy-induced hypertension	9	69.2	64.2–74.2	20.2
Sepsis	6	48.7	43.3–54.1	21.9
Active management third stage labor	2	40.2	31.0–49.5	37.4
HIV/AIDS	11	40.6	36.7–44.6	16.2

[a] Excludes questions related to HIV/AIDS.

Table 3 shows that facility-based providers scored higher than community-based providers overall (68.2% versus 53.2%) and in all individual topics except knowledge of asepsia/antisepsia. Given that the sample of facility-based providers is small and potentially biased due to self-selection, it was not meaningful to test for statistically significant differences among sub-groups of facility-based providers. But the sample of community providers approximated a random sample, so we analyzed the differences in scores among them for the four different regions (southeast, northeast, western, and southern). Analysis of variance (ANOVA) yielded significant differences in knowledge scores for the normal labor and delivery topic

between community providers from the different regions (F=6.22, p=0.001), but no significant differences among regions in the overall knowledge score or the scores for the other individual topics. The Bonferroni post-hoc test showed that community providers from the southern region scored significantly better than those from the other regions on questions related to normal labor and delivery: 19% better than the southeast region (p=0.006), 17% better than the northeast region (p=0.038), and 24% better than the western region (p=0.001).[32,33]

Table 3. Difference in knowledge test scores between hospital-based providers (n=18) and community-based providers (n=43)

Topic	Mean Score[a] by Work Location		Mean Difference (in Percentage Points) (95% CI)	p-value [b]
	Hospital-Based	Community-Based		
Total score	68.2	53.2	15.0 (10.6–19.4)	<0.001
Asepsia/antisepsia	47.6	48.2	-0.5 (-13.6–12.5)	NS
Labor and delivery	68.1	52.1	16.0 (9.7–22.4)	<0.001
Immediate newborn care	70.4	59.3	11.1 (4.1–18.0)	0.002
Postpartum hemorrhage	71.4	54.0	17.3 (8.5–26.2)	<0.001
Pregnancy-induced hypertension	79.6	64.3	15.3 (4.5–26.1)	0.006
Sepsis	70.4	38.8	31.6 (22.4–40.8)	<0.001
Active management third stage labor	63.9	25.6	38.3 (20.3–56.4)	<0.001
HIV/AIDS	51.5	34.9	16.6 (10.2–23.0)	<0.001

[a]All scores reported as percentage of questions answered correctly.

[b] Although we have calculated the p-value here, we believe that the small sample and potential bias due to self-selection of facility-based providers do not allow us to infer to a larger population.

2. Skills assessment

Sixty-two providers completed the five skills stations: 14 hospital based, 43 community based, and five from other areas. The facility-based providers included one consultant obstetrician, four residents, one intern, five nurse-midwives, two staff nurses, and one for whom professional information was not available. The community-based providers included one nurse-midwife and 42 community midwives. The five providers from other locations included one nurse-midwife, one staff nurse, and three for whom professional information was not available. As noted above, each skill station was organized in three parts: preparing for the procedure, performing it, and completing post-procedure tasks. In the preparatory and post-procedure portions of each station, participants were evaluated on their compliance with standards for aseptic procedure (e.g., washing hands, using new or re-sterilized gloves and disinfecting equipment, disposing of or disinfecting gloves properly). Also included in preparatory and post-procedure evaluation was "patient rapport": Did the provider greet the patient, explain what he or she was going to do, provide emotional support, explain the outcome afterwards, etc.? Before examining scores for each skill individually, we tested for significant differences in mean score between the preparatory and post-procedure tasks versus tasks associated with the procedure itself. Since anatomical models were used rather than real patients, we hypothesized that providers might pay more attention to the procedure itself than to asepsia and "patient rapport." If this were the case, we expected higher scores on the middle part of each skill station than on the first and third part.

Interestingly, pre- and post-scores were significantly different on four of the five different skills, but the procedure score was not always higher. For both types of neonatal resuscitation—mouth-to-mouth and nose, and resuscitation with an ambu bag—procedure scores were significantly higher than pre- and post-scores ($p<0.001$ in both cases). For bimanual uterine compression and IV insertion, procedure scores were six and nine percentage points *lower* than pre- and post-scores. Both these differences were statistically significant (p=0.013 and p=0.002, respectively). For manual removal of placenta, the mean procedure score was three percentage points lower than the pre- and post-scores, but the difference was only marginally significant (p=0.089).

As a result of these differences, we based the analysis of the five separate skill stations on their during-procedure score alone, excluding the pre- and post-procedure steps. However, we used all the steps (pre-, during, and post-procedure) for the calculation of overall skill score, and for asepsia and patient rapport. The competency scores for asepsia and patient rapport were obtained by summing the scores from each station related to these topics. The results are in Table 4.

Table 4. Skills station scores (n=62)

Skill Station/Index	Mean [a]	95% CI	SD
Overall skill [b]	46.1	42.0–50.2	16.0
Resuscitation with ambu bag [c]	78.7	75.3–82.2	13.6
Resuscitation mouth-to-mouth and nose [c]	82.4	77.4–87.4	19.6
Manual removal of placenta [c]	18.4	9.5–27.3	35.1
Bimanual uterine compression [c]	18.7	9.8–27.5	35.0
IV insertion [c]	56.3	48.4–64.2	31.0
Asepsia [b]	43.2	39.1–47.3	16.1
Patient rapport [b]	36.2	30.5–41.9	22.5

[a] All scores reported as percentage of steps completed correctly.

[b] Overall skill score and the asepsia and patient rapport indices are the percentage of steps (pre-, during, and post-procedure) completed correctly. Overall skill score is based on all questions, while the asepsia and patient rapport indices are based on all questions related to these topics from each of the five skills stations.

[c] The scores of the five individual skills are percentage of steps completed correctly during the procedure only, excluding pre- and post-procedure tasks.

Since only 14 facility-based providers completed the skills tests, it was not meaningful to test for the statistical significance of the differences in provider scores between facilities. However, we did test for differences in scores between facility-based providers (n=14) and community-based providers (n=43). The results are in Table 5.

Based on the independent samples t-tests, facility-based providers scored significantly higher on overall skills, neonatal resuscitation with an ambu bag, and IV insertion. They also scored higher on aseptic procedure, patient rapport, manual removal of placenta, and bimanual uterine compression, but not significantly or only marginally significantly. Community-based providers scored higher on skills related to mouth-to-mouth and nose resuscitation, but the difference was not statistically significant. These results must be viewed with caution because of the small sample and potential bias due to self-selection of hospital-based providers.

Table 5. Difference in skills scores between hospital-based providers (n=14) and community-based providers (n=43)

Theme	Mean Score by Work Location [a]		Mean Difference (In Percentage Points) (95% CI)	p-value [b]
	Hospital Based	Community Based		
Overall skill [c]	56.9	42.7	14.2 (4.5–23.9)	0.005
Resuscitation with ambu bag [d]	85.7	75.8	9.9 (1.8–18.0)	0.018
Resuscitation mouth-to-mouth & nose [d]	75.3	84.1	15.5 (-21.1–3.4)	0.155
Manual removal of placenta [d]	38.1	14.2	23.9 (-5.1–53.1)	0.101
Bimanual uterine compression [d]	38.8	14.3	24.5 (-3.6–52.6)	0.083
IV insertion [d]	80.7	44.7	36.1 (19.6–52.5)	<0.001
Asepsia [c]	49.3	41.2	8.1 (-1.3–17.5)	0.114
Patient rapport [c]	48.0	33.9	14.1 (-3.0–31.2)	0.100

[a] All scores reported as percentage of questions answered correctly.

[b] Although we have calculated the p-value, we believe that the small and potentially biased sample of hospital-based providers does not allow us to infer to a larger population.

[c] Overall skill score and the asepsia and patient rapport indices are the percentage of steps (pre-, during, and post-procedure) completed correctly. Overall skill score is based on all questions, while the asepsia and patient rapport indices are based on all questions related to these topics from each of the five skills stations.

[d] The scores of the five individual skills are the percentage of steps completed correctly during the procedure only, excluding pre- and post-procedure tasks.

We tested differences between the regions for facility-based and community-based providers using one-way ANOVA. Community-based providers from the northeast region (n=9) scored slightly higher than other community-based providers on patient rapport, but the differences in score were not statistically significant. Northeast region community-based providers also scored better than community-based providers from the other three regions in terms of skill at placing an IV line ($F=4.27$, $p=0.011$). However, among the four regions, the Bonferroni post-hoc test showed that the only statistically significant difference was between providers from the northeast region and providers from the Western region. Providers from the northeast region scored 37.8 percentage points higher ($p=0.007$) but the small sample size makes this estimate unstable as shown by the wide confidence interval (95% CI: 7.9–67.7%). These results must be viewed with caution because of the small sample and potential bias due to self-selection of hospital-based providers.

Sixty-three participants completed the self-evaluation survey, but most did not answer every question: The number of responses per question ranged from 42 to 53. Table 6 presents the self-assessment results and the related portion of the knowledge or skills evaluations for each skill or procedure. The self-assessment ratings are not strictly comparable to the knowledge and skills scores since they are measured differently. Qualitatively, however, there appears to be correspondence in some areas but not in others. For instance, providers' self-assessment of their ability to carry out active management of third stage labor is quite high (85.4% report that it is "easy" or "very easy"), whereas knowledge test scores on this topic are quite low (40.2% of questions were answered correctly). On the other hand, 51.0% of providers qualify neonatal resuscitation as "difficult" or "very difficult," but on average providers performed 78.7% of steps correctly when tested with an ambu bag and 82.4% of steps correctly when tested on mouth-to-mouth and nose resuscitation. Few classified manual removal of placenta and bimanual uterine compression as "easy" or "very easy" (9.5% and 22.5%, respectively). This self-assessment seems more in line with the low scores on skills testing for these two procedures.

