

Barriers and facilitators to infection prevention and control in a neonatal unit in a low resource setting, Zimbabwe – a theory-driven qualitative study to inform design of a behaviour change intervention.

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Structured summary (249/250 words)

Background: Hospital-acquired infection (HAI) is an increasing cause of neonatal morbidity/mortality in low-income settings. Hospital staff behaviours (e.g. hand hygiene) are key contributors to HAI. Understanding the drivers of these can inform designing interventions to improve infection prevention and control (IPC).

Aim: To explore barriers/facilitators to IPC in a neonatal unit in Harare, Zimbabwe.

Methods: Interviews were conducted with fifteen staff members of neonatal and maternity units alongside ethnographic observations. The interview guide and data analysis were informed by the COM-B (Capability, Oppportunity, Motivation-Behaviour) model and explored individual, socio-cultural, and organisational barriers/facilitators to IPC. Potential interventions were identified using the Behaviour-Change Wheel framework.

Findings: Enablers within Capability included awareness of IPC, and within Motivation beliefs that IPC was crucial to one's role, and concerns about consequences of poor IPC. Staff were optimistic that IPC could improve, contingent upon resource availability (Oppportunity). Barriers included: limited knowledge of guidelines, no formal feedback on performance (Capability), lack of resources (Oppportunity), often leading to improvisation and poor habit formation. Further barriers included the unit's hierarchy e.g. low engagement of cleaners and mothers in IPC, and staff witnessing implementation of poor practices by other team members (Oppportunity). Potential interventions could include role-modelling, engaging mothers and staff across cadres, audit and feedback and flexible protocols (adaptable to water/handrub availability).

Conclusions: Most barriers to IPC fell within Opportunity, whilst most enablers fell under Capability and Motivation. Theory-based investigation provides basis for systematically identifying and developing interventions to address barriers and enablers to IPC in low-income settings.

Introduction

The World Health Organisation (WHO) estimates that 25% of 2.8 million annual neonatal deaths are attributable to infection and many more babies have ongoing morbidity [1]. Furthermore, neonates are increasingly exposed to resistant healthcare-associated infections (HAIs), such as *Klebsiella pneumoniae*. As more births in African settings are facility-based, it is arguable that any infection associated with a delivery in hospital should be considered an HAI [2]. In low-income settings, overcrowding, understaffing, restricted infrastructural and microbiological support renders diagnosing and preventing spread of infections with infection prevention and control (IPC) interventions challenging [3]

The evidence base for IPC interventions in Southern African settings is scanty though increasing [4]. Several outbreaks have been associated with breaches in IPC policy, and understanding of IPC principles may be limited [5, 6]. IPC incorporates a set of complex behaviours, such as hand washing, waste management, and isolation. Therefore improving IPC and limiting HAIs will therefore likely require behaviour change. Multimodal IPC interventions including a strong behavioural change component have been effective and are considered best practice in high-income settings [7-9]. Although there is limited evidence on interventions in LMIC context, tailoring interventions contextually is crucial to ensure acceptability and sustainability. Guidance for developing complex behaviour change interventions advocates commencing with a theory-based understanding of what factors are influencing the behaviour of interest (i.e. conducting a 'behavioural diagnosis' of barriers and enablers), in order to design targeted interventions [10, 11].

One theory increasingly applied to explore influences on healthcare professional behaviours is the COM-B model [12], which stipulates that for any *behaviour* to take place there has to be *capability* (*psychological and physical*), *motivation* (*reflective and automatic*), and *opportunity* (*social and physical*). The COM-B model is mapped onto the Behaviour Change Wheel (BCW) framework, which specifies types of behaviour change interventions [12](Appendix A [13]). This enables systematic, transparent movement from behavioural diagnosis to intervention design, facilitating the selection of relevant, more likely effective behaviour change interventions [12]. COM-B has been applied to IPC and antimicrobial stewardship practices to design interventions [14, 15]. To our knowledge, these frameworks have not yet been applied to IPC in neonatal units (NNUs) in Southern African settings.

Context and Aims

The study aimed to be the first step in developing theory-based interventions to improve IPC practices in a low-resource neonatal unit. Harare Central Hospital (HCH) Neonatal unit, Zimbabwe has been used as a case study. Twelve thousand babies a year are born at HCH, and the 100-cot neonatal unit usually runs at 100-140% capacity. Forty percent of admitted babies have presumed sepsis [16], and a 2017 *Klebsiella pneumoniae* outbreak had a 33% case-fatality (Chimhini et al; in preparation).

Through applying the COM-B model and BCW framework, we aimed to:

1. systematically explore barriers and facilitators to IPC behaviours among healthcare staff in NNU/Maternity as a basis for identifying priority areas for intervention;
2. identify potential theory-based interventions to address barriers and enablers.

Methods

Design

A mixed-methods qualitative study, combining individual semi-structured interviews with first-person immersive non-participant ethnographic observations. That interviews rely on self-report and reflection, which may not fully capture what happens in practice or the environmental (physical and social) factors. Therefore, combining interviews with observations allows for triangulation and can bring stronger evidence to inform intervention design [17, 18]. Data were collected between 2018-2019. The interviews took place in September 2018, and ethnographic observation from February-March 2019.

Interviews – Recruitment

Recruitment involved: convenience sampling among junior staff in the unit (announcing the study among nurses, midwives and cleaners during morning handovers on consecutive days), and purposive sampling among senior staff members (approaching senior clinicians directly). Interested participants volunteered their names, and the list of interviewees were drawn at random by the interviewer.

Fifteen participants working across four departments of neonatal/maternal care were interviewed in September 2018 (n=4 physicians, n=4 general nurses, n=6 nurse midwives, n=1 cleaner). Fifty percent were in leadership positions (Appendix B).

Interviews - topic guide and data collection

To protect participants' identity, no demographic characteristics were collected except for: role, years working in role and the hospital. Interviews were semi-structured, including questions to explore potential barriers and enablers to IPC related to each of the COM-B domains (Appendix C). Target behaviours of interest included: hand-washing, cleaning (e.g. of the unit and equipment), and performing clean procedures (e.g. intravenous cannulation). The interview also allowed for open-ended, follow-on prompts to expand upon participant responses. The interviews were conducted in private during working hours by a Zimbabwean social scientist in English and the local language - Shona. The interviews were audio-recorded, transcribed verbatim, anonymised and translated into English, where required.

Ethnographic observations – data collection

An ethnographic researcher conducted observations in neonatal and maternity units. The observations took place over six weeks, involved non-participatory site visits and staff shadowing during eight days (morning and daytime shifts), and one night shift. The observations were written up in a form of a daily log that was analysed subsequently.

First phase of data analysis – identifying barriers and facilitators

Interview data analysis

First, the interview transcripts were analysed deductively (top-down) by coding participant responses according to COM-B domains. For instance, *"I am worried about myself, members of the staff, my colleagues, the relatives, my family as, because I can take infection here and go home with it"* was coded under 'Reflective Motivation'. Secondly, similar responses across participants coded to the

same COM-B domain were grouped, and theme labels inductively generated (bottom-up). The theme labels summarised the role that each domain played in facilitating or hindering IPC practices in this context.

Ethnographic data analysis

The ethnographic daily logs were analysed inductively and continually clustering emerging themes during the period of field research. Additional data from observation was tested according to these emerging themes. Secondly, to allow data synthesis from two data sources, these themes were then mapped onto the COM-B framework and integrated with themes from the interview analysis (See Appendix D for the themes and COM-B mapping). New themes emerging from the observations were added to the COM-B codebook.

Second phase of data analysis - Identifying potential intervention functions and components

Identified barriers and facilitators to IPC were linked with potential intervention components using the BCW framework [12]. This involved consulting matrices that map domains from the COM-B model to broad types of interventions specified in the BCW (e.g. education, training, persuasion), plus more granular behaviour change techniques (e.g. goal-setting, action planning, social comparison, feedback) [12, 13]. Potentially relevant intervention strategies were then considered by the wider team against the APEASE criteria (Affordability, practicability, effectiveness and cost-effectiveness, acceptability, side-effects/safety and equity) [12, 19].

Ethical considerations

The study was approved by Harare Central Hospital Ethics Committee (HCHC 070618/58), the Biomedical Research and Training Institute in Harare (AP148/2018), Medical Research Council of Zimbabwe (MRCZ/A/2354), and UCL Research Ethics Committee (5019/004). Interview participants provided informed consent before the interviews commenced and were provided with refreshments but no financial incentives. Informed consent was obtained prior to shadowing.

