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Barriers and opportunities experienced by staff when implementing infection prevention and control guidelines during labour and delivery in healthcare 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: A structured survey was undertaken in the maternity ward and delivery unit of six healthcare 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 handwashing facilities — with water, functioning taps and soap available — were present in the delivery units of all six facilities, but were present in only one postnatal 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of training, inadequate availability of personal protective equipment, inadequate hand hygiene practices, and outdated procedures to reprocess re-usable medical equipment.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 the centres included in this study. Recommended interim measures include the introduction of champions to systematize step-down training and to monitor and provide feedback at facility level.

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Introduction

An estimated 3 million children die during the neonatal period (birth to 28 days) annually [1], and infections account for approximately 26% of neonatal deaths. Newborns delivered in healthcare facilities (HCFs) in low-income countries have three to 20 times greater risk of contracting healthcare-associated infections (HAIs) compared with those delivered in high-income countries [2]. Women are also susceptible to HAIs 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 is 37 per 1000 births [5]. Nationally, 36% of births in Nigeria occur in HCFs and increasing HCF-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 HAIs [6].

Many LMICs 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 HCFs. 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 HCFs in 54 LMICs found that 35% lack soap for handwashing [10]. The need for invasive procedures during delivery and the high intensity of those procedures create unique challenges for IPC which are compounded by inadequate infrastructure and equipment. Limited data are available on the experience of staff implementing infection prevention strategies at facility level in LMICs, and understanding these experiences may help understand limitations to current IPC improvement programmes and identify opportunities for improvement. This study aimed to examine barriers and opportunities that HCF staff face when following IPC protocols in high-volume HCFs in two states in Nigeria.

Methods

This study was conducted in two states in Nigeria: Kogi and Ebonyi. All study HCFs participated in quality improvement 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 training on a broad range of maternal and newborn interventions (BEmONC and ENC), which included limited content or skills practice on IPC. Following clinical training, on-site support also focused on the full range of maternal and newborn services, including components of IPC (Figure 1). The assessment of IPC practices reported here was embedded within a larger observational study of hygiene practices [11].

Quality improvement activities were delivered to all six study facilities (five healthcare facilities 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 needlestick injuries

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

Figure 1. Maternal and Child Survival Program details of quality improvement programming.

Study setting

HCF-based births account for 68% of all births in Ebonyi state and 79% of all births in Kogi state, yet maternal and neonatal mortality rates remain as high as national rates [5]. Of the 240 primary, secondary and tertiary HCFs supported by MCSP across both states, six were selected purposively for this study. Specifically, HCFs with high average monthly deliveries were selected to ensure that sufficient births could be observed within the duration of the study. One primary, one secondary and one tertiary HCF was selected in each state. Birth rates recorded between April 2016 and March 2017 ranged from 32 to 297 births per month (Table I).

Data collection

Tools were adapted from the existing World Health Organization (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 HCF conditions, a structured facility readiness checklist was conducted in the postnatal ward and delivery unit on the first day of data collection in each HCF. 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 HCF. Participants were selected based on availability and willingness to be interviewed. Interviews followed a semi-structured guide. Specific aims of each data collection tool are outlined in Figure 2.

Table I
Average monthly birth rates for each study facility between April 2016 and March 2017

	Primary	Secondary	Tertiary
Kogi	32	97	116
Ebonyi	42	297	179

Data analysis

Quantitative data analysis and management were conducted in Stata SE v15 (Stata Corp., College Station, TX, 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 Word (Microsoft Corp., Redmond, WA, USA), and thematic analysis was conducted based on established components of IPC practice [14]. Data were compared between respondents to identify variation and similarity among cleaners, nurse/midwives and managers [13].

Ethical approval

Ethical approval was 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 online supplementary material.

Staffing and provider roles and responsibilities

Each shift had a matron, and all nurse/midwives and cleaners reported to the matron. Cleaners were responsible for all routine cleaning of delivery units, postnatal wards, toilets and linen, and 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 IPC

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

At facility level, formal staff training on IPC delivered by HCF personnel was reported in five of the 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, their knowledge through HCF meetings. In half of the HCFs, it was reported that all cadres of staff, including cleaners, attended formal training on a rotation basis. In two of the six HCFs, only senior staff managers attended formal training. Five of six

Facility readiness checklist
To assess the availability and condition of: • 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: • staffing • staff training • policies and procedures for IPC • sterilization/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

Figure 2. Specific aims of data collection tools. IPC, infection prevention and control.