Table 6. Comparison of provider self-assessment and test score

Task	Provider Self-Assessment (n=63)						Actual Test Score [b]
	Easy or Very Easy (n)	Difficult or Very Difficult (n)	I don't know (n)	I don't perform task (n)	Blank (n)	Average easy or very easy (%) [a]	
Use a partograph	10	3	12	17	21	40.0	N/A [c]
Equipment sterilization/Infection prevention [d]	26	2	6	11	18	76.5	48.7%
Equipment sterilization/Infection prevention [e]							43.2%
Active management of third stage labor [d]	41	5	0	2	15	89.1	40.2%
Manual removal of placenta [e]	5	10	10	28	10	20.0	18.4%
Bimanual uterine compression [e]	11	5	8	25	14	45.8	18.7%
Neonatal resuscitation (ambu bag) [e]	18	25	1	5	14	40.9	78.7%
Neonatal resuscitation (mouth-to-mouth/nose) [e]							82.4%
IV insertion [e]	23	12	4	11	13	59.0	56.3%

[a] The number of providers answering Easy or very easy as a percentage of the sum of providers answering Easy or very easy, Difficult or very difficult, and I don't know.

[b] Percent correct on corresponding knowledge test questions or skills station.

[c] We did not measure skill at using a partograph in Jamaica where partograph use is not part of standard clinical practice.

[d] As measured by the knowledge test.

[e] As measured by the skills stations.

D. Discussion

1. Logistics

As in other study countries, the written test in Jamaica took much longer than anticipated. While some physicians could complete it in an hour, as we had anticipated, other participants needed as long as two hours.*

Many facility-based providers declined to participate in the competency testing, so the final sample includes only a few providers from each hospital. The only exception was at Cornwall Regional Hospital where the entire obstetric (OB) department presented for testing. Reasons given for the low participation rates were that the maternity staff were too busy to leave their jobs and that their motivation for being assessed was low. At Black River, the study hired a replacement staff person for the day of testing, but even then participation was low. Of the 56 community midwives selected for testing, 13 could not attend due to torrential rains that precluded transport to the testing facility.

2. Competency scores

In general, knowledge scores in Jamaica were higher than in other study countries. Both facility- and community-based participants scored considerably better on questions related to pregnancy-induced hypertension than on any other topic. One explanation for this difference is that following on the findings from the Jamaica Perinatal Morbidity and Mortality Survey that hypertensive disorders was the most prevalent pregnancy complication affecting both maternal and perinatal mortality and morbidity, Jamaica emphasized developing tools to train staff in the management of this condition at the community and hospital level.[34,35] Both groups scored less than 50% on questions related to asepsia and antisepsia. The consistency of the scores between the knowledge and skills tests on these two topics suggests that this

* Before being used again, the competency test should be reviewed by a group of content experts who should help select a shorter number of the most clinically relevant questions. Ideally, input from expert nurse-midwives and obstetrician/gynecologists with extensive developing country experience should lead to development of a bank of questions on each topic area. Questions related to each topic area could then be rotated in and out of the test to permit application of different versions of the test that would provide equivalent measures of knowledge.

result is not an artifact of the testing process. Facility-based providers scored higher than community-based ones in nearly every area of knowledge and skill. One reason for this might be that, on average, facility-based providers receive more training than community-based midwives. Since most births in Jamaica occur in health facilities, facility-based providers also have more opportunity than community midwives to practice their knowledge and skills. However, given the considerable self-selection that occurred among facility-based providers tested, it is difficult to know if their scores are representative of facility-based providers in general. It is plausible that competency could be an important factor in self-selection: More competent (and therefore presumably more confident) providers might be more likely to choose to participate while less competent ones might be more likely to decline. The CMW scores are more likely to be representative of the population of CMWs as a whole, since these participants were selected randomly and any failure to participate was caused by weather, a factor unrelated to competency.

With the exception of questions related to PIH, CMWs showed much higher knowledge of newborn care than of maternal care. One possible reason for this is that as the proportion of hospital births has risen, community midwives are devoted more towards the care of newborns in the community when parents bring the children to child welfare clinics and when they make home visits. CMW knowledge about sepsis and active management of third-stage labor was particularly low. Both CMWs and facility-based providers demonstrated superior skills at managing neonatal resuscitation and placing an IV line than at performing manual removal of a placenta or bimanual uterine compression. Skills scores in these two areas were especially low: around 38% for facility-based providers and around 14% for CMWs. Before we carried out the competency assessment, some Jamaican experts recommended dropping the skills test for bimanual uterine compression, arguing that it is no longer practiced in Jamaica. However, study team observers and faculty from the Midwifery School of Victoria Jubilee Hospital reported that bimanual uterine compression is still included in the Jamaican midwifery curriculum. International consultants to the study also noted that bimanual uterine compression is an important life-saving measure in cases of severe hemorrhage. As a result, the investigators elected to retain this skills test as part of the competency evaluation. No one suggested dropping manual removal of placenta from the competency evaluation, and skills scores for this procedure were nearly identical to those for bimanual uterine compression. In sum, results seem to indicate a significant skills deficit at managing postpartum hemorrhage among both groups of providers. Since postpartum hemorrhage is the most common cause of maternal death worldwide and the second leading cause of maternal death in Jamaica, this is clearly an area that needs attention.

The lack of correlation between knowledge and skills scores for the different topics tested in this evaluation may confirm that knowledge and skills are two distinct dimensions of competence: Knowing intellectually how a procedure works or what it is supposed to accomplish does not necessarily indicate ability to perform it and vice versa. In Jamaica, this was particularly true of postpartum hemorrhage: Despite an average knowledge score on this topic of 71.4% among hospital-based providers, skills scores for two of the most common procedures to control postpartum hemorrhage were only around 38%. To get a valid measure of competence, it is necessary to test both knowledge and skills.

Self-assessment has been shown to be not very accurate in measuring performance as individuals either over- or under-rate their performance. However, when used as a tool to assess learning needs prior to a training program, self-assessment has been accurate.[28,36] Study respondents were asked by outside researchers led by senior medical personnel to complete the competency exams. They had no expectation of further training or supervisory action as the results were to be confidential. In this context self-assessment was not an accurate reflection of competence.

III. Enabling Environment Study

A. Objectives

The objective for the Enabling Environment Study was to better understand the relative contribution of core enabling factors and essential elements to the performance of health personnel who attend women during labor, delivery, and in the immediate postpartum period. We also hoped to assess the relative contribution of competency to performance in the context of environments with different enabling factors and essential elements.

B. Methods

Examining how different environmental factors influence performance requires measuring performance itself (as an outcome variable) and the factors thought to contribute to it (as explanatory variables). As one performance measure, we used a structured observation checklist (form J2.4) based on IMPAC guidelines to observe management of labor, delivery, and the first two hours of postpartum care for both mother and newborn. As shown in Table 1, we observed 7–34 births in each of the four study hospitals. Shift rotations previously scheduled by each facility determined which providers would be observed on which days and during which shifts. We observed at least three providers from each study hospital. At each study hospital, data collection was continuous for two to three days, both day and night, and included one weekend day and night.

Four separate observer teams collected this performance data: one team at each hospital. Each team functioned in two sub-teams, with each hospital's sub-team alternating 12-hour shifts. At Victoria Jubilee, Cornwall Regional, and St. Ann's Bay, each sub-team was led by an obstetrician or physician and one or two midwives or nurses; at Black River a single nurse comprised each sub-team with a physician on call to answer questions or assist with busy periods.

All data collectors (three obstetricians, three general practitioners, one pediatrician, and 18 midwives) were either retired or currently practicing at sites different from the study sites. They were trained in data collection procedures for the study at the MOH in Kingston and at Cornwall Regional Hospital by study staff (McCaw-Binns and Burkhalter). Training topics included the rationale for the study and how the results would be used. Each instrument was reviewed and the intent of each item clarified. In some cases, the data collectors suggested useful changes in the wording or form of the questions. Data collectors were told that if during their observation they were concerned with the care or well-being of a patient, mother or newborn, they should cease observing and intervene as they would normally do in their practice, and then note they had done so on the data collection form.

At all four study hospitals, we conducted medical record reviews to evaluate performance at managing three obstetric complications: hemorrhage, pre-eclampsia or eclampsia, and sepsis. We opted for record reviews because the limited time available for data collection made it unlikely that we would observe a sufficient number of complications as they occurred. Record reviews were carried out on the same medical case histories reviewed for the Third Delay Study. (The review process is detailed below in the methods section for Third Delay.) Three Ob/Gyns carried out all record reviews for both studies. They evaluated performance by determining whether the team managing each patient had carried out a set of 4–10 very basic steps recommended by IMPAC guidelines as essential for each complication.

Data on factors that contribute to an enabling environment were collected with four different instruments. Three instruments were completed by providers when they completed the written portion of the competency test (see the Competency Study methods section above for more details on the procedure). Providers were first asked to list all factors that contributed in either a positive or a negative way to their performance as birth attendants. This was administered in the form of a "free list" according to the

technique described by Weller and Romney.[37,38] Next, each provider was asked to respond to a written survey (form J.2.3) about the presence or absence of certain enabling factors in their work environment: adequate training, supervision, team work, and use of job aids, among others. Finally, each provider completed a 31-question survey (form J.2.2) examining different aspects of motivation at the same setting as the written knowledge test described above. Questions for the motivation survey were adapted from previous research on health worker motivation in developing countries.[26–29] The fourth (form J.2.5) was applied once in the emergency room and once on the OB ward at each facility. It measured the unit's hours of operation, the presence or absence of written standards of care, and the availability of key drugs, equipment, and supplies, which we refer to as "essential elements" of obstetric care. The list of essential elements was created based on IMPAC guidelines, experience from the Ecuador pilot test of the instruments, and other published literature.[4,38] In Jamaica, the essential elements instrument was not completed until several months after the births had been observed. The essential elements form was filled out by the research staff who observed performance, by the country coordinator, or by other knowledgeable persons at the facility.