Results

Phase I: behavioural analysis

The interviews identified barriers and facilitators to IPC across all COM-B domains (Table I). Appendix E reports all themes from both data sources with frequencies and illustrative quotes. Overall, themes from the ethnographic observations tended to corroborate or elaborate on the interview themes, particularly for the domains of Social and Physical Opportunity. Additionally, they brought new findings (e.g. insights about the staff cuddling and comforting babies without appropriate hygiene). The results for each COM-B domain are summarised below.

Capability – psychological and physical

Staff were aware of the unit's IPC underperformance, but had limited knowledge of actual HAI rates and did not receive any formal feedback on their IPC-related performance. Interviewees tended to be knowledgeable about many aspects of IPC and the relevant practices involved, but some believed that other staff lacked the knowledge necessary to perform IPC tasks - "[staff] tend to say 'I do hand washing' but when you ask them to demonstrate they will not be knowing how to do it" (MN15). Indeed, although some of the interviewees received training on IPC in the past, there was limited training offered at the unit: an important barrier given the high rotation of staff. However, not all

staff believed that training would be sufficient - *"the challenges come on implementation because the resources were never availed for training we just train people but resources are not there"* (MN8).

Some staff admitted forgetting about IPC, especially when working under pressure (e.g. attending to emergency). Furthermore, some staff tended to rely on explicit information about infectious cases or visual cues (e.g. rash) as basis for deciding to engage in best practice IPC, sometimes with limited or incorrect understanding of mechanisms of transmission e.g. believing that syphilis is transmitted via contact rather than sexually: *"there will not be need to use gloves all the time as long as my hands are clean, but they are some who are infected e.g. who are syphilis positive I will need to use gloves so that I do not get infected."* (MN4)

Local or international guidelines on IPC were known to senior staff. However, some felt that the existing protocols were inadequate when key sanitary resources were unavailable (e.g. water), and expressed a need for new flexible protocols- 'next best' guidelines. Finally, when faced with resource shortages, staff improvised (e.g. *"Sometimes there are no catheters and even the urine bag. So you end up connecting a urinary catheter and at the end of the catheter you put a glove to improvise"* (PH14) or using paper that had previously been written on to clean their hands), but some gave up altogether.

Motivation – reflective

Interviewees tended to have high motivation to perform IPC-related behaviours and reported prioritising IPC-related tasks whenever possible. Staff often had well-defined roles regarding IPC, and viewed all staff as well as adult patients and babies' families as being responsible for IPC outcomes. The senior staff played an important role through monitoring, teaching and correcting IPC-related practices, while cleaning duties were the responsibility of the cleaning or junior nursing staff. Nevertheless, one junior doctor reported viewing their role in IPC very narrowly: *"All I do personally is discarding sharps in a sharps tin, that's as far as I go"* (PH6).

Secondly, many interviewees tended to be confident in performing different IPC practices that were part of their role, or on which they have received some training (e.g. isolating patients due to a recent cholera outbreak). Staff were also aware of the importance of IPC for morbidity and mortality within and beyond the hospital. Many interviewees had intentions or goals that were congruent with adhering to IPC practices and improving patient outcomes, as well as protecting their own health or the health of their families. Finally, most staff were optimistic about IPC improving in the unit, but this was contingent on resource availability.

Motivation – automatic

There was limited use of reinforcement for performing IPC-related tasks, including incentives. There were also no sanctions for poor performance, although staff could be verbally criticised. Emotions tended to be important enablers of IPC, e.g. upholding IPC standards was intrinsically rewarding to some staff. Many staff were worried about the serious consequences of poor IPC, including for their own families: *"... so I do worry whether or not I have given a baby sepsis and I do worry whether I am taking infection back to my child at home."* (PH16) Furthermore, ethnographic observation indicates that disgust towards certain bodily fluids (e.g. mother's vomit, as well as babies' faeces and blood) was more likely to motivate IPC behaviour.

Opportunity - physical

All interviewees discussed at length the lack of resources required for upholding IPC standards (e.g. gloves, water, soap, sanitisers, protective clothing). Moreover, IPC was at risk due to shortages of other key resources on the unit (e.g. Oxygen nasal prongs, thermometers), which often led staff to sterilize and re-use single-use equipment or share equipment with other hospital units. One clinician admitted developing negative habits due to the lack of resources: *"When there is no water and there is no alcohol, you are stuck [...] and then it becomes a bad habit and then that habit becomes a lifestyle"* (PH16). This was reflected in the observations: even on days where both were available, the nurses, mothers and doctors sometimes refrained from washing their hands or using disinfectant for no apparent reason.

Furthermore, over-crowding in the unit prevented isolation, high visitor traffic without control access (not only mothers who attend 6-8 times per day for feeding, but for example full surgical teams with medical students for training) potentially promoted infection transmission, and staff shortages, especially the cleaning staff, made it challenging to keep up with IPC activities. Although ethnographic observations showed that the unit was designed with IPC in mind, many resources had aged, reached their capacity or could not be kept sterile at busy times (e.g. the sluice room at the centre of the unit). Broken toilets or clean facilities for carers (mothers) also resulted in these adults transferring across the hospital wards several times per day, risking cross-contamination.

The observations identified further areas hindering IPC, including staff and mothers interacting with many objects during daily routines without sufficient hand hygiene (e.g. stethoscopes, mobile phones, benches on which mothers sit during feeding times). Finally, and possibly due to no alternatives, staff were seen during the ethnographic observations to use baby cots and sinks as temporary desks to write notes on or as placeholders for items (e.g. staplers). The fact that these themes have not emerged during the interviews may suggest that staff were not aware of the importance of these practices and objects in terms of IPC.

Opportunity – social

Social influence was a very important factor for IPC in the unit. Staff's practices around IPC were influenced by their colleagues, e.g. through reminders and encouragement, as well as explicit instructions. At the same time, interviewees reported noticing other staff members not performing IPC tasks. Similarly, a common ethnographic finding was that clothing, personal items and accessories of both lay and reviewing teams at the unit often fell short of IPC recommendations (e.g. long sleeves, ties, wristwatches, omnipresence of personal bags).

The unit was very hierarchical, which was especially clear from the observations (with clinicians at the top and neonates' mothers at the bottom), and which impacted both on IPC, and communication between staff in the unit. Discussions about IPC tended to happen among peers, but there seemed to be important barriers for the junior cadres to voice concerns or suggestions. *"I think that communication is key amongst ourselves, as a cleaner I should be able to talk to a doctor for example if he drops a needle it will very difficult to tell him that."* (CL13). The cleaning staff were also not involved in the discussions on IPC *"I think that they should invite us once or even once a month to a meeting of cleaners like what the Doctors do every Wednesday"* (CL13). At the same time, low awareness and disengagement of managerial staff was also mentioned: *'The assumption from the administrators is that everything is okay down here, yet we who are on the ground are saying no, all*

is not well' (DR14).

Furthermore, there was a lack of regular and formalised unit-wide meetings to address IPC practices and outcomes. Additionally, there was also no system to inform all staff, including the cleaners, about known cases of infections among specific patients or best IPC practices: *"no one explains to you [...] or even to tell you that this mess [needing cleaning] is from a deadly infection or that the ward you are about to enter has a baby suffering from this type of infection"* (CL13).

Staff tended to approach only adults (and their bodily fluids) and patients with clearly visible signs of infections (e.g. skin rash) with greater consideration of IPC standards (e.g. using gloves). In contrast, neonates who were asymptomatic were treated as *uninfectious* as opposed to infectious. As a result, neonates were often cuddled with little to no barrier nursing, and no gloves were used when cleaning baby vomit or changing diapers. Finally, although some staff mentioned educating patient carers (i.e. mothers) on elements of IPC, the latter group played a minimal role in IPC.

Phase 2 – identifying potential intervention components

Table I presents potential intervention types to address identified barriers and enablers in this context, according to the BCW [12]. Appendix F and G provide details of intermediary steps, selecting relevant intervention types and component behaviour change techniques. Special considerations were given to intervention components that could have unintended negative consequences as per APEASE criteria and cultural norms, such as high cost, low sustainability or stigmatisation (e.g. marking infectious neonates might impact on the care provided by their relatives).

Discussion

This theory-informed mixed-methods study identified that Capability, Opportunity and Motivation were influences on the performance of IPC behaviours among staff in a Zimbabwean neonatal unit. Barriers in the domains of psychological capability (e.g. knowledge and behaviour regulation), as well as social and physical opportunity emerged as key barriers to performing IPC-related behaviours. However, staff already demonstrated high motivation and commitment to adhere to IPC practices, which manifested in improvisation when faced with severely constrained resources. The study has identified enablers and targets that could be the focus of future interventions even in the absence of resources considered vital to IPC in high-income settings, in particular involving and empowering junior staff and parents.

