Barriers and opportunities experienced by staff when implementing infection prevention and control guidelines during labour and delivery in health care facilities in Nigeria

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Summary

Background

Infections account for 15% of neonatal deaths and one tenth of maternal mortality globally. Evidence-based practices to prevent and control infection are essential to reduce newborn and maternal mortality.

Aim

To identify the barriers and opportunities experienced by staff when implementing infection prevention and control (IPC) guidelines in maternity wards and delivery units in six health centres in two states in Nigeria.

Methods

We completed a structured survey in the maternity ward and delivery unit of six health care facilities to assess critical infrastructure and equipment. A survey was completed with the matron to assess staff practices and quality assurance procedures. Data were triangulated with qualitative data from interviews with facility staff.

Findings

Usable hand washing facilities - with water, functioning taps and soap available - were present in the delivery units of all six facilities; but were present in only one post-natal ward. All facilities were visibly clean, and staff demonstrated a strong will to comply with protocol. Areas of concern included effectiveness of training; inadequate availability of personal protective equipment; inadequate hand hygiene practices; and outdated procedures to reprocess reusable medical equipment.

Conclusion

Safe childbirth and postnatal care require comprehensive adherence to hand hygiene protocols and the use of disposable personal protective equipment. Financial, equipment, and human resource constraints are obstacles to effective implementation of IPC in labour and delivery wards in our study

site. Recommended interim measures include the introduction of champions to systematise step-down trainings and to monitor and provide feedback at facility level.

Introduction

An estimated 3 million children die during the neonatal period (birth through 28 days) annually (1), and infections account for approximately 26% of neonatal deaths. Newborns delivered in health care facilities (HCF) in low income countries have 3-20 times greater risk of contracting healthcare-associated infections (HAI) compared to newborns delivered in high income countries (2). Women are also susceptible to HAI during childbirth, and sepsis-related deaths are estimated to account for one tenth of the global maternal mortality burden (3). Almost all sepsis-related maternal deaths are recorded in low- and middle-income countries (LMICs) (4). The maternal mortality rate in Nigeria is among the highest in the world at 576 deaths per 100,000 live births, and the neonatal mortality rate stands at 37 per 1,000 births (5). Nationally 36% of births in Nigeria occur in HCFs and increasing facility-based births is a national priority. It is essential that efforts to increase the number of women giving birth in HCFs are coupled with evidence-based infection prevention and control (IPC) strategies to reduce the risk of HAI (6).

Many LMIC have yet to incorporate basic components of IPC into policy and practice. In-service training on IPC is often limited and is not always available to frontline healthcare workers (7) and dedicated HAI surveillance often lacks resources and expertise (8). The necessary physical infrastructure to support IPC is absent in many facilities. Global estimates report that 55% of HCFs in least developed countries lack basic water services, and one in five lack improved sanitation (9). Data from health care facilities (HCF) in 54 LMIC found that 35% lack soap for hand washing (10). The necessity for invasive procedures during delivery, and the high intensity of those procedures creates unique challenges for IPC which are compounded by inadequate infrastructure and equipment. There are limited available data on the experience of staff implementing infection prevention strategies at the facility level in LMICs; and understanding these experiences may help understand limitations to current IPC improvement programs and identify opportunities for improvement. This study aimed to

examine barriers and opportunities that facility staff face when following IPC protocols in high-volume healthcare facilities in two states in Nigeria.

Methods

This study was conducted in two states of Nigeria, Kogi and Ebonyi. All study facilities participated in quality improvement (QI) programming in the six months preceding data collection, with technical assistance delivered by the United States Agency for International Development (USAID) funded Maternal and Child Survival Program (MCSP). MCSP provided offsite clinical trainings on a broad range of maternal and newborn interventions (BEmONC and ENC), which included limited content or skills practice on IPC. Following the clinical trainings, on-site support also focused on the full range of maternal and newborn services, including components of IPC as noted in Figure 1. The assessment of IPC practices reported here was embedded within a larger observational study of hygiene practices (11).