C. Results

1. Health worker motivation and enabling factors

Motivation survey

The scores for the motivation survey indicate moderate levels of satisfaction, on average. The first part, Satisfaction I, has 19 items that focus on the health worker's job. Satisfaction II has 12 that focus on the worker's hospital environment. Health workers scored each item using a five-point Likert scale where 1 = very unsatisfied and 5 = very unsatisfied. The two scales are significantly correlated in the Jamaica data (Pearson $r = 0.57$, $p<0.001$, $n = 46$). Cronbach's alphas for the two scales indicate that they are internally consistent (Satisfaction I, $\alpha = 0.88$, Satisfaction II, $\alpha = 0.84$). Average scores for the two scales were computed by taking the mean of items in the scale, while allowing up to 25% of the items in the scale to be missing (blank).

Satisfaction I—Health Worker's Job (Items 1–19): mean (SD) = 3.1 (0.6), range = 2.3–4.5, n = 62

Satisfaction II—Health Worker's Hospital Environment (Items 20–31): mean (SD) = 3.6 (0.6), range = 2.0–5.0, n = 47

Analysis of variance of the satisfaction scores indicates no statistically significant differences among hospitals. Average scores of Satisfaction I range from 2.9 (Black River) to 3.5 (Cornwall Regional). Average scores on Satisfaction II range from 3.4 (Victoria Jubilee) to 3.8 (Southern Regional).

Enabling factors

Training in past two years: The amount of training in the past two years was calculated by summing the training indicated on essential obstetric care (EOC) training (item 4), interpersonal communication training (item 7), and other training on labor and delivery (item 8). Items were coded 0 for "no training" and 1 or higher for "any training," or, in the case of EOC training, to indicate the number of trainings in the previous two years. Mean (SD) = 1.9 (1.7), range = 0–5, n = 60.

Health worker assessment of proper use of clinical histories: A measure indicating the proper use of clinical histories was calculated by averaging three items on different aspects of clinical histories (items 11.1, 11.2, 11.3). Each item was scored on a 5-point scale ranging from 1 "never" to 5 "always" to indicate the proper use and completion of clinical histories. Mean (SD) = 3.8 (0.5), range = 2–5, n = 54.

Health worker assessment of performance of self and others: A summary measure of the health worker's subjective assessment of different aspects of his/her performance and that of co-workers was calculated by averaging items 13–20. Up to 25% of the items for an individual respondent were allowed to be

missing in the calculation of the score for that individual. Items were reverse coded as needed (items 15, 17, 18 and 19). The response scale ranges from 1 "strongly disagree" to 5 "strongly agree." Mean (SD) = 3.7 (0.4), range = 3–4.9, n = 47.

Health worker assessment of presence of supervisory system: A count of the presence of internal and/or external supervisory systems was calculated by summing items 21 and 26 (coded 0 for "no supervisory system" and 1 for "supervisory system"). Mean (SD) = 1.4 (0.5), range = 0–2, n = 57.

Associations between health worker motivation and enabling factors

Pearson's correlations between motivation and enabling environment summary variables (above) reveal no statistically significant associations.

2. Characteristics of patients and provider teams

Characteristics of birthing mothers

Seventy-three births were observed in all four hospitals. (This sample excludes 30 pregnant women who were admitted and included in the larger sample but for which a birth was not observed for any of several reasons.) Characteristics of the women who gave birth are summarized in Tables 7a and 7b.

Table 7a. Characteristics of birthing mothers

	Mean	SD	Min	Max	n
Average age in years	26.5	7.0	14	43	73
Previous births (average)	2.0	2.0	0	8	70

Table 7b. Characteristics of birthing mothers

	n	%
First Language		
English	73	100
Accompanied by anyone		
Yes	62	84.9
No	9	12.3
Missing	2	2.7
Diagnosis		
Tuberculosis	0	0
HIV/AIDS	4	5.6
Syphilis	6	8.7
Other STI	2	2.7

Health worker team characteristics

The composition of the health worker team was assigned to one of three categories: (1) attending physician, medical resident, intern; (2) nurse/midwife; or (3) auxiliary nurse/aide and other. This third category is referred to as "other" in the results reported below.

Labor: For cases with non-missing provider data during labor (and excluding women not in labor), the health worker team on average consisted of 3.2 workers (SD = 1.5, range = 1–8, n = 71). Most labors were attended by two or three health workers: 28.2% (20 of 71) by two and 29.6% (21 of 71) by three. Midwives and/or nurses attended all 71 cases with non-missing data. At sometime during labor, 54.9% (39 of 71) of the women were attended by one or more physician/resident/interns.

Intrapartum phase: For cases with non-missing provider data during the intrapartum (delivery) phase (and excluding all cases having C-sections), the health worker team on average consisted of 1.6 workers (SD = 0.9, range = 1–5, n = 50). Most of these deliveries (62.0%, 31 of 50) received care from only one health worker. All but two of these cases (29 of 31) were attended by a single midwife/nurse; one of the two remaining deliveries was attended by a physician and the other by a worker classified as "other." A physician/resident/intern was present during the intrapartum phase in 8% (4 of 50) of the cases observed.

Postpartum: Mother: For cases with non-missing provider data during postpartum maternal care, the health worker team attending the mother on average consisted of 1.5 workers (SD = 0.7, range = 1–4, n = 48). Most of cases received care from only one (56.3%, 27 of 48) or two (35.4%, 17 of 48) health workers. During this care, a physician/resident/intern was present in 18.8% (9 of 48) of the cases and in five of these was the only provider present. One or more midwives and/or nurses was present in 83.3% (40 of 48) of the cases.

Postpartum: Newborn: For cases with non-missing provider data during postpartum newborn care, the health worker team on average consisted of 1.6 workers (SD = 0.76, range = 1–3, n = 49). Most cases received care from only one (55.1%, 27 of 49) or two (28.6%, 14 of 49) health workers. During this care, a physician/resident/intern was present in 16.3% (8 of 49) of the cases and in five of these as the only provider present. One or more midwives and/or nurses were present in 73.5% (36 of 49) of the cases.

We also compared (1) provider teams with one or more skilled workers (doctor, resident, nurse, midwife, intern) and (2) provider teams with only less skilled workers ("other"). Nearly all the teams in the labor, intrapartum, and postpartum: mother phases included one or more skilled health workers, but 18% of the teams attending the newborn in the postpartum phase were unskilled only (Table 8).

Table 8. Skilled versus less skilled teams

	Skilled Team	Less Skilled Team
	n (%)	n (%)
Labor	71 (100)	0 (0)
Intrapartum	49 (98.0)	1 (2.0)
Postpartum: Mother	45 (93.7)	3 (6.3)
Postpartum: Newborn	40 (81.6)	9 (18.4)

3. Duration of and performance during labor, delivery, and immediate postpartum phases

Duration of observed labor, delivery, and postpartum care

Beginning to end of provider observation of patient(s): The average duration of the labor and delivery observation period from beginning to end was 6.2 hours (SD = 3.8, range = 2.1–22.8, n = 72).

Beginning to time of birth: The average duration from the beginning of the labor observation to the time when the baby was born was 4.6 hours (SD = 4.1, range = 0.1–20.8, n = 62). By hospital the average duration was: 4.6 hours at Victoria Jubilee, 3.9 hours at Cornwall Regional, 5.6 hours at St. Ann's Bay, and 5.4 hours at Black River.

Birth to end of observation: The duration from birth to end of postpartum observation averaged 1.8 hours (SD = 0.4, range = 0.33–2.0, n = 58).

Performance

Observations of 72 birthing women at all hospitals were analyzed to show the percentage of cases for which key tasks were performed and the average frequency that monitoring indicators were assessed. Results for labor, delivery, and postpartum phases are in Tables 9–13. Monitoring the partograph Alert Line and Action Line were key labor monitoring tasks in other countries in the study, but not in Jamaica

because partographs are neither required nor usually used in Jamaica. "Missing" refers to blank data fields or cases where the observer specifically checked that data were missing when it should not have been. "Not observed" refers to cases when the observer had to leave the observation area, the patient left the area and the observer could not follow, or the observer indicated it was an inappropriate question for this case (e.g., tasks related to labor monitoring for a born-before-arrival or immediate delivery).

Tables 9a and 9b show the average frequency (times per hour) that seven key indicators were monitored during labor. Table 9a shows the overall frequency and cases monitored at least once across all four hospitals, while Table 9b shows the frequency for each hospital. In Table 9a, six of the seven indicators were assessed at least once during labor in 85% or more of the cases observed; one indicator (duration of contractions) was never assessed in 23.9% of the observed cases. All of the indicators except "FHR (fetal heart rate) during first hour" were assessed less than once per hour on average, even though IMPAC guidelines call for twice per hour. Although sample sizes for individual hospitals are too small to make reliable statistical inferences, Table 9b suggests that differences in average frequency between the hospitals may be quite large and with a definite order.

Table 9a. Performance of key monitoring tasks during labor

	Frequency of Monitoring Task Performance (per Hour) [a]			Cases with Task Performed at Least Once [a]		
Indicator	**Average (SD)**	**Range**	**Valid n [b]**	**Performed at Least Once**	**Valid n [b]**	**%**
FHR during first hour	1.75 (1.1)	1.0–6.0	59	59	67	88.1
FHR after first hour	0.74 (0.5)	0.1–2.4	40	47	55	85.5
Maternal blood pressure	0.78 (0.6)	0.1–2.2	52	61	63	96.8
Maternal pulse	0.81 (0.6)	0.0–6.4	53	62	54	96.9
Intervals between contractions	0.82 (0.7)	0.1–3.3	36	44	51	86.3
Duration of contraction	0.87 (0.8)	0.2–3.3	28	35	46	76.1
Vaginal exam	0.77 (1.0)	0.1–6.7	53	62	64	96.9

[a] Both Frequency and Performed at least once refer to cases. For example 47 out of 55 cases had their FHR checked once or more after the 1st hour of observation during labor.