Our findings align with previous research. Poor compliance with IPC practices has been observed both in high and low-income settings and across health settings [20-24]. Limited resources are a common contributor to poor IPC practices [22, 25-27]. Our study also showed how economic upheavals exacerbated pre-existing constraints affecting the Zimbabwean health system [26]. These included supply limitations, including water and alcohol hand sanitisers, as well as aging and overstretched facilities, understaffing, and heavy workload. These shortages negatively impacted on motivation and self-efficacy to perform IPC, as found in HICs [25].

Other barriers found here and elsewhere included lack of guidelines [28], insufficient knowledge or skills [20, 21, 27, 29], low prioritisation of IPC tasks and competing demands [21, 29]. The importance of considering IPC as a habitual behaviour cannot be overstated [21, 30].

We found that staff were motivated to perform IPC practices, including for self-protection and avoidance of contact with bodily fluids, which is an important IPC facilitator [21, 27, 31]. However, motivation to perform IPC practices is not ubiquitous [24, 25, 27]. This could demonstrate real differences in motivation between settings, or potentially our study over-sampling more motivated staff members.

Implications for Interventions

Interventions showing promise to improve IPC practices tend to include multiple components [20, 31, 32]. We identified several theory-informed components meeting the APEASE criteria [13, 19], some in line with existing recommendations and similar studies [9, 27]. Staff's capability could be improved through IPC protocols that stipulate what is best practice in the absence of running water or soap (i.e. 'next-best' practice) [9], setting attainable targets rather than promoting despondency and abandonment of IPC. Prompts could help trigger IPC behaviours among staff [21] but the present findings emphasise the need for non-stigmatising cues. Furthermore, capability could be improved via regular monitoring and feedback [32].

Although guidelines and educational initiatives have so far not been consistently associated with good IPC practices [9, 20, 31, 33], targeted materials and training can help ensure understanding among staff and visitors [29]. Our findings suggest that education should cover the importance of hygiene practices around asymptomatic neonates who may nevertheless be infectious: poor hand washing among staff can contribute to transmitting *Klebsiella pneumoniae* from neonates' faeces and vomitus [34]. The training resources should promote problem solving and action planning in the context of competing demands and resource constraint [35] and include persuasive components (e.g. feedback from credible sources, rewards, verbal persuasion about capabilities) to increase motivation and self-efficacy [31].

Considering minimal time and resources, training could be delivered through on-site mentoring and demonstrations, as well as videos or mobile-based training. In November 2018 the NNU in HCH has already implemented a digital quality improvement and data collection platform which incorporates decision support (NeoTree), replacing paper admission/discharge/death documentation [36]. NeoTree could be utilised as a platform to deliver IPC training as well as monitoring and feedback of staff performance.

Finally, the study highlights the untapped potential of human capital in the unit. IPC is a complex set of team-level behaviours requiring mutual coordination and understanding across levels, and which is highly responsive to social influences [21, 25, 31]. Firstly, the senior team members should play a greater part as role models [21, 25]. Secondly, given hierarchical structures in the unit it is crucial to create a supportive environment promoting communication and empowering disenfranchised staff members. Cleaners are an important yet often poorly integrated role, as found in maternity units in Bangladesh, India, Gambia and Zanzibar [37]. Introducing dedicated training sessions to the primary carers of the neonates (i.e. mothers) and educational materials to family visitors (e.g. videos/posters directed at the fathers) could improve IPC outcomes, as shown recently in India [38].

Strengths and limitations

The strengths of the study include the use of a systematic, evidence-based theoretical frameworks

(the COM-B model and the Behaviour Change Wheel) to explore barriers and enablers of IPC-related behaviours, and to identify relevant interventions. The use of triangulation through integration of interview data and ethnographic observations enabled a nuanced description of factors influencing IPC.

However, the study was conducted among a relatively small sample of participants, with some roles being represented by a single interviewee (e.g. a cleaner). There was also an overrepresentation of staff in leadership positions and those likely to have high capability and motivation to engage in IPC practices. It is possible that these two domains of influences would still need to be researched and addressed in future interventions, especially among more junior and cleaning staff. We did not include interviews with parents, who play a crucial role in caring for their infants. Any sustainable IPC intervention will likely need to incorporate family members.

Implications for future research

This study was designed as a first step in the best-practice development of interventions to limit HAIs. Future research should address how to engage patient families and junior cadres in IPC practices, and to systematically assess the feasibility and effectiveness of the different intervention components identified in this study.

Conclusions

Using a structured, theory-based approach to describe barriers and facilitators to IPC has allowed us to inductively plan contextually appropriate behaviour change interventions. Although the challenge of IPC in NNUs in low income settings such as Harare Central Hospital can appear insurmountable and overwhelming, we found cause for optimism in this systematic approach. Staff were motivated to improve, and understood the importance of IPC for their patients and for protecting themselves and their families. Using the methodology offered by the Behaviour Change wheel we have unpicked areas that may be feasible and affordable to intervene such as positive feedback, role modelling, establishing 'next best' protocols for IPC in the absence of sanitisers and water, offering training to all new staff and visitors, and engaging patients' carers and relatives in IPC tasks.

Contributors

FF, FL, GC, SC conceptualised the study. SM, SW, NK advised on the grant and study protocol. FF and FL obtained the funding and lead on securing ethical approvals. GC oversaw data collection and local IRB approvals. KS and FR conducted data collection. AH and JRP conducted data analysis. AH, FR, JRP, FF, FL, GC, and SC interpreted the data. AH, JRP, and FF prepared the preliminary draft. All authors contributed to the final manuscript.

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Conflict of interest

AH, JRP, KS, FR, SM, SW, NK, FL, FF declare no conflict of interest. GC and SC are senior consultants in Harare Central Hospital neonatal unit.

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Table I: Summary of barriers to IPC practices across COM-B domains, together with recommended intervention functions (IFs) and example behaviour change techniques

Barriers in each COM-B domain	IFs	Example behaviour change techniques (in progress)	Example intervention components judged to meet the APEASE criteria in the current context (this is a first draft, please amend as needed)
Capability - psychological and physical			
Limited knowledge of some aspects of IPC and IPC guidelines; inadequate IPC protocols in the unit	E1, E2, ER, T, M	Adding objects to the environment;	Provide copies of guidelines on IPC; develop flexible IPC protocols that account for the limited IPC resources (e.g. ‘next-best’ practice if water/hand rub not available)
Competing demands may lead to forgetting about IPC and prioritising other behaviours or tasks; some staff perform IPC practices only for patients with known or visible signs of infection		Action planning; Adding objects to the environment; prompts and cues; problem solving.	Offer training to staff that emphasises that lack of visual cues does not rule out infections; Introduce discrete, non-stigmatising prompts informing all staff about infectious neonates and contaminated objects.
No training adapted for the unit and for new staff; limited knowledge of IPC among some staff		Instructions on how to perform the behaviour; Demonstration of the behaviour; Persuasion about capability.	Mandatory training on IPC, including instructional videos for all new and visiting medical staff; training sessions with UV gel and UV light to reinforce high level hand-washing techniques; training tailored to the limited/intermittently available resources in the unit.
Motivation – reflective and automatic			
Confidence in performing IPC tasks tends to be contingent on availability of appropriate resources	E1, E2, P, M	Social support (unspecified), social support (practical), problem solving, action planning,	Offer training and protocols on how to improve IPC practices even in the absence of resources that are normally required for IPC (e.g. water).
Insufficient rewards and no sanctions for poor performance on IPC practices		Rewards, Incentives	Train staff on how to provide social rewards or introduce other system of sustainable incentives to promote good IPC practices (e.g. leader boards, IPC champion of the month, opportunities for training)
Opportunity – physical and social			
Shortage of supplies and staff; heavy workload and overcrowding;	E2, ER, M, R	Restructuring the environment ;problem solving, action planning, goal setting (behaviour), goal setting (outcome),	Employ additional cleaning staff; allocate tasks related to IPC among other staff; introduce sections in each room only for infectious patients and contaminated objects
Lack of formal and unit-wide discussions of IPC or feedback; and insufficient communication about best IPC practices and infection cases in the unit.		Action planning, goal setting and review, adding objects to the environment, self-monitoring, feedback on behaviour and outcomes of the behaviour,	Establishing regular meetings to discuss IPC at the unit and to provide feedback to different staff members about their performance and its impact on infection levels; Establish ways to inform all staff members about known cases of infection in the unit.
High traffic of visitors into the unit; poor		Adding Objects to the environment,	Introduce strict limits on who can enter the unit; expect all visits to

adherence to IPC practices among clinical and family visitors, including wearing inappropriate cloths and bringing street items (e.g. phones and bags)
Hierarchical relationships hinder communications between different staff groups and adult patients; patients' mothers (and other relatives) play a very limited role in IPC.