Study setting

Facility-based births account for 68% of total births in Ebonyi state and 79% of total births in Kogi state, yet maternal and neonatal mortality rates remain as high as national rates (5). Of the 240 primary, secondary and tertiary facilities supported by MCSP across both states, 6 were purposively selected for our study. Specifically, we identified facilities with high average monthly deliveries to ensure sufficient births could be observed within the duration of the study. We selected one primary, one secondary and one tertiary in each state. Birth rates recorded over the period April 2016 – Mar 2017 ranged from 32 to 297 births per month (Table I).

Data collection

Tools were adapted from the existing WHO WASHFIT (12) and SoapBox WASH (water, sanitation, and hygiene) & Clean Toolkit (13) tools. Prior to the start of the study, tools were pre-tested in five non-study HCFs in Abuja and Ebonyi states. Data were collected on a pre-programmed digital platform (SurveyCTO software). To document facility conditions, a structured facility readiness checklist was

conducted in the post-natal ward and delivery unit on the first day of data collection in each facility. A survey was also completed in interview format with the matron of the maternity ward. Qualitative interviews were conducted with the manager, one nurse/midwife, and one cleaner in each facility. Participants were selected based on availability and willingness to participate in the interview. Interviews followed a semi-structured guide. Specific aims of each data collection tool are outlined in Figure 2.

Data analysis

Quantitative data analysis and management was conducted in Stata SE v15 (Stata Corp, College Station, USA). Data were analysed descriptively and triangulated with qualitative data to provide insight into key aspects of IPC, such as patient care equipment, personal protective equipment and hand hygiene. Qualitative data were transcribed into MS Word (Microsoft Corporation, Redmond, USA) and thematic analysis was conducted based on established components of IPC practice (14). Data were compared across respondents to identify variation and similarity among cleaners, nurse/midwives and heads of facility (13).

Ethics

Ethics approvals were granted by the Institutional Review Board at the London School of Hygiene and Tropical Medicine (13643), and the Ethical Review Boards of Kogi state (MOH/KGS/1376/1/84) and Ebonyi state (SMOH/ERC/33/017) in Nigeria.

Results

Table II provides a summary of the facility readiness checklist findings. Qualitative findings related to key IPC practices are presented below. Further contextual information and supporting quotations are included in the Supplemental Material.

Staffing and provider roles and responsibilities

Each shift had a matron, and all other nurse/midwives and cleaners reported to the matron. Cleaners were responsible for all routine cleaning of delivery units, post-natal wards, toilets and linen; but nurse/midwives were responsible for supervision of cleaners' work.

Cleaners also played an active – although often informal - role in assisting delivery due to competing demands on nurse/midwives' time. The assistance provided during labour and delivery often included handling and preparing instruments. In addition, cleaners reported playing an active role in direct care such as holding, cleaning and dressing the newborn. Understaffing at the HCF was identified as a barrier to adherence to IPC protocol, particularly when more than one woman came to deliver at the same time.

Institutional systems for Infection Prevention Control

The matrons at five of the six HCFs said that their facilities had IPC protocols in place that included a standardised protocol for handwashing and for decontamination of bodily fluids/spills. A sterilisation protocol was in place at all six HCFs. Waste management protocols were in place in four out of six facilities, and a protocol for disposal of sharps was in place in five out of six HCFs.

At the facility-level, formal staff trainings on IPC delivered by facility personnel were reported in five out of six HCFs. HCFs were not able to provide training to all staff, but those staff who did attend were expected to 'step down', or pass on, learnings through facility meetings. In half of the facilities it was reported that all cadres of staff, including cleaners, attended formal training on a rotation basis. In two of six HCFs, only senior staff managers attended formal training. Five of six heads of facility confirmed that there were systems in operation to step-down training content, although the consistency and rigour of these step-down trainings was not reported on. Content of trainings was described as highly didactic with little mention of in-service learning. Some respondents said that when content from formal training sessions were "stepped down" to cleaners, messages focused

predominantly on the need for cleaners to protect themselves from infection during their routine duties.