[b] The sample sizes (n) are number of valid cases across all hospitals. The sample sizes for Frequency are equal to or less than those for "Task Performed at Least Once" because of missing data on the duration of the observation period (a variable used to calculate frequency).

Table 9b. Average frequency of key labor monitoring tasks, by hospital

Indicator	**Victoria Jubilee (n)**	**Cornwall Regional (n)**	**St. Ann's Bay (n)**	**Black River (n)**
FHR during first hour	1.56 (18)	2.33 (21)	1.14 (14)	1.67 (6)
FHR after first hour	0.72 (13)	0.90 (15)	0.64 (9)	0.33 (3)
Maternal blood pressure	0.86 (17)	0.90 (15)	0.70 (15)	0.39 (5)
Maternal pulse	0.84 (17)	1.10 (16)	0.59 (15)	0.39 (5)
Intervals between contractions	0.64 (14)	0.87 (10)	1.49 (7)	0.29 (5)
Duration of contraction	0.73 (8)	0.88 (9)	1.52 (6)	0.29 (5)
Vaginal exam	1.70 (18)	1.12 (16)	0.60 (14)	0.36 (5)
Pooled mean frequency	1.06 (105)	1.26 (102)	0.86 (80)	0.58 (34)

The sample sizes (n) for each hospital equal the number of valid cases (Yes, No, and Missing). Statistical inferences about individual hospitals and comparisons between hospitals based on the data in this table are not valid due to the small sample sizes for individual hospitals.

Out of the 18 tasks listed in Table 10, health workers on average performed 12.5 per case during the intrapartum phase (SD = 1.5, range 9–15, n = 48).

Table 10. Performance during intrapartum phase

Indicator [a]	Yes	%	No	%	Miss-ing	%	Not Obs.	% [b]	% Yes [c] (Yes/Valid n)
Hands washed	39	54.2%	12	16.7%	2	2.8%	19	26.4%	73.6%
Perineum cleaned	46	63.9%	6	8.3%	4	5.6%	16	22.2%	82.1%
New or re-sterilized gloves	52	72.2%	0	0.0%	5	6.9%	15	20.8%	91.2%
Sterile drapes and clothing	19	26.4%	31	43.1%	7	9.7%	15	20.8%	33.3%
Protect perineum	47	65.3%	5	6.9%	3	4.2%	17	23.6%	85.5%
Suction newborn *	14	19.4%	33	45.8%	4	5.6%	21	29.2%	27.5%
One hand each side baby head	46	63.9%	5	6.9%	4	5.6%	17	23.6%	83.6%
Clamp and cut umbilical cord *	49	68.1%	0	0.0%	5	6.9%	18	25.0%	90.7%
Use sterile instrument to cut cord *	49	68.1%	0	0.0%	4	5.6%	19	26.4%	92.5%
Baby in skin-to-skin contact with mother *	21	29.2%	25	34.7%	4	5.6%	22	30.6%	42.0%
Dry and cover newborn *	49	68.1%	0	0.0%	4	5.6%	19	26.4%	92.5%
Give mother oxytocin	46	63.9%	3	4.2%	8	11.1%	15	20.8%	80.7%
Observe and manage delivery of placenta	43	59.7%	0	0.0%	13	18.1%	16	22.2%	76.8%
Confirm uterus is well-contracted	53	73.6%	0	0.0%	4	5.6%	15	20.8%	93.0%
Examine vulval-perineal region	52	72.2%	0	0.0%	5	6.9%	15	20.8%	91.2%
Examine birth canal	53	73.6%	1	1.4%	3	4.2%	15	20.8%	93.0%
Examine placenta	50	69.4%	2	2.8%	3	4.2%	17	23.6%	90.9%
Record number of blood vessels in cord *	44	61.1%	3	4.2%	4	5.6%	21	29.2%	86.3%

[a] The number of Yes, No, Missing, and Not observed responses for each indicator sum to 72, and the corresponding percentages sum to 100%.

[b] Not observed cases include, among other reasons, 12 C-sections and 14 other cases in which the delivery was not observed for all 18 indicators, and 4 stillbirths for the 6 indicators noted with an asterisk (*).

[c] The Not observed cases are not included in the denominator for this column, where "Valid n" (the denominator) equals the sum of the Yes, No, and Missing cases for each indicator.

Of the four maternal postpartum tasks listed in Table 11, health workers on average performed 3.4 per case (SD = 1.1, range = 0–4, n = 39).

Table 11. Performance of four key tasks during maternal postpartum care

Indicator [a]	Yes	(%)	No	(%)	Miss-ing	(%)	Not Obs.	% [b]	% Yes [c] (Yes/ valid N)
Check uterine retraction	52	72.2%	0	0.0%	5	6.9%	15	20.8	91.2%
Check external genitalia for hemorrhage	52	72.2%	0	0.0%	5	6.9%	15	20.8	91.2%
Initiate breastfeeding within two hours *	34	47.2%	3	4.2%	15	20.8%	20	27.8	65.4%
Check mother's temperature	42	58.3%	3	4.2%	9	12.5%	18	25.0	77.8%

[a] The number of Yes, No, Missing, and Not observed responses for each indicator sum to 72, and the corresponding percentages sum to 100%.

[b] Not observed cases include, among other reasons, 12 C-sections and 14 other cases in which the delivery was not observed for the 4 indicators, and 4 stillbirths for the indicator noted with an asterisk (*).

[c] The Not observed cases are not included in denominator for the "% Yes (Yes/valid n)" column, where "valid n" (the denominator) equals the sum of the Yes, No and Missing cases for each indicator.

Of the four newborn postpartum tasks listed in Table 12, health workers on average performed 2.9 per case (SD = 1.3, range = 0–4, n = 44).

Table 12. Performance of four key tasks during newborn postpartum care

Indicator [a]	Yes	%	No	%	Miss-ing	%	Not Obs.	% [b]	% Yes [c] (Yes/Valid n)
Apply antimicrobial drop/ointment	45	62.5%	2	2.8%	11	15.3%	14	19.4%	77.6%
Allow baby to breastfeed on demand	32	44.4%	9	12.5%	16	22.2%	15	20.8%	56.1%
Keep infant under constant supervision	42	58.3%	4	5.6%	13	18.1%	13	18.1%	71.2%
Clean blood and meconium from skin	48	66.7%	0	0.0%	12	16.7%	12	16.7%	80.0%

[a] The number of Yes, No, Missing, and Not observed responses for each indicator total 72, and the corresponding percentages total 100%.

[b] Not observed cases include, among other reasons, 14 cases in which the delivery was not observed and 4 stillbirths for all indicators.

[c] The Not observed cases are not included in the denominator for the "% Yes (Yes/Valid n)" column, where "Valid n" (the denominator) equals the sum of the Yes, No, and Missing cases for each indicator.

Tables 13a and 13b summarize the average frequency (times per hour) that four key indicators were monitored during the postpartum (mother and newborn) phase. Table 13a shows the overall frequency and cases monitored at least once across all four hospitals, while Table 13b shows frequency for each hospital. Two postpartum indicators (mother's pulse, and baby's color and respiration) were assessed at least once for nearly all of the cases observed, while the other two were never assessed in 40% (baby's temperature) and 28% (umbilical cord checked) of the cases (Table 13a). The average frequency of postpartum monitoring ranged from only 0.8 times per hour for baby's temperature to 1.9 times per hour for baby's color and respiration, clearly less than the twice per hour recommended by the IMPAC guidelines. Although sample sizes for individual hospitals are too small to make reliable statistical inferences, Table 13b suggests that differences in average frequency between some of the hospitals may be quite large.

Table 13a. Performance of key monitoring tasks during the postpartum phases

	Frequency of Monitoring Task Performance (per Hour)			Cases with Task Performed at Least Once		
Indicator	Average (SD)	Range	Valid n [a]	Performed at Least Once	Valid n [a]	Percentage
Mother's pulse	0.82 (0.5)	0.5-2.9	49	49	49	100
Baby's color and respiration	1.88 (2.3)	0.5-12.0	47	47	51	92.2
Baby's temperature	1.31 (1.9)	0.5-9.0	21	21	35	60.0
Umbilical cord checked	1.36 (1.7)	0.5-9.0	28	28	39	71.8

[a] The denominators (Valid n) for the Frequency and Performed at least once indicators do not always agree because of missing data on the duration of the observation period used in the Frequency indicator calculation.

Table 13b. Average frequency of postpartum monitoring tasks, by hospital

Indicator	Victoria Jubilee (n)	Cornwall Regional (n)	St. Ann's Bay (n)	Black River (n)
Mother's pulse	0.75 (19)	0.77 (13)	0.72 (12)	1.45 (5)
Baby's color and respiration	2.14 (18)	1.04 (13)	2.71 (11)	1.35 (5)
Baby's temperature	0.96 (8)	0.75 (4)	2.06 (7)	1.25 (2)
Umbilical cord checked	1.03 (11)	0.90 (5)	2.34 (8)	0.87 (4)
Pooled mean frequency	1.28 (56)	0.89 (35)	1.88 (38)	1.25 (16)

The sample sizes (n) for each hospital equal the number of valid cases (Yes, No and Missing). Statistical inferences about individual hospitals and comparisons between hospitals based on the data in this table are not valid due to the small sample sizes for individual hospitals.