E1= Education, E2=Enablement; ER=Environmental Restructuring; M=Modelling, P=Persuasion; R=Restriction, T=Training

Instructions on how to perform the behaviour,	adherence to strict IPC protocols (e.g. do not allow street clothes); offer space to leave bags or personal items; use prompts and cues to remind staff and visitors about their responsibilities towards IPC
Social support (unspecified), social support (practical), action planning,	Empower junior staff and patients' family to voice concerns and remind staff about IPC practices (e.g. hand washing); prepare materials on IPC (e.g. posters, training videos) targeting different family members of the patients (e.g. mothers, fathers).

Article title: Barriers and facilitators to infection prevention and control in a neonatal unit in Zimbabwe – a theory-driven qualitative study to inform design of a behaviour change intervention.

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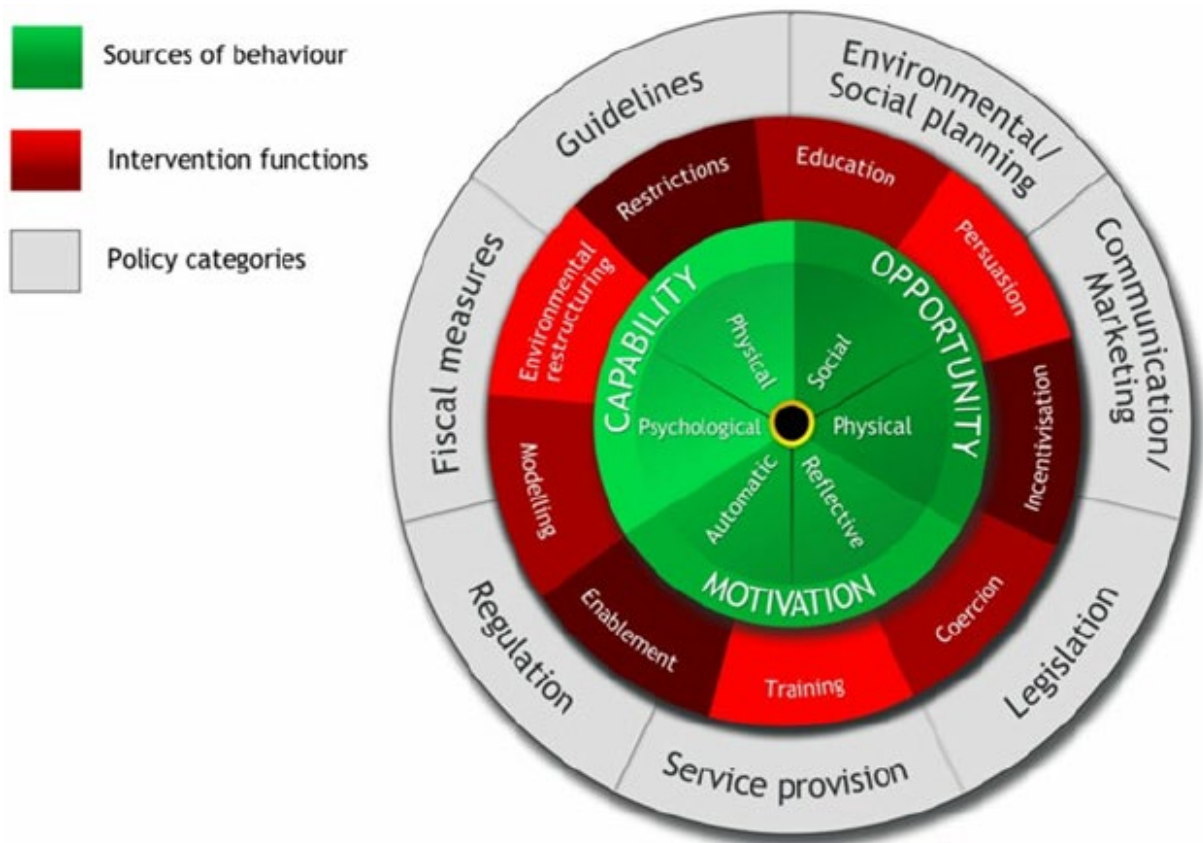
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Appendix A – Behaviour Change Wheel Diagram

Diagram of the Behaviour Change Wheel (Michie et al, 2014).



Appendix B – Interviewees characteristics

Table B1: Sample characteristics (CL=cleaner, PH=physician, MN=midwife or nurse)

ID	Clinical group	Years in the hospital	Months in the role	Position	Leadership	Department
MN2	Midwives/ nurses	≤3	≤6	Sister in Charge	Yes	Maternity
PH3	Clinician	4-7	≤6	Paediatrician	Yes	Neonatal
MN4	Midwives/ nurses	≤3	7-24	Nurse	No	Neonatal
MN5	Midwives/ nurses	≥8	≤6	Sister in Charge	Yes	Neonatal
MN6	Midwives/ nurses	≤3	≤6	Nursing student	No	Neonatal
PH7	Clinician	≤3	≤6	Medical student	No	Neonatal
MN8	Midwives/ nurses	≥8	7-24	Administrator	Yes	Executive
MN9	Midwives/ nurses	≥8	7-24	Midwife	No	Admissions
MN10	Midwives/ nurses	≥8	≤3	Midwife	No	Maternity
MN12	Midwives/ nurses	≥8	≤6	Midwife	No	Maternity
CL13	Cleaner	≤3	≤6	Cleaner	No	Neonatal
PH14	Clinician	≤3	≤6	SRMO	Yes	Neonatal
MN15	Midwives/ nurses	≥8	≥36	Administrator	Yes	Executive
PH16	Clinician	≤3	≤6	Registrar	No	Neonatal
MN17	Midwives/ nurses	4-7	≥36	Midwife tutor	Yes	Maternity

Table B2: Frequency of sample characteristics

		Frequency (N=15)
Clinical group	Midwife/nurse	10
	Physician	4
	Cleaner	1
Leadership role	Yes	8
	No	7
Department	Maternity	4
	Admissions	1
	Neonatal	8
	Executive	2

Table B3: Time spent in the hospital and in the role per clinical group

Clinical group	Statistics	Years in the hospital	Months in the role
Midwives/Nurses (N=10)	Mean (SD)	6.5 (4.4)	21 (29.7)
	Range	(0–14)	(1–96)
	Median	8	7
Physicians (N=4)	Mean (SD)	4 (4.9)	4 (1.9)
	Range	(2–12)	(2–6)
	Median	2.5	2.5
Cleaner (N=1)		5	24

Appendix C – Interview topic guide

Appendix C1 – the interview questions mapped onto COM-B.

The interview was developed by FF, KS and SM in consultation with FL. The Interview Guide was developed to explore all domains of the COM-B model (physical and psychological capability, reflective and automatic motivation, as well as physical and social capability). The COM-B model can be further elaborated by the Theoretical Domains Framework (TDF) (Cane et al., 2012; Atkins et al, 2017), which can help to develop individual questions. Therefore, the wording of the interview questions were guided by the TDF, which maps directly onto the COM-B model, as shown below in the table:

Sample question as applied to this study		
COM-B Domain	TDF Domain	
Psychological Capability	Knowledge	What do you understand by infection prevention control (IPC)?
		Do you know of any local/national/international guidelines about IPC?
		What do you understand by the term ‘Hospital acquired infections’?
	Memory, attention and decision processes	How easy/difficult is it to remember the steps involved in infection prevention control procedures in daily practice?
		What prompts you to perform a certain IPC task?
		How do you decide whether to perform a certain IPC procedure (e.g. equipment sterilization; isolation of a patient)
		How do you balance the risks/benefits of an invasive procedure e.g. cannulation/ventilation?
	Behavioural regulation	Do you receive feedback on your performance of infection prevention control procedures?
		Are there any incentives or sanctions for performing/not performing IPC tasks?
		Do you know how IPC in the neonatal unit compares with the rest of the hospital? Or with other hospitals?
Physical Capability	Skills	Do you have the skills/training you need to perform the IPC tasks that are part of your role?
		Can you think of any ways your own skills in performing tasks related to infection prevention control that could be improved?