Hand hygiene, gloves and personal protective equipment

All six HCFs had a usable handwashing facility (HWF) with water, functioning taps and soap available in the delivery unit. In two of six HCFs, non-functioning permanent fixtures had been substituted with Veronica buckets (a plastic bucket filled with water with a tap underneath it). Disposable gloves were available at each HWF and were stored away from risk of contamination. Disposable towels were not available in any of the HCFs, and no hand hygiene posters were observed near HWFs.

Qualitative interviews with nurse/midwives revealed good comprehension of techniques for handwashing prior to administering care during labour and delivery, including washing down to the wrists and using the elbow to turn off the tap. Nurse/midwives also correctly explained that hand hygiene should be followed before and after touching a patient. However, reported practice varied between respondents. For example, one nurse/midwife at a primary facility said simply that she washed her hands before starting a delivery and again after it had finished.

All nurse/midwives explained the practice of double gloving during delivery. Nurse/midwifes described donning two pairs of gloves so that the top pair can be removed if contaminated and the nurse/midwife can continue to attend to the patient without intermediary hand hygiene. The underglove was not considered to be compromised by this process and two of the nurse/midwives interviewed referred to the under glove as ‘sterile’.

Patient care equipment

Data provided by the matron indicated that essential medical instruments for delivery (cord clamps, scissors/ blade to cut cord, episiotomy scissors, suture material and needle, and neonatal bags and masks) were available in all HCFs and sterile in five of six HCFs. An autoclave was reported as available

and functioning in five of six HCFs. However, when nurse/midwives and cleaners were asked to describe the process they followed to reprocess medical instruments, only 3 nurse/midwives mentioned autoclaving (referred to as 'boiling'). Across all interviews, including those with heads of facilities, chemical disinfection was favoured over steaming or boiling. Reprocessing equipment started by soaking equipment in chlorine solution. This was followed by washing in soapy water, rinsing, soaking again in chlorine solution, and finally packing and covering for next use.

Nurse/midwives interviewed reported adequate protocol for the immediate disposal of single-use patient care equipment into allocated sharps disposal boxes. Some HCFs lacked financing for adequate supply of single-use items; thus, clients were expected to provide their own single-use items. Common items expected to be provided by the patient were cannulas, syringes, soap and bleach, and a protective plastic sheet to cover the birthing bed. In half of all HCFs labouring clients were expected to provide sterile gloves for use during delivery. If a client arrived without the required items, the HCF would usually provide them at a fee. However, matrons confirmed that in two facilities, women may be sent away until they could return with the items.

Staff motivation for IPC compliance

Both nurse/midwives and cleaners reported that they followed IPC protocols to comply with the directives of matrons, doctors or management. However, some nurse/midwives indicated a more internalised motivation stemming from the need to protect themselves and to protect the patient. This motivation to ensure patient safety resulted in some nurse/midwives covering the cost for patient care equipment out of their own pockets when these items were not available for free at the facility.

Cleaners at one HCF reported that senior staff bought them essential equipment such as gloves when the facility had no budget available to cover this cost. Cleaners indicated IPC compliance was driven by the need to protect themselves from infection, and they stated this was the reason they were told

during training. Pride was also indicated as a strong driver of cleaner's behaviour, with one cleaner expressing the desire to be considered the cleanest facility in the state.

Environmental cleaning

The facility assessment found that delivery units were visibly clean. Data from all interviews suggest that cleaning the delivery unit is done both on a routine basis (ranging from once per day to three times per day); and in response to need during each delivery.

Mops, buckets, gloves, and dustpans were available for cleaning in all facilities. One primary facility did not have bleach or disinfectant available, although all cleaners interviewed reported they regularly checked stock and would inform their matron in adequate time if stocks were running low. Mop heads were visibly dirty in three of six HCFs. Only two HCFs had a dedicated budget for cleaning expenditures and in one facility, cleaners indicated the cost for supplies was covered at their matron's expense, rather than with facility funds. Women were expected to provide bleach in four of six HCF.

Waste management

Five of six facilities used sharps boxes in the delivery unit however, in three of these facilities, sharps waste was above the fill line indicated on disposal boxes. Aside from sharps, only three of six of the HCFs followed recommended practice and further segregated their waste into infectious, non-infectious and hazardous within the HCF, and only one HCF used a colour coded system to do so.