Table II
Infection prevention and control (IPC) indicators based on facility readiness checklist and survey with matron. HWF, handwashing facility

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 (postnatal care unit)							1/6
	Soap is currently available at HWF (postnatal care unit)							2/6
	Disposable towels are available (postnatal 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
	Re-usable equipment is sterilized/ chemically disinfected							6/6
Linen	Bed sheets available (postnatal ward)							4/6
	Bed sheets visibly clean (postnatal ward)							3/6
	Bed sheets changed between patients (postnatal 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	

heads of facilities confirmed that there were systems in place to step-down training content, although the consistency and rigour of this step-down training was not reported. Content of training was described as highly didactic with little mention of in-service learning. Some respondents said that when content from formal training sessions was '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 the 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 HCF said simply that she washed her hands before starting a delivery and again after delivery 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 were sterile in five of the six HCFs. An autoclave was reported as available and functioning in five of the six HCFs. However, when nurse/midwives and cleaners were asked to describe the process they followed to reprocess medical instruments, only three 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 subsequent use.

Nurse/midwives reported adequate protocols 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 patients 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 in two HCFs stated that women may be sent away until they can 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 internalized 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 of patient care equipment out of their own pockets when these items were not available for free at the HCF.

Cleaners at one HCF reported that senior staff bought them essential equipment such as gloves when the HCF had no budget available to cover this cost. Cleaners indicated that 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 cleaners' behaviour, with one cleaner expressing the desire to be considered the cleanest HCF in the state.

Environmental cleaning

The HCF assessment found that delivery units were visibly clean. Data from all interviews suggested that delivery units are cleaned 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 HCFs. One primary HCF did not have bleach or disinfectant available, although all cleaners interviewed reported that they checked stock levels regularly and informed their matron in adequate time if stocks were running low. Mop heads were visibly dirty in three of the six HCFs. Only two HCFs had a dedicated budget for cleaning expenditures, and at one HCF, cleaners indicated that the cost of supplies was covered at their matron's expense, rather than with HCF funds. Women were expected to provide bleach in four of the six HCFs.

Waste management

Five of the six HCFs used sharps boxes in the delivery unit; however, in three of these HCFs, sharps waste was above the fill line indicated on disposal boxes. Aside from sharps, only three of the six 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

This assessment of HCF conditions and staff practices in six HCFs in Nigeria found multiple barriers to compliance with IPC

strategies in labour and delivery units even within the context of a large, comprehensive quality of care improvement programme. The study sample is not representative of all HCFs supported by MCSP. The 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 HWFs in delivery units and visible cleanliness of delivery units and postnatal wards. However, as swab tests were not performed, it cannot be assumed 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 personal protective equipment, inadequate hand hygiene practices, and outdated procedures to reprocess medical equipment. Staff responses also indicate that IPC compliance is hindered by financial resource constraints which result in understaffing, and senior staff or patients having to cover the 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, 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 LMICs found that chlorine solution was still universally in use, as described in the present 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 autoclaves 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 healthcare worker [19], but they recommended that both sets of gloves should be removed following potential contamination. However, the present findings suggest that double gloving practices are being operationalized by healthcare staff as a shortcut to proper hand hygiene. 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 HCFs [11] found very low rates of handwashing with soap or rubbing with alcohol-based gel prior to donning gloves, suggesting that this critical step is often missed.

This 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 HCF supply chains, such as the senior staff covering the cost or requiring mothers to provide their own materials when arriving at the HCF to deliver. 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 personal protective equipment 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 mobilizing facility IPC champions [21]. Champions are positioned to build organizational support for new practices and facilitate the use of organizational 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 this study. Due to sampling methodology, the findings may not be generalizable beyond the HCFs 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, this study 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.

In conclusion, with increasing numbers of women giving birth in HCFs, it is critical to enable HCFs to provide a clean and safe environment to deliver and provide quality intrapartum and postnatal care in order to reduce maternal and neonatal mortality. This 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 systematize step-down training and to increase opportunities to monitor and provide feedback. In order to address larger issues of financial resource constraints, adequate staffing and dedicated budgets for IPC equipment are necessary.

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Appendix A. Supplementary data

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