Reflective Motivation	Beliefs about capabilities	Are there any aspects of infection prevention control you are more or less confident about performing?
		Do you have the skills necessary to perform your IPC tasks?
	Beliefs about consequences	To what extent do you believe infection prevention control can impact the outcome for babies on the neonatal unit?
		What do you understand by hospital acquired infections and their causes?
		To what extent do you believe infection prevention control techniques can prevent the spread of hospital acquired infections in the neonatal unit? Are there other factors which are more important? (e.g. overcrowding)
Goals		What do you think would happen if you didn't perform IPC related tasks (to you/patient/your family)?
		Do you think there are any practices in the unit that make the chance of hospital acquired infection worse?
	Goals	Do you have any IPC goals?
	Identity & Social-Professional Role	What are your professional roles and responsibilities at Harare Central Hospital?
		What are your daily routines?
Intentions		How long have you been working in this role, and in this in hospital specifically?
		To what extent do you think infection prevention control is part of your role?
		What tasks do you perform as part of your professional role that are involved in IPC?
		Who else is important in changing IPC practices?
		Do you sometimes find it difficult to perform IPC tasks (e.g. hand hygiene or environmental cleaning)? What gets in the way?
Motivation and Goals		Do you sometimes forget to perform IPC tasks despite intention?
		Do you have any specific goals for improved infection prevention control practices?
		Are there other things you have to do which are more important than IPC tasks?
		Do you know how IPC in the neonatal unit compares with the rest of the hospital? Or with other hospitals?
		Can you think of any ways of improving IPC within the neonatal unit?

	Optimism	<p>How hopeful are you that infection prevention control can be improved in the neonatal unit?</p> <p>Can you think of any ways of improving IPC within the neonatal unit?</p>
Automatic Motivation	Emotions	<p>Do you ever worry about performing IPC tasks? Or not performing them?</p> <p>Are there any factors about particular patients or families that would influence whether or not you perform IPC tasks?</p> <p>Do you sometimes forget to perform IPC tasks?</p>
	Reinforcement	<p>Are there any incentives or sanctions for performing/not performing IPC tasks?</p>
Physical Opportunity	Environmental context and resources	<p>Do you have the necessary resources to perform your IPC tasks?</p> <p>What is missing/needed?</p> <p>How does the physical layout of the ward help/hinder effective IPC practices? (e.g. availability and location of alcohol gel dispensers, access to equipment, proximity of cots, running water, incubators, sinks, functioning sluice)</p>
Social Opportunity	Social influences	<p>Do you think there is good understanding among your colleagues/seniors/other cadres about IPC? Or are there conflicting beliefs?</p> <p>Do you ever discuss IPC with colleagues in hospitals? (when/ how often/ with whom- formal or informal meetings)</p> <p>Are there any factors about particular patients or families that would influence whether or not you perform IPC tasks?</p> <p>To what extent do your colleagues influence your IPC practices (seniors, other cadres, peers)?</p>

Appendix C2 - Interview Topic Guide (Interview flow)

1. Work life and routines
 - a. Can you tell me about your roles and responsibilities at work in Harare Central Hospital?
 - i. Is there any part of your role that is focused on Infection prevention control?
 - b. What are your daily routines?
 - c. How long have you been working in this role, and in this in hospital specifically?
2. What do you understand by infection prevention and control (IPC)?
 - a. To what extent do you think infection prevention control is part of your role? Who else has an important role in IPC? (e.g. IPC team, microbiology)
 - b. Do you know of any local guidelines about IPC? Or national/international?
 - i. Probe on their familiarity with these, how applicable they feel they are to their role, how clear/evidence based etc
 - c. What do you understand by hospital acquired infections and their causes?
 - d. What tasks do you perform that are important in infection prevention control?
 - i. Hand hygiene is relevant for all. Depending on staff cadre- this could include e.g. **nurses**: sterilising equipment and cleaning unit, maintaining isolation for infectious babies, barrier nursing. **Doctors**: sterile procedures, identifying and ordering isolation of septic babies. **Admin**: organising guidelines and auditing their implementation, ensuring supply chains of equipment such as gloves and alcohol hand rub. **Microbiology/IPC**: handling infectious samples safely, feeding back results of blood cultures, notification and management of outbreaks, audit, education of other staff members.
 - e. Do you sometimes find it difficult to perform IPC tasks (e.g. hand hygiene or environmental cleaning)
 - i. What gets in the way of performing your IPC tasks?
 - ii. Are there other things you have to do which are more important?
 - iii. Do you sometimes forget to perform IPC tasks?
 - iv. Do you have the skills/training you need to perform IPC tasks?
 - f. Do you have the necessary resources to perform your IPC tasks
 - i. What is missing/needed?
 - ii. How does the physical layout of the ward help/hinder effective IPC practices? (e.g. availability and location of alcohol gel dispensers, access to equipment, proximity of cots, running water, incubators, sinks, functioning sluice, space)
 - g. What prompts you to perform a certain IPC task?
 - i. How do you decide whether to perform a certain IPC procedure (e.g. equipment sterilization, isolation of a patient)
 - h. Are there any skills within infection prevention control you are more or less confident about performing?
 - i. e.g. depending on cadre: hand hygiene, isolation, environmental and equipment decontamination, clean/sterile procedures, barrier nursing, identification of sepsis, microbiological procedures for outbreak investigation)
 - i. Do you ever worry about performing IPC tasks? Or not performing them?

- i. What do you think would happen if you didn't perform them?
 - 1. Probe what would happen to patient/to you/to your family?
- j. Do you think there are any practices in the unit that make the chance of hospital acquired infection higher? How do you balance the risks/benefits?
 - i. E.g. ventilation→ ventilation acquired pneumonia, cannulation→ line infections
- k. Do you receive feedback on your performance of IPC tasks?
 - i. From peers? Seniors? Parents?
 - ii. Do you know how the hospital acquired infection rate in the neonatal unit compares with the rest of the hospital? Or with other hospitals?
 - iii. Do you ever discuss IPC with colleagues in hospitals? (when/ how often/ with whom- formal or informal meetings)
- l. Can you think of any ways of improving IPC within the neonatal unit?
- m. How hopeful are you that IPC within the neonatal unit can be improved?
- n. Do you think there is good understanding among your colleagues/seniors/other cadres about IPC? Or are there conflicting beliefs?
- o. Are there any factors about particular patients or families that would influence whether or not you perform IPC tasks?
- p. To what extent do your colleagues influence your IPC practices (seniors, other cadres, peers)?
- q. Are there any incentives or sanctions for performing/not performing IPC tasks?
- r. Do you have any specific goals for improved infection prevention control practices? Both personally and for the hospital/department?

Appendix D – Ethnographic observations (theme summary)

Note: Below is a summary of emerging topics from the ethnographic observations conducted by Dr Francesca Rickli. These summaries, together with the original observations, were coded to the same codebook developed for the interview data to identify areas of overlap (converging themes), and new emerging themes (these are highlighted in grey below). The codebook was based on COM-B domains, but was extended by the Theoretical Domains Framework to support data analysis.

Observed areas of concern:

Descriptions of different circumstances and practices concerning infection prevention and control.

Procedures: (Doctors, nurses)

Writing of nursing care plan and taking of notes (baby cots as desks), procedure bench, feeding babies, changing babies, transfer of babies from room to room, admitting babies, discharging babies, taking vital signs, ward rounds, etc.

Cleaning: (Nurse aides, cleaners, nurses)

Damp dusting, cleaning of floors, cleaning of linen in sluice room, changing of linen both in babies' cots and on procedure bench, cups for breast milk, baby cots, etc.

Waste management: (all actors involved)

trash on the ground, waste on procedure bench, sharp objects, etc.