D. Discussion

1. Data collection

Of the three studies, the one on the enabling environment had the most data collection instruments and was perhaps also the most complex. The essential elements data collection form (J.2.5) is relatively easy to use but difficult to analyze because of the many types of medications and dosages. The form used to record the direct observation of care during normal labor, delivery, and immediate postpartum care (J.2.4) sometimes requires the observer to stay focused over a long period in order to monitor care during a long labor. To save time, observers may try to monitor two or three labor cases at once using this instrument, which could lead to questionable data when one (or more) of the cases go the delivery phase. It may be advisable to monitor only one labor at a time in future data collections. The form used for chart review of obstetric complications (J.4.2) requires a reviewer with a strong clinical background and qualifications to interpret the data, often ambiguous, in the charts. The motivation questionnaire (J.2.2) and the enabling factors questionnaire (J.2.3) seem to work well.

2. Results of the observations

Nearly all phases of all cases were attended by staff with advanced professional training (physicians, midwives, and nurses).

Labor monitoring appears to be very inadequately performed. WHO guidelines indicate that FHR should be measured every five minutes (12 times per hour) during the first hour of labor and every 15 minutes (four times per hour) after that. In fact, the direct observation data indicate that FHR was measured on average only 1.75 times per hour in the first hour and only 0.74 times per hour thereafter. Thus, many cases were not measured sufficiently often to detect fetal distress in a timely way. A similar failing was apparent for monitoring the mother. For example, the guidelines state that blood pressure and duration of contractions should be measured twice an hour during labor, but on average, the blood pressure was measured 0.78 times per hour and contractions 0.87 times. This inadequate labor monitoring means that many complications might not be noticed in time to take appropriate corrective action. (Note that some mothers arrive at the facility at the end of labor, already in the intrapartum phase or even after delivery, precluding labor monitoring. Such cases must be accounted for correctly to prevent an erroneously low estimated average of frequency of monitoring.)

Most of the observed tasks during the intrapartum phase were performed for well over 80% of the cases. However, two important tasks—washing hands before attending a patient (73.6%) and observing and managing the delivery of the placenta (76.8 %)—were performed less frequently. A few tasks were performed only occasionally, including using sterile drapes and clothing (33.3%), suctioning the newborn (27.5%), and putting the baby into skin-to-skin contact with the mother (42.0%).

Four key postpartum maternal care tasks were performed for most cases in the two hours following delivery: uterine retraction and external genitalia were checked in over 90% of the cases, the mother's temperature was taken in 78.0% of the cases, and breastfeeding was initiated in 65.4% of the cases. Postpartum newborn care was performed almost as often: antimicrobial ointment was applied in 77.6% of the cases, and the baby was cleaned of blood and meconium in 80.0% of the cases, but newborns were under constant surveillance in only 71.2% of the cases. Postpartum monitoring varied depending on the indicator. During the first two hours postpartum, the mother's pulse and baby's color and respiration were checked at least once in over 90% of the cases, but the umbilical cord and baby's temperature were not checked at all in 28.2% and 40.0% of the cases, respectively.

The data obtained from the charts of patients with maternal complications indicate that many tasks were performed to standard. Of the three complications reviewed, sepsis management was performed better (89.8%, 53/59, four not observed) than pre-eclampsia (67.0%, 65/97, 20 not observed) or postpartum hemorrhage (60.1%, 125/208, eight not observed). For sepsis, the charts indicate that key tasks were generally performed; for example, fever was assessed 90.0% of the time (18/20) and a combination of

antibiotics was given 100% of the time (21/21). For pre-eclampsia cases, the chart review indicates mixed performance; for example, parental hydralazine was given 38.5% of the time (5/13), and the mother was placed on her left side 46.2% of the time (6/13), while blood pressure was always assessed (13/13), and fetal condition was assessed 88.9% of the time (8/9). Similarly, the chart review recorded mixed performance for postpartum hemorrhage; for example, signs of shock were assessed 40.7% of the time (11/27), the uterus was massaged 36.0% of the time (9/25), and the bladder was catheterized 34.6% of the time (9/26), while vaginal bleeding was assessed and oxytocin given 92.3% of the time (24/26), and intravenous solution was started 74.1% of the time (20/27).

However, 28.0% of the data from the charts was not there (missing or "not observed"). This included 31.5% from hemorrhage cases, 30.8% from pre-eclampsia cases, and only 11.1% from sepsis cases. Postpartum hemorrhage, with a sample size of 216 presents, was the largest source of missing data, although missing data are also important for pre-eclampsia (n=113). If these data were not missing, their inclusion could significantly influence the figures reported here for hemorrhage and pre-eclampsia case management. The more conservative approach is to assume that cases with less information are cases where management was inadequate. This has been done in part in the currently reported figures, which include "missing" data in the denominator but exclude "not observed" data. (Including the "not observed" data in the denominator would lower the reported performance.)

IV. Third Delay Study

A. Objectives

Objectives for the Third Delay Study included: (1) define and measure the third delay for the treatment of OB emergencies in facilities, (2) develop methods to measure the time interval for components of intra-facility emergency OB care and document apparent factors related to delayed care, and (3) develop measures useful for monitoring changes that occur after quality improvement interventions.

B. Methods

To measure components of the third delay, we employed patient flow analysis in the OB ward as well as a medical record audit. The patient flow analysis methodology has been used in other studies to document waiting times during family planning out-patient visits and was adapted to use for in-patient observations. As shown in Table 1, the local study team completed 102 observations on OB wards and 105 medical record reviews. In Jamaica, nearly all women arriving at a health facility for obstetric care go directly to the OB ward, rather than to emergency, so no cases were observed in the emergency area.

1. Patient flow analysis

To analyze patient flow on the OB ward (which received both emergency and non-emergency OB cases), we employed an instrument to record information on the following key events:

1. The time the woman arrived at the hospital/OB ward;
2. The time the initial exam began;
3. The time of the first exam by a senior health professional (i.e., a doctor or other provider with sufficient training to diagnose and treat rather than just record signs or symptoms);
4. The time a senior health professional gave verbal or written orders for treatment or tests;
5. The time a complication was diagnosed;
6. The time medications were given; specifically, any antibiotics, oxytocin, or magnesium sulfate ($MgSO_4$);
7. The time procedures were conducted; specifically, forceps/vacuum extraction or C-section deliveries, dilatation and curettage, laparotomy;
8. Date and time of the birth, if the woman was in labor;
9. Final diagnosis;

10. Number of times vital signs and uterine contractions were monitored;
11. The time of discharge or transfer and patient's condition at discharge (hospitalized, referred, discharged to home, discharged against medical advice, or deceased).

The team of observers on the OB ward recorded the information for the patient flow analysis. Observations were made during two or three consecutive days, including one weekend day. Time of arrival was defined as entry into the obstetric ward.

2. Medical record review

Three obstetricians, Drs. Elizabeth McDougal, Donette Simms-Stewart, and Ian Bamberry, were selected to carry out the medical record review because of their clinical expertise, their experience working at the reference hospital, and their familiarity with clinical records. At three hospitals, records were selected from calendar year 2001 by requesting a computer printout of all cases with five diagnoses, compiled by diagnostic codes. We selected a systematic random sample from the computer-generated list. At the district hospital, we perused the delivery book to identify patients with the selected complications, because the patient administration system was not yet computerized. We reviewed all identified cases for 2001 for the following diagnoses:

1. Postpartum hemorrhage
2. Severe pre-eclampsia or eclampsia
3. Obstructed labor (cephalopelvic disproportion)
4. Chorioamnionitis or puerperal sepsis
5. Septic abortion or post-abortion vaginal, uterine, or intestinal lesions

This led to a selection of 14 to 36 cases per hospital. Once selected, each medical record was reviewed using a form designed to capture information about the initial exam performed in the emergency room and on the OB ward, diagnosis, and definitive treatment. Questions were included for postpartum hemorrhage; pre-eclampsia or eclampsia; and sepsis, endometritis, and chorioamnionitis. As noted above, this more detailed information was used to evaluate performance at managing obstetric complications for the Enabling Environment Study.

C. Results

1. Medical record reviews

Reviewers examined 105 medical records: 36 at the referral hospital, Victoria Jubilee; 26 at Cornwall Regional; 29 at St. Ann's Bay; and 14 at Black River. Of these 105, 37 patients delivered by C-section, and 22 were emergency incoming transfers; and there were eight fetal deaths and 70 live births. For the 105 patients there were 124 diagnoses that fit the study criteria, with 26 patients having multiple diagnoses and 10 with other diagnoses (Table 14).

Table 14. Number of diagnoses by type of OB emergency

Type of OB Emergency	Number of Diagnoses
Postpartum hemorrhage	23
Eclampsia/severe pre-eclampsia	41
Obstructed labor	21
Sepsis	26
Post-abortion complications	13
Multiple diagnoses	26

The record reviewer determined whether a delay had occurred at any of three different points in the patient's care. At the patient's initial evaluation the reviewer determined if there had been a delay in

evaluating the patient based on the information available in the chart. Two examples of delays in the initial evaluation that could result in delayed recognition of an OB emergency are: (1) the patient's not being evaluated on arrival and (2) her not being monitored adequately. The reviewer next determined whether a delay had occurred in the diagnosis of the OB emergency based on his or her expert judgment and the information available in the record. Finally, the reviewer determined if there had been a delay in the treatment for each emergency. The definitive treatment for each emergency was considered when determining the delay. Table 15 displays the results by diagnosis category. Of the 105 records reviewed, 49 (46.6%) had at least one delay according to the reviewers. Twenty-three of 105 records (21.9%) showed delays in the initial evaluation; 17 of 105 (16.2%) showed delays in the diagnosis; and 35 of 100 (35.0%) showed delays in the definitive treatment. The greatest number of delays was for the care of patients diagnosed with obstructed labor.