Discussion

Our assessment of facility conditions and staff practice in six HCFs in Nigeria found multiple barriers to compliance with IPC strategies in labour and delivery units even within the context of large, comprehensive quality of care improvement programme. Our sample is not representative of all facilities supported by MCSP. Our findings, however, document the persistent health system constraints that warrant additional investment to strengthen IPC in LMICs, especially in maternity settings. Areas where HCFs were performing well in IPC compliance included provision of usable hand

washing facilities in delivery units and visible cleanliness of delivery unit and post-natal ward. However, as we did not do swab tests, we cannot assume that cleanliness correlates with microbiological safety (15). Critical areas of concern related to IPC included: lack of provision of single-use towels for hand drying, inadequate availability of cleaning products and equipment; inadequate segregation of waste; inadequate provision of PPE; inadequate hand hygiene practices; and outdated procedures to reprocess medical equipment. Staff responses also indicate IPC compliance is hindered by financial resource constraints which result in understaffing and senior staff or patients having to cover costs for essential equipment. Understaffing was highlighted as a determinant of poor IPC compliance. If there are not sufficient staff on shift, compliance with hand hygiene and interim cleaning may be forfeited in order to attend to births and care for newborns (16).

Although medical equipment was reportedly available and sterile in five of the six HCFs included in the study; respondents reported that the first step for reprocessing equipment was to soak the item in 0.5% chlorine solution. This is in accordance with the training materials available at the time of MCSP interventions. Soaking medical equipment in 0.5% chlorine solution prior to cleaning is no longer advised as the disinfectant may be inactivated by blood and body fluids, which could then become a source of microbial contamination and result in the formation of biofilms (17). A study of sterile processing capability in LMIC found that chlorine solution was still universally in use as described in our study (18). Changing long-established procedures will require renewed focus to update national guidelines, curricula and trainers and requires time and resources. In addition, workable solutions to increasing use of the autoclave are needed.

Potential misinterpretation of sterility was evident in nurse/midwife reports on the common practice of double gloving in place of hand hygiene. IPC training materials used at the time of this study recommended the use of double gloving during vaginal delivery for the purpose of protecting the HCW (19) but they recommend both sets of gloves are removed following potential contamination. However, our findings suggest that double gloving practices are being operationalized by health care

staff as a shortcut to proper hand hygiene protocol. Global guidelines on glove use in HCFs (16, 20) note that donning and removing gloves can result in contamination when not coupled with handwashing with soap. Previously reported observational findings from these facilities (11) found very low rates of hand washing with soap or rubbing with alcohol-based gel prior to donning gloves, suggesting that this critical step in often missed.

Our study found evidence that staff are aware of gaps in IPC and have developed strategies in response. These include provisions to ensure that essential IPC equipment is available when not provided for by facility supply chains, such as the senior staff covering the cost or requiring mothers to provide their own materials when arriving at the facility for birth. However, these adaptations to institutional financial resource scarcity may compromise quality assurance systems in place at the health system-level, resulting in poorer quality/ contaminated PPE and patient care equipment. However, the existence of these strategies demonstrates recognition of the importance of IPC, and a strong motivation to comply with protocol.

Training mechanisms which rely on step down modalities to reach all members of staff were also described as little more than announcements in meetings, often reduced to directives for staff to protect themselves. The effectiveness of step-down modalities could be increased by mobilising facility IPC champions (21). Champions are positioned to build organisational support for new practices, facilitate the use of organisational resources (14) and could provide oversight to the current system of step-down training. Previous studies have shown that regular monitoring of IPC practices, and feedback can increase adherence (22). Champions could be enabled to play this monitoring role.

There are limitations to our study. Due to sampling methodology our findings may not be generalisable beyond the facilities included in the study. The structured tools used in this study provide data to describe current conditions and practices in HCFs, but they cannot describe why those practices are favoured. Where possible we have used qualitative data to answer this question, but

further research is needed. For example, an in-depth exploration of behavioural determinants could help inform intervention strategies to improve IPC adherence in HCFs.