<u>Theme</u>	Theme description and further details	<u>TDF domain</u>	<u>COM-B domain</u>
Limitation of Resources	The limitation of resources is one of the most pressing topics being raised by the different actors. The main issue for IPC is the unreliable water supply as well as the shortage of disinfectant.	Environmental Context and Resources	Physical Opportunity
	Material which is supposed to be used once, but which is used for several months (e.g. oxygen tubes).	Environmental Context and Resources Behaviour Regulation	Physical Opportunity Psychological capability
	A further issue is the shortage of staff.	Social Influence	Social Opportunity
Material surroundings & physical setup:	When studying the layout of the NNU it becomes clear that it was planned with IPC in mind, e.g. entrance doors which swing open, two sinks before entering the wards etc. However, due to space constraints, the cots often are placed too close together, e.g. between 10cm and 20 cm apart from each other in Observatory. Although there are rules where the sicker, infected or smaller babies are supposed to lie (e.g. in Transit A, where the premature babies are placed in the middle, because that's where it is warmest), there is little space to isolate infectious babies (e.g. in Observatory, where an infected baby's cot is placed under the phototherapy contraption, 50cm away from the next baby).	Environmental Context and Resources	Physical Opportunity
	Due to special constraints, tasks are performed in different locations, e.g. the babies' cots are often used as "desks", the nursing care plans are written there, or staplers are placed on top	Environmental Context and Resources	Physical Opportunity

	of babies blankets etc. [new theme: Using babies' cots as temporary desks or placeholders during routine procedures]		
Improvisation	<p>Due to limited resources, the different actors are forced to improvise and find solutions with the material, staff or time at hand. This strategy often leads to deviations from the ideal hygienic behaviour.</p> <ul style="list-style-type: none"> Using paper to clean hands Using only water instead of disinfectant plus water, using only disinfectant instead of water and disinfectant, using cold water instead of hot water etc. 	Behaviour Regulation	Psychological Capability
Disgust	<p>When considering the use of gloves especially by the nurses, it becomes clear that different bodily fluids trigger different emotional reactions. Mother's vomit, faeces and blood are always met with gloves, this behaviour points to the disgust associated with these different bodily fluids. However, the babies' vomit and mother's milk are often touched without gloves, e.g. babies are fed by the midwives without gloves on. Doctors often carry babies from their cots to the procedure bench without wearing gloves. The midwives soothe babies by carrying them around without gloves, pressed towards their uniforms. This indicates that behaviour around the babies which is associated with (maternal) care, i.e. feeding, carrying, soothing is not connected with disgust and therefore leads to less careful hygiene behaviour.</p>	<p>Social Influence</p> <p>Memory, Attention and Decision Making</p>	<p>Social Opportunity</p> <p>Psychological Capability</p>
Hierarchy	<p>The NNU is a place characterised by a strong hierarchical structure. This is evident not only in the clothing and uniforms worn by doctors, nurses, mothers, nurses and cleaners, but also in various status symbols. For example, the doctors always wear their stethoscope around their necks, the nurses wear their epaulettes with pride and it is no coincidence that it is reserved for doctors to come to work with street clothes.</p>	Social Influence	Social Opportunity
	Hierarchical interactions (i.e. top down) result in the interruption of routines, e.g. damp dusting	Social Influence	Social Opportunity
	Mothers at the lower end of pecking order, e.g. Nurse to mothers: "If you don't breastfeed, your husband will leave you". Mothers are rarely seen to speak up to nurses or to enforce IPC positive behaviour towards their babies	Social Influence	Social Opportunity
Routine	<p>Hygiene works well when a routine can be kept up. However, different material and social constraints lead to ruptures in these routines, which has consequences for the up-keep of hygiene. In interviews as well as informal conversations the lack of water and disinfectant was always mentioned as the most significant constraint to the upkeep of proper hygiene. However, as ethnographic observation has revealed, even on days where both are available the different actors often don't wash their hands or don't use disinfectant.</p>	<p>Environmental Context and Resources</p> <p>Social Influence</p>	<p>Physical Opportunity</p> <p>Social Opportunity</p>
Death	<p>Depending on where a baby dies (not the case in NICU) it is often not removed immediately from its place of death, i.e. remains in the cot or on the resuscitator where it has died for a while, e.g. dead baby next to premature arrival. Until the mother can be told and all the documents are cleared, the baby cannot be moved to the sluice room, therefore, deceased babies are sometimes kept on the wards for more than 12 hours. Make transition from clean to dirty.</p>	Environmental Context and Resources	Physical Opportunity

Mobile phones	Mobile phones are ever-present. Mothers, nurses and doctors often take them out of pockets and bags, they are plugged into the sockets everywhere around the wards. Mobile phones, though known hearths of bacteria, are necessary tools in the assessment of patients, calculation of numbers and communication between staff. It seems, however, that there is little awareness of their impact on IPC.	Environmental Context and Resources Social Influence Knowledge	Physical Opportunity Social Opportunity Psychological Capability
Economic hardship	The staff at the NNU is affected by the struggling Zimbabwean economy. This has led to strikes by different unions at the beginning of the year. As a consequence, the nurses are now working fewer days, but longer hours, in order to avoid the high transport cost. Understaffing is a barrier to IPC, because certain procedures, e.g. damp dusting cannot be performed as many times as prescribed. The chronic understaffing during the night shift especially, leads to exhaustion on the part of doctors and nurses, tiredness which results in less attention and care to IPC. Although nurses are supposed to rest during the night shifts, they are not provided with a space to do so, and are forced to find alternative solutions.	Environmental Context and Resources Social Influence	Physical Opportunity Social Opportunity

Appendix E – Thematic coding framework, theme description and illustrative quotes

Table E1: The COM-B informed thematic coding framework, theme description and illustrative quotes. Themes marked with ‘**’ have been corroborated by the ethnographic observations, and those marked with ‘***’ emerged only during the ethnographic observations. (MN=Midwives/Nurses; DR=Physicians, CL=Cleaners)

COM-B Domain	TDF Domain	Higher level theme (<i>n</i> signifies the number of interviewees contributing data)	Barrier/ Enabler/ Mixed	Lower level sub-themes Theme [<i>in brackets are references to other TDF domains where strong links emerged</i>]	N (out of 15)	Barrier/ Enabler/ Mixed	Sample quotes (CL=cleaner, MN=midwife/nurse, PH=physician) or descriptions from the ethnographic observation
Capability-Psychological	Knowledge (15)	Staff have mixed knowledge about IPC practices and available guidelines on IPC (N=15)	Mixed	Staff are (not) aware of different guidelines and protocols for IPC	15	Mixed	“Which guidelines are you using on this hospital to do infection prevention control, is it national guidelines? R: There are some that we are using; I am not sure whether they are hospital or national guidelines.” (MN5) “And the local ones, you know that they are there but are you familiar with what is contained in there? R: Not what is contained there exactly, but I am just generalising, I have never set eyes on the documents but I assume what I think is there should be there is there, but I have never seen them.” (MN3)
				Staff does (not) have sufficient knowledge of what IPC is and its importance (<i>incorporates now Some staff in the unit may have insufficient understanding of IPC</i>)	15	Mixed	“What do you understand by infection prevention and control? R: These are processes and scientific methods that are set in place to prevent harm to patients, and the care givers and the staff from infection.” (PH16) “What causes these hospital acquired infections? I am not aware of the hospital acquired infections” (CL13)
				Staff know how and when to perform different IPC practices	13	Enabler	“I make sure that I wash my hands using soap and aseptic solutions, I make sure that before I do a procedure I use antiseptic soaps such

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							<p>as alcohol, then I make sure that I use sterile packs and also aaah that's it, and also wear protective clothing if they are available." (MN12)</p> <p>"In between handling our babies or in between each procedure we have to wash our hands or to sanitise to prevent infection, if there are any spillages on the floor, you have to disinfect that area before you clean" (MN5)</p>
		Staff are aware about the poor adherence to IPC standards in the unit, but not about the infection rates (n=15*)	Mixed	Staff are aware about the poor adherence to IPC standards in the unit	15*	Enabler	I think in terms of national guidelines there were very applicable the World Health organisation standards are a little bit high for us we are still very behind (PH16)
				Staff are (not) aware of the rates of infections in the unit	7	Mixed	<p>I: Do you know how the rate of Hospital acquired in the neonatal or labour wards compares with the rest of the hospital? R: Yes, for example here in NNU recently it has been documented that about 80% of our babies have sepsis whereas those who come from outside about 60% that's appalling, that's quite a huge number (MN17)</p> <p>Do you know how the hospital acquired infections in the neonatal unit compares with the rest of the hospital? No, I don't (MN6)</p>
	Behavioural Regulation (15)	There are very limited opportunities for all staff to discuss infection cases, or to share feedback on IPC practices and outcomes (n=15)	Mixed	There is limited formal and recurrent feedback and it tends to be negative	15	Barrier	<p>"The only feedback that you get is when you see a patient who has pelvic abscess or puerperal sepsis then you realise someone blundered somewhere or we blundered." (PH14)</p> <p>"Ok, do you receive feedback on your performance of your IPC task, do someone maybe from your peers your seniors or family, do you receive feedback? R: Not that I know of, except the feedback got from this research where they call the labs, that the feedback that I got for infection control" (MN2)</p>