Table 15. Number of cases with delays in initial evaluation, diagnosis, and definitive treatment for five major OB emergencies

Type of OB Emergency	Delay in Initial Evaluation (n = 23*)	Delay in Diagnosis (n = 17*)	Delay in Definitive Treatment (n = 35*)
Postpartum hemorrhage	4	3	4
Eclampsia/severe pre-eclampsia	8	5	9
Obstructed labor	8	5	11
Sepsis	1	3	11
Post-abortion complications	1	0	3

The columns do not total "n" because some cases have multiple diagnoses and/or "other" diagnoses.

Examples of delays in each of the three points of care were:

Initial evaluation:

- One-hour lag between doctor being called and arrival.
- Inadequate and late review of patient status from 09:30 to 17:05.
- Personnel not available to assess patient with post-abortion complications from private doctor abortion. Delayed diagnosis for one day due to unavailability of ultrasound.
- Patient arriving at night with blood pressure at 170/130 not seen by doctor for 10 hours.
- OB specialist not available at night. Specialist arrived at 02:30 and saw patient at 08:30.
- Emergency transfer not seen for 2 hours 48 minutes as assistant surgeon and circulating nurse not available.
- OB specialist saw patient with convulsions 1 hour 30 minutes after emergency arrival.
- Arrived at 10:30 and assessed at 15:05, diagnosed with severe pre-eclampsia, placenta abruption.
- Arrived at 13:30, 23 hours until first assessment.
- Arrived at 3:35 and seen at 9:15.
- Arrived at 13:35 and seen by specialist at 18:50, diagnosis of cephalopelvic disproportion-obstructed labor.
- Arrived at midnight, initial assessment at noon.
- Not seen until the following day; efforts of small hospital to consult OB specialist at referral hospital were difficult.

Diagnosis:

- Wrong diagnosis by intern; resident didn't examine patient for six hours. Should have insisted that resident come to see patient earlier. Treatment ordered by intern worsened patient's condition.

- No Doppler ultrasound available for diagnosis of deep vein thrombosis. Didn't diagnose sepsis soon enough despite increased temperature.
- Patient not checked for 12 hours from 16:45 to 05:15, which delayed diagnosis of obstructed labor.
- HELP syndrome on admission, but not diagnosed until three days later. Blood results not available during night.
- Although admitted from antenatal clinic with pre-eclampsia, not diagnosed with it in hospital for two days.
- Night-time delay of four hours for antibiotic administration.
- Patient couldn't afford ultrasound.
- Busy labor ward led to delay in diagnosis of obstructed labor and decision for C-section.
- Night arrival led to delay in diagnosis of placenta abruption. Could not locate specialist.
- Incorrect diagnosis leading to a delay in treatment of 36 hours.
- Cephalopelvic disproportion not diagnosed for three days and seven hours.
- Incorrect diagnosis of postpartum hemorrhage, which should have been puerperal sepsis, led to two trips to hospital and 12-hour delay for laparotomy; OB specialist not available at night.
- Missed diagnosis of postpartum hemorrhage, medical officer not called.

Definitive treatment:

- Problems with power supply in radiology meant computerized temography scan couldn't be done, resulting in a pulmonary embolism that wasn't detected.
- Had to wait for an hour to use operating room due to an ongoing case; diagnosis was postpartum hemorrhage.
- Lack of sufficient blood products led to two-hour delay in transfusion. Took almost two hours to give $MgSO_4$.
- Antibiotics not given for six hours and 20 minutes.
- Delay in C-section of four hours due to room being used by an emergency C-section and then the room being cleaned.
- Personnel not available in operating room; had to wait 48 hours for C-section.
- Night arrival delayed dose of $MgSO_4$.
- A 14-year old needed parental consent for dilation and curettage. Mother contacted but refused to consent for one day.
- Delayed C-section due to nursing shortage in evening.
- Delayed C-section due to busy delivery suite and not enough personnel.
- Delayed C-section waiting for assistant surgeon; only one surgeon was ready in operating room.
- Premature labor patient should have been transferred to referral hospital, but hospital wouldn't accept referral. Infant died as there was no pediatric team at small hospital.
- Indecision or failure of referral hospital to accept transfer from small hospital led to missed diagnosis of transverse lie leading to infant death after four days in labor, six hours from decision to C-section.

Time intervals from diagnosis to definitive treatment

As shown in Table 16, we were able to calculate time intervals from diagnosis to definitive treatment from 93 of the 124 diagnoses (75.0%). Due to the small sample sizes, we were unable to determine if the average time was significantly different between the four hospitals.

Table 16. Mean interval between diagnosis and administration of definitive treatment, by hospital (minutes)

Diagnosis	Hospital				Overall Pooled Mean (25^{th} to 75^{th} %)
	Victoria Jubilee	Cornwall Regional	St. Ann's Bay	Black River	
Postpartum hemorrhage	0.0	12.0	100.0	1.25	13.8
n = 12	n = 2	n = 5	n = 1	n = 4	(0–16 mins)
Pre-eclampsia/eclampsia					
Anti-hypertensives	219.6	42.5	131.4	146.7	162.7
n = 24	n = 10	n= 2	n = 9	n = 3	(49–255 mins)
Pre-eclampsia/eclampsia					
Anticonvulsants ($MgS0_4$)	98.6	143.3	25.4	--	87.0
n = 21	n = 8	n = 6	n = 7		(0–85 mins)
Obstructed Labor					
C-section	85.5	111.7	216.0	266.5	157.5
n = 17	n = 6	n = 3	n = 6	n = 2	(59–178 mins)
Sepsis					
Antibiotics	294.3	461.3	262.0	--	364.9
n = 9	n = 4	n = 4	n = 1		(183–525 mins)
Post-abortion complications					
n = 8	140.0	17.5	362.5	--	220.6
	n = 2	n = 2	n = 4		(13–176 mins)

Time intervals from order to definitive treatment

We measured time intervals from order to definitive treatment for 105 records by subtracting the time of administration from the time of the order. As there were outliers for each set of time intervals, we calculated the overall pooled mean and the interquartile range (25^{th} to 75^{th} percentile) to find how the middle 50% of the distribution is scattered. Table 17 presents the average order-to-administration intervals of several definitive treatments. Due to small sample sizes, we could not determine whether the average times were significantly different between hospitals.

Table 17. Mean interval between order and administration of definitive treatment, by hospital (minutes)

Treatment	Hospital				Overall Pooled Mean (25^{th} to 75^{th} %)
	Victoria Jubilee	Cornwall Regional	St. Ann's Bay	Black River	
Antibiotic	349.1	144.2	68.3	15.0	209.3
n = 45	n = 19	n = 14	n = 11	n = 1	(18–365 mins)
Oxytocin	46.1	41.2	35.7	0.0	36.6
n = 48	n = 14	n= 14	n = 15	n = 5	(0–37 mins)
C-section	77.0	91.4	90.4	205.0	102.4
n = 34	n = 13	n = 7	n = 9	n = 5	(40–168 mins)
Blood transfusion	53.0	0.0	38.5	--	42.8
n = 8	n = 5	n = 1	n = 2		(4–76 mins)
Magnesuim sulfate	21.0	71.0	26.7	--	34.8
n = 21	n = 9	n = 5	n = 7		(0–56 mins)
Anti-hypertensive	89.6	35.0	85.3	6.7	74.6
n = 27	n = 11	n = 2	n = 11	n = 3	(0–105 mins)

Figure 1. Time in minutes from decision to start of C-section by hospital

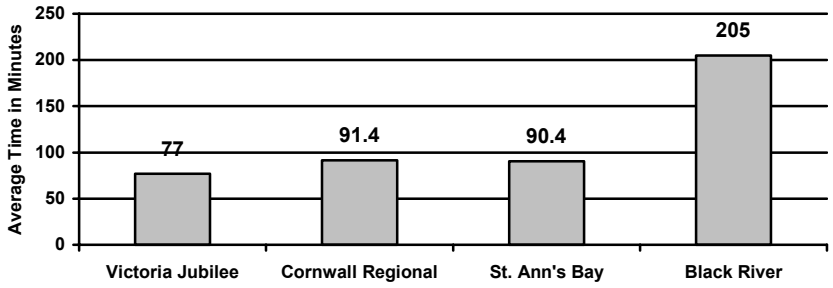


Figure 1 illustrates the difference by hospital in the interval between the decision for a C-section and its start. The large referral hospital, Victoria Jubilee, had an average time interval of 1.28 hours, compared to 1.52 hours at Cornwall Regional, 1.51 hours at St. Ann's Bay, and 3.42 hours at Black River. These differences are not statistically significant due to the small sample size, but the length of the delays at the smallest hospital is cause for concern.