Conclusion

With rising numbers of women giving birth in facilities, enabling HCFs to provide a clean and safe environment to deliver and provide quality intrapartum and postnatal care is critical to reducing maternal and neonatal mortality. Our study found a strong will to comply with IPC protocol from all staff, yet compliance was hindered by financial constraints which result in reduced training capacity, understaffing and limited IPC supplies and equipment. Recommended interim measures to improve IPC compliance include the introduction of champions to systematise step-down trainings and to increase opportunities to monitor and provide feedback. In order to address larger issues of financial resource constraints, adequate facility staffing and dedicated budgets for IPC equipment are necessary.

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Conflict of interest:

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript. Helen Buxton, Erin Flynn, Olutunde Oluyinka, Tess Shiras, Joanna EstevesMills, Oliver Cumming, Stephen Sara, Robert Dreibelbis

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Table I: Average monthly birth rates for each study facilitated based on 12-month period April 2016 – March 2017

	Primary	Secondary	Tertiary
Kogi	32	97	116
Ebonyi	42	297	179

Table II: IPC Indicators based on facility readiness checklist and survey with matron

IPC Domain	Indicator	Facility 1	Facility 2	Facility 3	Facility 4	Facility 5	Facility 6	Total
Hand hygiene and glove use	Water at HWF (labour and delivery unit)							6/6
	Soap available at HWF (labour and delivery unit)							6/6
	Alcohol based hand rub available (labour and delivery unit)							4/6
	Disposable towels available (labour and delivery unit)							0/6
	Disposable single use gloves available and safely stored							6/6
	Water is currently available at HWF (post-natal care unit)							1/6
	Soap is currently available at HWF (post-natal care unit)							2/6
	Disposable towels are available (post-natal care unit)							0/6
Personal protective equipment	Single use plastic aprons available and safely stored							4/6
	Face protection available							2/6
Patient care equipment	Equipment is visibly clean							6/6
	Equipment is stored above floor level							6/6
	Reusable equipment is sterilized/ chemically disinfected							6/6
Linen	Bed sheets available (post-natal ward)							4/6
	Bed sheets visibly clean (post-natal ward)							3/6
	Bed sheets changed between patients (post-natal ward)							4/6
	Designated clean area used to store linen							3/6
	Soiled linen segregated							4/6
Waste Management	Waste segregated							3/6
	Waste burnt on site							2/6
	Facility has placenta pit							2/6
	Sharps waste is below line on box							3/6
	Sharps boxes disposed of correctly							4/6
Environmental Cleaning	Visibly clean							6/6
	Delivery unit cleaned after each delivery							6/6
	Segregated cleaning equipment used for clinical waste							2/6
	Bleach/ bleaching power is available							5/6
	Walls and ceilings are routinely cleaned and sanitized							5/6
	TOTAL SCORE out of potential 28	**19**	**20**	**16**	**18**	**18**	**14**	

Figure 1: MCSP details of quality improvement (QI) programming

QI activities were delivered to all six study facilities (5 HCFs commenced in December 2016, and one in June 2017).

Content covered:

- Routine cleaning
- Waste management
- Linen management
- Patient care equipment
- Personal protective equipment (including gloves)
- Hand hygiene
- Prevention of needle stick injuries

Following initial training, partners such as state Ministry of Health, were encouraged to institutionalise quarterly integrated supporting supervision visits to provide ongoing mentorship and to develop action plans to fill gaps in service provision.

Figure 2: Specific aims of data collection tools

Facility Readiness Checklist:
To assess the availability and condition of the following: • water source • handwashing facilities and hand hygiene equipment • cleaning equipment • waste disposal mechanisms • patient care equipment • toilets And to assess overall cleanliness of facilities
Survey with matron:
To assess provision and acceptability of the following: • staffing • staff training • policies and procedures for IPC • sterilisation/ equipment reprocessing capabilities • routine birthing practices
Qualitative interviews:
To identify specific: • provider knowledge and capacity to perform IPC protocols • provider motivators for adherence to IPC protocols • barriers experienced by providers to adhere to IPC protocols.