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				There are (no) formal meetings about IPC aimed at addressing the challenges	15	Mixed	<p>"Yes, we do discuss, usually before we do duty allocation, we have meetings and discuss and remind each other to always do IPC tasks, and we have a ward meeting every Wednesday." (MN5)</p> <p>"So it's informally said. And when you set an alarming level, people then pick one or two cases and we do a clinical meeting or an audit on this thing just to sensitize each other that maybe there is something that we are doing wrong" (PH14)</p> <p>"We never find time to discuss about IPC [...] I think that they should invite us once or even once a month to a meeting of cleaners like what the Doctor's do every Wednesday (CL13)"</p>
				There is insufficient communication in the unit about infections and best IPC practice	5	Barrier	no one explains to you that no this is mess from a cholera patient and should be handled in this manner, or even to tell you that this mess is from a deadly infection or that the ward you are about to enter has a baby suffering from this type of infection and if you are susceptible to that infection do not go inside, we do not get that information (CL13)
		There are sometimes inadequate IPC protocols for the unit, especially for times when IPC resources are limited, and they are poorly implemented (n=9)	Barrier	There are sometimes inadequate IPC protocols for the unit and they are poorly implemented	9	Barrier	<p>"We need an IPC protocol, when we have an IPC protocol for the neonatal clinic, one that applies at least with resources that we have."(PH16)</p> <p>"As a unit we have policies, on even how to perform procedures, how you nurse different types of babies , we have SOPs, those SOPs will guide the nurses on how to nurse that client and what measures to be taken pertaining to that baby that is being nursed, we also have the immunity policy." (NM2)</p>

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		Staff tends to improvise when faced with shortage of resources, although some give up on IPC procedures altogether (n=14*)	Mixed	Staff (do not) improvise when faced with shortage of resources, but gives up on IPC** (n=14) [MADP] //When faced by supply shortage some staff improvises or perform only the minimum of IPC procedures, while others abandon them altogether (n=9)	14**	Mixed	<p>"We have challenges when we are catheterizing the patients, sometimes there are no catheters and even the urine bag. So you end up connecting a urinary catheter and at the end of the catheter you put a glove to improvise, so a lot of improvising has to be done" (PH14)</p> <p>"If things are available I do but if they are not there is nothing I can do". (PH7)</p>
	Memory, Attention, and Decision, Making (15)	Remembering about IPC procedures is often challenging and staff sometimes rely on being reminded by others or on explicit information or visual cues suggesting presence of infections (n=14+)	Mixed	Remembering about IPC practices is sometimes challenging	14	Mixed	"Personally, I do not forget, maybe it is because I am a theatre nurse, theatre nurses are a bit critic and also when I go around the ward. (MN15)"
				Reminders help not to forget about IPC [SI]	10	Enabler	At times we tend to forget that because we tend to think that you pick the bugs in here and forget about bringing them in so sometimes we do forget and if somebody does not remind you then you forget (PH16)
				More stringent IPC procedures are (not) applied predominantly to patients with known infections, or applied incorrectly e.g. concern that a sexually transmitted infection could be transmitted by touch	8	Mixed	<p>"there are cases, it's not all the babies who are infected so there will not be need to use gloves all the time as long as my hands are clean, but they are some who are infected e.g. who are syphilis positive I will need to use gloves so that I do not get infected. (MN4)</p> <p>I have learnt that IPC is for everyone, for every patient, because I have learnt that I am not only protecting myself but I am protecting them as well, and conditions are deceiving, the healthiest baby will infect you with something, that's multi drug resistant and the one who look sick will probably not, so we need to practice IPC on every child. (PH16)</p>

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		Emergencies and other tasks may take priority over IPC practices (n=9*)	Mixed	Emergencies and other tasks may take priority over IPC practices	9*	Mixed	<p>“IPC is more important than everything else that you have to do, so far I have had emergencies but I have never met an emergency in which I had to neglect Infection prevention control practices (PH16)”</p> <p>“We do caesarean sections so infection control is of utmost important but there are challenges here and there for example you have finished operating on a patient and then you here that in the ward there is a patient who has collapsed and you just rush in to the labour ward, you do not have time to change your attire (PH14).”</p>
		Both good and bad IPC practices can become a habit (n=7)	Mixed	Both good and bad IPC practices can become a habit	7	Mixed	<p>“Is there anything that reminds you to do that? R: it’s now in me to either wash hands or sanitize” (MN4)</p> <p>“When there is no water and there is no alcohol, you are stuck, resources limit and then it becomes a bad habit and then that habit becomes a lifestyle, I think that’s what drives the lifestyle” (PH16)</p>
Capability-Physical	Skills (15)	Staff recognise the importance of training and some receive training at some point in their career, but it is not sufficient at the unit (n=15)	Mixed	Staff receive some training on IPC but not enough in the unit	13	Mixed	<p>“I: Do you have the skills/training you need to perform IPC tasks? No I wasn’t trained on IPC but we just learnt it in general nursing.” (MN6)</p> <p>“I have been trained in these workshops on IPC, we were being taught on how to wash our hands, how to open packs and we were also being sensitised also maybe when giving injections, what is expected of you...” (MN15)</p>
				There is insufficient training	13	Enabler	<p>“There is need for the nurses to go for infection control workshops, even the ISO certification training is very important, people will be knowledgeable from the cleaner to the highest level about infection control measures.” (MN2)</p>

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							<p>“who then tend to say I do hand washing but when you ask them to demonstrate they will not be knowing how to do it” (MN15)</p> <p>“I wish these workshops can be attended by even our cleaners, so they know how and where to use a certain mop. Maybe use one mop in the kitchen and a different one in the ward.” (MN4)</p>
				Training is not enough if resources are not there	3	Barrier	<p>“I think we have trained about 450 nurses last year, I was part of the trainers but still now the challenges come on implementation because the resources were never availed so training we just train people but resources are not there” (MN8)</p>
Motivation – reflective	Social and Professional Role and Identity (15)	IPC requires teamwork and is seen as a responsibility of all staff, patients and their relatives (n=15)	Enabler	IPC requires teamwork and is a responsibility of all staff, patients and their relatives	15	Enabler	<p>“I also think the lab plays an important role as they advise us on what we are growing in the unit, also the pharmacy in terms of the antibiotics stewardship because the growth of resistant organisms depends on what and we are using our antibiotics so I think all of those people needs to involved in IPC, and even the cleaners are also involved in infection control” (PH3)</p> <p>“I think everybody: family, parent, patient IPC measures should be employed to everybody, not selectively, what we should do is to explain every procedure we are to do on the mother or baby to the family members without discrimination.” (MN17)</p>
		Staff tend to have well-defined roles for IPC (n=15)	Enabler	Different staff members have specific roles and responsibilities for IPC	15	Enabler	<p>“So in all that is there part of your role that is focused on infection prevention control? R: Yes there is, I also make sure that when we enter in each ward I have to inform the staff that they have to take Infection prevention control.” (MN5)</p>
				Staff see IPC as an important or integral part of their role, even if it is not specified in their duties	13	Enabler	<p>“Is there part of your role that is specifically focused on infection prevention control? R: Not necessarily that it is defined, that this is where I come in as infection but I think it just</p>

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							comes in as we are conscious of the fact that we are working with mothers and we deliver babies (PH14)."
	Beliefs about capabilities	Staff are confident in IPC tasks that are part of their role or they received training on (n=11)	Enabler	Staff are confident in IPC tasks that are part of their role or they received training on	11	Enabler	"Do you have the skills and training you need to perform IPC tasks? Were you trained? Have you ever attended workshops on IPC? R: I do have the skills, that's why I can say and repeat confidently that I can impart this knowledge to others" (MN17).
				Confidence in managing outbreaks due to recent experience, e.g. isolation (n=4).	4	Enabler	"Isolation of patients, I am confident to do isolation of persons and I even correct people on how they are supposed to do it" (MN15)
		Availability of IPC resources impacts on the confidence to perform IPC (N=15*)	Barrier	Availability of IPC resources impacts on the confidence to perform IPC*	15*	Barrier	"Do you at times find it difficult to perform infection prevention control tasks in this unit, like hand hygiene, environmental cleaning? R: It is not difficult when we have our running water and soap, but at times we don't have running water" (MN4)
	Beliefs about consequences (15)	Staff believes that poor IPC practices endangers their patients, themselves, and their families outside the hospital (n=15)	Enabler	Poor IPC is closely linked with morbidity and mortality among patients	15	Enabler	"I: What do you think would happen if didn't perform IPC tasks? R: A lot. There will be a breakout of diseases. It will not be nice. A lot of times we have patients of pelvic abscess, post-partum, and post-abortion sepsis. Then you also start having neonatal sepsis. Mortality is high" (PH14)
				Poor IPC in the hospital can impact on staff's and their families' health	13	Enabler	"What else do you think will happen either to you, or your patients or your family if you did not perform these IPC tasks? R: We will all get infected, for example I might carry the bug from here to the baby and the mother might come and hold the baby and get infected and the father might come as well" (MN4)
				Sharing the limited resources increases infection risk	6	Enabler	"Most of the time they were not available, when they were available we will be sharing one per ward, a ward has about 8 to 10 healthcare workers at any given time, and that it will not be fixed and at one point if I decide to put on a trolley and walk with it, I will just walk with it and people will be not