2. Patient flow analysis

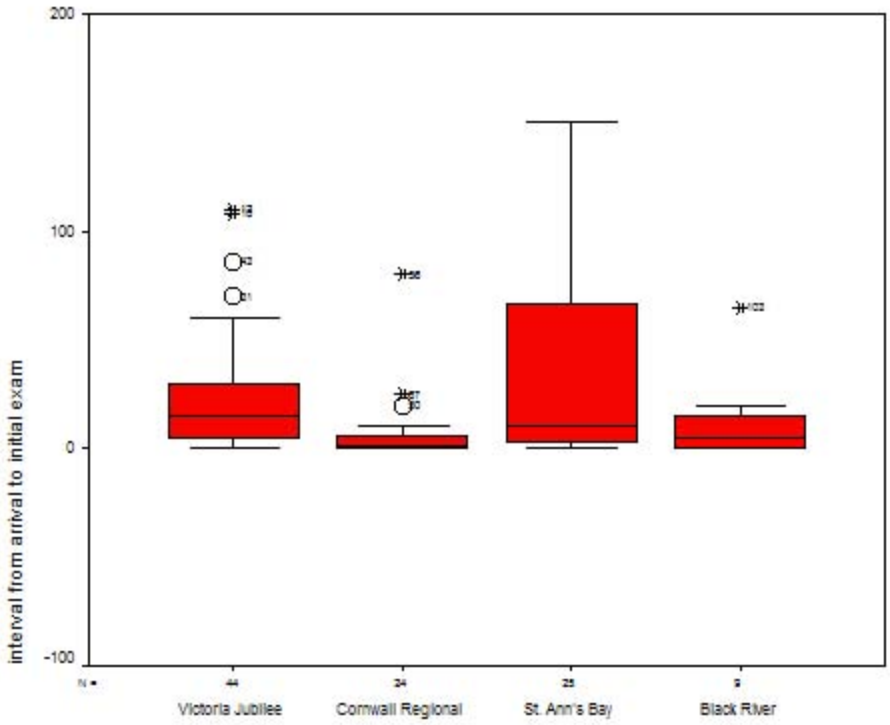
Arrival to exam: The patient flow analysis measured, for all female patients arriving in the OB Department, the time interval between arrival and an exam. During patient flow analysis, 103 patients were observed: 45 at Victoria Jubilee, 24 at Cornwall Regional, 25 at St. Ann's Bay, and 9 at Black River.

Time intervals were available for 102 patients from arrival at the OB Department to the initial exam by any health worker and for 82 patients (80.4%) from arrival at OB to an exam by a *professional* health worker. The mean time interval for all patients from arrival to the initial exam by any health worker was 21 minutes and for an exam by a professional health worker, 43 minutes. Figure 2 displays these intervals by hospital. The arrival-to-initial-exam interval was longest at St. Ann's Bay (81 minutes), as was the time spent waiting for an exam by a professional after the initial exam (40 minutes). The average total time spent by a patient between arrival at OB and an exam by a professional was the shortest at Cornwall Regional (15 minutes), followed by Black River (22 minutes), and then Victoria Jubilee (37 minutes) ($F_{(3, 78)} = 5.354$, $p = 0.002$).

Figure 2. Time interval from arrival at OB to exam by a professional, by hospital

Figure 3 shows the median (solid bar), 25–75 percentiles (shaded bar), range (I-bar), and outliers (asterisks and circles) of the interval from arrival at the OB Department to the initial exam, by hospital. It highlights the fact that although the hospitals have similar medians for this interval, the variances are very different. Cornwall Regional and Black River have very small deviations from the median, while St. Ann's Bay Hospital has a large one.

Figure 3. Distribution of interval from arrival at OB to initial exam in minutes, by hospital



Of the 103 patients arriving in OB, 82 were in labor and 21 were not. The average time from arrival at OB to initial exam was 19 minutes for the former and 30 minutes for the latter, although this difference was not statistically significant (Figure 4).

Figure 4. Average time from arrival at OB to initial exam by diagnosis (in labor or not), all hospitals

We examined the effect of arriving on a weekend day versus a weekday and the effect of arriving at night versus during the day, because the literature mentions these two factors as possible causes for delay before the initial evaluation. Of the 102 cases where this information was recorded, 56% arrived during the day (6 a.m.–6 p.m.) and 44% at night (6 p.m.–6 a.m.); 37% arrived on a weekend and 63% on a weekday (Table 18). Waiting times were significantly longer on weekdays. When we examined these results by hospital using a multifactorial ANOVA, the interaction term of hospital and day of arrival was only marginally significant, and neither the main effect of hospital nor the day of the week was significant.

Table 18. Average intervals to initial exam and exam by professional by day of week and time of day (minutes)

Time or Day of Arrival	Interval in Minutes from Arrival at OB Department to …	
	… Initial Exam	… Exam by a Professional
Weekday	26.6 (n = 64)*	53.8 (n = 52) †
Weekend	11.5 (n = 38)	23.5 (n = 30)
Day	24.8 (n = 58)	46.3 (n = 44)
Night	15.8 (n = 44)	38.6 (n = 38)

* $F_{(1,100)} = 6.422$, $p = 0.013$ † $F_{(1,80)} = 5.552$, $p = 0.021$

There was no significant difference in waiting times between daytime and night-time arrival. However, a multifactorial analysis found that waiting times during the day or night differed significantly by hospital (Table 19). Victoria Jubilee and St. Ann's Bay had longer waiting times during the day than the other two hospitals. Waiting time until initial exam was shorter at night at all hospitals, but waiting time for an exam by a professional at night was longer at St. Ann's Bay and Black River, the two smaller hospitals, and shorter at Victoria Jubilee and Cornwall Regional, the two larger hospitals.

Table 19. Average intervals to initial exam and exam by professional by day of week and time of day, by hospital (minutes)

Hospital		Interval in Minutes from Arrival at OB Department to …	
		…Initial Exam	…Exam by a Professional
Victoria Jubilee	Weekend	13.5	26.6
n = 44	Weekday	27.8	42.2
Cornwall Regional	Weekend	9.8	16.7
n = 24	Weekday	3.4	12.7
St. Ann's Bay	Weekend	3.4	29.0
n = 25	Weekday	40.6	92.8
Black River	Weekend	21.3	21.7
n = 9	Weekday	5.0	22.3
Victoria Jubilee	Day	24.8*	44.0†
n = 44	Night	20.3	24.8
Cornwall Regional	Day	9.8	20.1
n = 24	Night	5.1	10.6
St. Ann's Bay	Day	43.0	78.4
n = 25	Night	24.0	82.6
Black River	Day	18.0	18.3
n = 9	Night	5.0	24.8

* $F_{(1,100)} = 3.713$, $p = .014$ † $F_{(1,100)} = 5.234$, $p = .002$

Time to C-section: We were unable to measure the interval between the decision for a C-section and its start for patients observed during the patient flow. Of the 12 patients who had C-sections, information on when the order was given for a C-section was available for only five patients (57 minutes, 94 minutes, 190 minutes, 769 minutes, 1299 minutes).

Time from diagnosis to definitive treatment: No information was collected on when the treatment was given for the six patients with pre-eclampsia.

Third delays: Of the patients observed during patient flow analysis, delays occurred in care for the following reasons: (1) C-section was delayed because the ambulance had to go in one direction to pick up the nurse and the other direction to pick up the anesthetist, (2) elective C-section for twins was delayed because patient wanted to wait for her private doctor, and (3) delay in the transfer of patient with obstructed labor from small hospital to referral hospital was due to delay in decision to transfer (five hours after initial contact with referral hospital) and delay in transfer itself (two hours) due to change of personnel.

D. Discussion

Most of the delays found in the record review occurred during treatment, especially for obstructed labor, sepsis, and pre-eclampsia/eclampsia. The reasons cited were delays in C-sections due to busy personnel or occupied operating room suites. Times were documented in the records at the national and regional hospitals but less so at the district hospital. Information on mean time intervals could be calculated for all five OB emergencies. Postpartum hemorrhage had the shortest time to treatment followed by pre-eclampsia/eclampsia treated with an anticonvulsant. The longest time to treatment was for sepsis treated with antibiotics, followed by post-abortion complications. The time interval between order and administration of treatments was also the longest for antibiotics, especially at the national referral hospital. This suggests that the process for obtaining an antibiotic to give on the OB ward should be reviewed at this hospital.

The time from order to administration of a C-section at the national and regional hospitals was well under two hours. However, at the district hospital it was over three hours, calling for a review of the procedures for emergency C-sections there.

Of the waiting times between arrival and an exam by a professional, St. Ann's Bay had by far the longest time (81 minutes). Patients arriving there on a weekday had a mean waiting time of 93 minutes before being seen by a professional: 78 minutes if daytime or 83 minutes if night-time. The process for assessing patients there during the week should be reviewed and improved.

References

1. Hill K, AbouZhar C, and Wardlaw T. Estimates of maternal mortality for 1995. *Bull World Health Organization* 2001; 79:182–93.
2. World Health Organization. Revised 1990 Estimates of Maternal Mortality: A New Approach by WHO and UNICEF. Geneva: WHO, 1996:16.
3. Donnay F. Maternal survival in developing countries: What has been done, what can be achieved in the next decade. *Int J Gynaecol Obstet* 2000; 70:89–97.
4. Graham WJ, Bell JS, and Bullough CH. Can skilled attendance at delivery reduce maternal mortality in developing countries? In: De Brouwere V, Van Lerberghe W, eds. *Safe Motherhood Strategies: A Review of the Evidence; Studies in Health Services Organisation and Policy, 17.* Antwerp: ITGPress, 2001:97–130.
5. Liljestrand J. Strategies to reduce maternal mortality worldwide. *Curr Opin Obstet Gynecol* 2000; 12:513–17.
6. Safe Motherhood Inter-Agency Group. Skilled Attendance at Delivery: A Review of the Evidence (November 2000 Draft). New York: Family Care International.
7. AbouZahr C and Wardlaw T. Maternal mortality at the end of a decade: Signs of progress? *Bull World Health Organization* 2001; 79:561–68.
8. UNICEF (United Nations Children's Fund). Progress since the World Summit for Children: A Statistical Review. New York, 2001.
9. Walsh JA, et al. Maternal and Perinatal Health. In: Jamison DT, Mosley WH, et al., eds. *Disease Control Priorities in Developing Countries.* New York: Oxford University Press, 1993.
10. Thaddeus S and Maine D. Too far to walk: Maternal mortality in context. *Soc Sci Med* 1994; 38:1091–110.
11. Prevention of Maternal Mortality Network. Barriers to treatment of obstetric emergencies in rural communities of West Africa. *Stud Fam Plann* 1992; 23:279–91.
12. Onwudiegwu U, Makinde O, Ezechi O, and Adeyemi A. Decision-ceasarean delivery interval in a Nigerian university hospital: Implications for maternal morbidity and mortality. *J Obstetrics & Gynaecology* 1999; 19:30–33.
13. Prevention of Maternal Mortality Network. Situation analyses of emergency obstetric care: examples from eleven operations research projects in West Africa. *Soc Sci Med* 1995; 40:657–67.
14. Hoestermann CF, Ogbaselassie G, Wacker J, and Bastert G. Maternal mortality in the main referral hospital in The Gambia, West Africa. *Trop Med Int Health* 1996; 1:710–17.
15. Gbangbade S and Reinke WA. Quality of Emergency Obstetric at the First and Secondary Referral Hospital Level in the Republic of Benin. Arlington, VA: MotherCare/John Snow, Inc., 1998.
16. Barnes-Josiah D, Myntti C, and Augustin A. The "three delays" as a framework for examining maternal mortality in Haiti. *Soc Sci Med* 1998; 46:981–93.
17. Barahona V, Casas B, Garcia-Barrios C, et al. Improving Post-Abortion Care in a Public Hospital in Oaxaca, Mexico. *Reproductive Health Matters* 1997; 9:20–27.
18. Boucar M, Bucagu M, Djibrina S, Edson W, Burkhalter B, Harvey SA, and Antonakos C. Safe Motherhood Studies—Results from Rwanda: Competency of Skilled Birth Attendants; The Enabling Environment for Skilled Attendance at Delivery; In-Hospital Delays in Obstetric Care (Documenting the Third Delay). *Operations Research Results.* Bethesda, MD: Published for the U.S. Agency for International Development (USAID) by the Quality Assurance Project, in press.

19. Gbangbade S, Harvey SA, Edson W, Burkhalter B, and Antonakos C. Safe Motherhood Studies—Results from Benin: Competency of Skilled Birth Attendants; The Enabling Environment for Skilled Attendance at Delivery; In-Hospital Delays in Obstetric Care (Documenting the Third Delay). *Operations Research Results.* Bethesda, MD: Published for the U.S. Agency for International Development (USAID) by the Quality Assurance Project, 2003.

20. Ayabaca P, Harvey SA, Edson WN, Burkhalter B, Antonakos C, Hermida J, y Romero P. Estudios de maternidad segura—Resultados del Ecuador: Competencia del personal calificado para la atención al parto; El ambiente viabilizador para la atención calificada al parto; Demoras en el tratamiento de complicaciones obstétricas dentro de los establecimientos de salud (Análisis de la tercera demora). *Resultados de la Investigación Operativa.* Bethesda, MD: Publicado para la Agencia de los Estados Unidos para el Desarrollo Internacional (USAID) por el Proyecto de Garantía de Calidad, 2004.

21. McCaw-Binns A, Standard-Goldson A, Ashley D, Walker G, and MacGillivray I. Access to care and maternal mortality in Jamaican hospitals: 1993–1995. *Int J Epidemiol* 2001; 30:796–801.

22. Keeling JW, McCaw-Binns AM, Ashley DE, and Golding J. Maternal mortality in Jamaica: Health care provision and causes of death. *Int J Gynaecol Obstet* 1991; 35:19–27.

23. Walker GJ, Ashley DE, McCaw AM, and Bernard GW. Maternal mortality in Jamaica. *Lancet* 1986; 1:486–88.

24. McCaw-Binns A and Coley M. The pitfalls of maternal mortality surveillance (Draft). Mona, Jamaica: Department Community Health and Psychiatry, University of the West Indies, nd (circa 2001).

25. Maine D, Wardlaw TM, Ward VM, et al. Guidelines for monitoring the availability and use of obstetric services. New York: UNICEF, WHO, UNFPA, 1997:102.

26. Kak N, Burkhalter B, and Cooper M-A. Measuring the Competence of Healthcare Providers. *Operations Research Issue Paper* 2(1). Bethesda, MD: Published for USAID by the Quality Assurance Project, 2001.

27. WHO, UNFPA, UNICEF, and the World Bank. IMPAC – Managing Complications in Pregnancy and Childbirth: A Guide for Midwives and Doctors. Vol. WHO/RHR/00.7. Geneva: WHO, Department of Reproductive Health & Research, 2000.

28. McDermott J, Beck D, Buffington ST, et al. Two models of in-service training to improve midwifery skills: How well do they work? *J Midwifery Women's Health* 2001; 46:217–25.

29. McDermott J, Beck D, Dwi Yani FI, Soraya I, Muslim PA, et al. Training Evaluation Report: MotherCare/Indonesia. Arlington, VA: MotherCare, John Snow, Inc., 1999:126.

30. Maternal and Neonatal Health Program. MNH Program: Evaluation of MNH Clinical Training for Service Providers (Draft). Baltimore, MD: JHPIEGO, 2001:81.

31. Ministerio de Salud Pública República del Ecuador. Normas y Procedimientos para la Atención de la Salud Reproductiva. Quito, 1999.

32. Norusis MJ. SPSS 11.0 Guide to Data Analysis. Upper Saddle River, NJ: Prentice Hall, 2002.

33. SPSS v. 11.5. Chicago: SPSS, Inc., 2002.

34. McCaw-Binns A. Case study: Jamaica, 1991–1995. In: *Reducing Maternal Mortality: Learning from Bolivia, China, Egypt, Honduras, Indonesia, Jamaica, and Zimbabwe.* MA Koblinsky, ed. Human Development Network: Health, Nutrition and Population Series. Washington, DC: World Bank, 2003.

35. Greenwood R, Golding J, McCaw-Binns A, Keeling J, and Ashley D. The epidemiology of perinatal death in Jamaica. *Paediatr Perinat Epidemiol* 1994; 8 (Suppl 1):143–57.

36. Bose S, Oliveras E, and Edson. WN. How can self-assessment improve the quality of healthcare? *Operations Research Results* 2(4). Published for USAID by the Quality Assurance Project, Bethesda, MD, and JHPIEG Corporation, Baltimore, MD. 2001.

37. Weller S and Romney A. *Systematic Data Collection. Qualitative Research Methods.* Vol. 10. Newbury Park, London, New Delhi: Sage Publications, 1988.

38. Djan JO, Kyei-Faried S, Twum S, Danquah JB, Ofori M, and Browne EN. Upgrading obstetric care at the health center level, Juaben, Ghana. The Kumasi PMM Team. *Int J Gynaecol Obstet* 1997; 59 Suppl 2:S83–90.

Appendix A: List of Data Collection Instruments

Code	Name/Description
1. Competency Study	
J.1.1	Knowledge test
J.1.2	Case studies: Use of the partograph (not used)
J.1.3	Frequency and perceived difficulties of clinical techniques
J.1.4	Checklist: Neonatal resuscitation with ambu bag
J.1.5	Checklist: Neonatal resuscitation: Mouth-to-mouth and nose
J.1.6	Checklist: Manual removal of placenta
J.1.7	Checklist: Bimanual uterine compression
J.1.8	Checklist: IV insertion
2. Enabling Environment Study	
J.2.1	Enabling factors for the labor and delivery room
J.2.2	Motivation questionnaire
J.2.3	Enabling factors questionnaire
J.2.4	Observation of care during normal labor and delivery
J.2.5	Questionnaire on essential elements for the delivery room in-charge
3. Third Delay Study	
J.3.2	Patient flow: Emergency service
J.3.3	Patient flow: Maternity
4. All-Study Instruments	
J.4.1	Registration form for the initial visit
J.4.2	Chart review of obstetric complications
J.4.3	Registration form for healthcare providers

Appendix B: Schedule of Jamaica Data Collection: May 28 to June 21, 2002

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Key AMB = Affette McCaw-Binns BB = Bart Burkhalter EH = Erica Hedmann (MOH) WE = Wendy Edson BR = Black River Hospital CRH = Cornwall Regional Hospital SAB = St. Ann's Bay Hospital VJH = Victoria Jubilee Hospital		**May 28** AMB previously visited hospitals, arranged data collection schedules BB arrival in Kingston	**29** Mtg at USAID Working mtg AMB + BB Prepare training in observation & patient flow	**30** Training in observations and patient flow (MOH classroom)	**31** Training in observations and patient flow (practical) Prepare for start of data collection	**June 1**
2 VJH observations (BB, EH, supervisor) SAB observations (AMB, supervisor) WE arrival in Kingston, 8:03 pm AMB night in St. Ann's Bay	**3** SAB (observations) VJH (observations) Prepare for staff assessments (WE)	**4** Training: staff assessments (WE, VJH) VJH (Staff Assessments – WE)	**5** VJH (Staff Assessments - WE)	**6** Prepare for CRH observations and 2 staff assessments	**7** Travel to Montego Bay (AMB, BB, WE) CRH (observations) AMB & WE return to Kgn BB night in Montego Bay	**8** CRH (observations) BB travel to BR SAB (Staff assessments - WE) AMB, WE + assessors drive from Kgn then WE to Mo Bay WE Night in Montego Bay BB Night in Black River
9 BR (Observations) EH to Black River BB & EH return to Kingston WE Night in Montego Bay	**10** CRH (staff assessments WE) AMB + assessors fly in from Kingston BR (observations) WE Night in Montego Bay	**11** CRH (staff assessments WE) BR (observations) BB departs Kingston to U.S.	**12** Organize and clean data Prepare for one staff assessment	**13** Training for chart reviews (WE) Clean data	**14** Chart reviews	**15** BR (staff assessments - WE) AMB, WE, assessors return to Kingston
16 WE departs Kingston for U.S.	**17** Chart reviews	**18** Chart reviews	**19** Chart reviews	**20** Chart reviews	**21** Chart reviews Mail reviews	**22**