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							knowing and people will be like where is the alcohol, you get it, so it's not there, if it's there it's not enough, if there it's not fixed..." (PH16)
	Intentions	Staff have intentions to prevent morbidity and mortality, as well as to protect themselves (n=15)	Enablers	Staff do their best to perform IPC practices	14	Enabler	"We are saying we want to reduce mortality and morbidity, by practicing infection prevention control" (MN10)
				Staff have intentions to prevent morbidity and mortality	4	Enabler	"It is an important issue because as nurses we want to prevent morbidity and mortality, infection is the one that cause mortality and morbidity so we are saying we need to minimise as much as possible, to improve lives" (MN10)
				Staff want to protect themselves	3	Enabler	"For me now it's the idea of wanting to protect myself and also through my audit I leant that it is a very important thing" (PH16)
	Goals (n=15)	Staff try to prioritise good IPC practices and aim to decrease deaths from poor IPC (n=15)	Enablers	IPC is important and a priority	15	Enabler	"Infection prevention is first then everything else follows." (MN4)
				Decrease unit IPC related rates	5	Enabler	"We are saying we want to save lives, we want to reduce morbidity and mortality as well, we need to prevent infection as much as possible". (MN10) "I think the main objective is to see the rate of infection come down in the unit..." (PH3)
				Goal to adhere to protocols	3	Enabler	The nurses and the staff have to adhere to those polices so that we will not go amiss (MN2)
	Optimism (n=14)	Staff are moderately optimistic that IPC can improve in the unit, but they often make it contingent on IPC-related resources (n=14)	Mixed	I am (not) hopeful IPC can be improved, especially with more staff involvement and resources	12	Mixed	"I think I am hopeful, if those things are improved for example if we have water, if we have clothes for parents and in between bed spacing, if the all staff practice Infection prevention control we reduce, the culture bottles if they are available, any infection is early dictated and treated and if the antibiotic is available the babies get well as soon as possible they can be discharged before acquiring other hospital acquired infection..." (MN5)

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				I am very hopeful or optimistic because some things are already improving	3	Enabler	"I have high hope since we have this issue of renovation of the unit, if the unit is renovated, we have unit renovated and we have equipment and the walls are redone and we have all the windows closed continuously like in the passage on the other side, there is no dust that is going to get into the wards and we have just one controlled entry point getting into the wards." (MN2)
Motivation-automatic (15)	Reinforcement (15)	Except for verbal criticism or occasional social recognition, there are no incentives for good IPC practices (n=15)	Mixed	There are no incentives for doing a good job	14	Barrier	"Are there any incentives or sanctions if you don't perform your IPC tasks? R: No you don't receive anything." (MN9)
				There can be criticism and negative comments for poor IPC, but no other sanctions	12	Mixed	"I will be afraid of my superiors in the sense that when they see that the ward is not cleaned and they might end up saying unpleasant words towards me" (CL13)
				Performing proper IPC is psychologically rewarding	4	Enabler	"I would say that there are incentives for that in that one feels good that one has done what they are supposed to do like if I do good to a patient I feel good and I know that God is happy that I have done what I am supposed to do..." (MN17)
				There can be verbal or social recognition for doing a good job	3	Enabler	"No there are no incentives for those who perform them but just to say well done to that individual because what I do sometimes is when I see someone perform those IPC tasks I then tend to say thank you, you did it very well" (MN115)
	Emotions (14)	Staff are worried about the consequences of poor IPC practices, and some feel good when adhering to IPC guidelines (n-14)	Enabler	I worry about possible consequences of poor IPC	14	Enabler	"I am worried about myself, members of the staff, my colleagues, the relatives, my family as, because I can take infection here and go home with it" (MN10)
				Proper IPC makes me feel good	4	Enabler	"At least I try to make sure that if anything is to go wrong, my conscience is clear because that way I believe I am better psychologically..." (PH14)
Opportunity-Social (15)	Social influence (15)	The unit is highly hierarchical which makes	Barrier	Staff regularly discusses IPC and IPC outcomes during informal meetings	15	Barrier	"I think if we do formal meetings it will help, rather than general talking" (MN12)

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		bottom-up communication difficult and marginalises mothers and cleaners (n=15*)		with peers (n=15)			
				Voicing views on IPC by lower cadre/junior staff could be negatively received by others	2	Barrier	"Amongst ourselves we do not discuss about IPC because if you do the others will look at and say this one is behaving as if she is our boss, so when you come from home you just do what you are supposed to do and not discuss with anyone as that might lead to clashes" (CL13)
				Strong hierarchical structures in the unit that supports primarily top-down communication	**	Barrier	Mothers at the lower end of pecking order, e.g. Nurse to mothers: "If you don't breastfeed, your husband will leave you". Mothers are rarely seen to speak up to nurses or to enforce IPC positive behaviour towards their babies (observations)
		Staff remind each other to perform IPC activities	Enabler	Staff remind each other to perform IPC activities	12	Enabler	"No there is no sanction for that, but like I said before, if I notice that someone did not do a certain task we just remind, may you please do these to prevent infection" (MN5)
		Staff can be important role models for each other but not everyone adheres to guidelines	Mixed	Often staff are seen to [not] adhere to some IPC practices and guidelines (e.g. no barrier nursing in the unit, poor hand hygiene)*	14	Mixed	"I: Do you isolation of infectious babies? R: Previously we used to because we had a ward which we used as an isolation, right now we do not isolate I: Do you do barrier nursing? R: Barrier nursing if there is, we used to, when we had that isolation unit, these days we do not do barrier nursing." (MN5) "What happens in barrier nursing? R: Barrier nursing, yes we are saying we as members of the staff we are having a patient with, unfortunately here we do not usually nurse infectious conditions" (MN10)
				Some staff are (not) good role models	6	Mixed	"Our senior cadres if they are around, they will never let you do something that compromises or increase the risk of infection to patients" (MN14) "We try to encourage the doctors to be as sterile as possible but at times they have challenges in the sense that there is a large number of patients and we are short staffed because ideally when a doctor is doing a

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							procedure he should have a nurse assisting him, so when the doctor is alone and there is no nurse because of staff, the Doctor has to run around looking for things so at the end they end up doing shortcuts" (PH3)
		Large and uncontrolled visit traffic, as well as some behaviours of patients' relatives pose risks to IPC	Barrier	Behaviour and visits of relatives and parents of patients in the unit pose risks to IPC	4	Barrier	"Yes, some will come to the wards requesting to do rituals for their babies while they are in the wards, like applying snuff, holy water we don't know how clean is the water and how safe it is so it will be dilemma for us as individuals, but normally we don't allow those so we seek clarity from our superiors before we let it happen" (MN2)
				Large volumes of visitors hinder IPC (5)*	5	Barrier	R: There is a lot, in terms of patients' visiting. Visiting hours, I think we need to limit the number of visitors especially in the early labour ward because you can see five relatives crowding on one patient (PH14)
				Need for a controlled access to the unit to limit traffic and infections (3)	3	Barrier	"we have just one controlled entry point getting into the wards. I think they are going to be 2, from the initial one as we come in there is a door and as we go again into the there is going to be another door. So I am just hoping that it will work out (MN2)
				Staff handle different objects, including personal items (e.g. bottles used for sanitising, stethoscopes, phones and tables), in between procedures and sometimes with no hand hygiene** [SI]	**		Ethnographic diaries included numerous descriptions of staff grabbing and carrying objects in between handling patients.
				Mobile phones are ever-present and are constantly used by staff and patients' relatives**	**		Mobile phones are ever-present. Mothers, nurses and doctors often take them out of pockets and bags, they are plugged into the sockets everywhere around the wards. Mobile phones, though known hearths of bacteria, are necessary tools in the assessment of patients, calculation of numbers and communication between staff. It seems, however, that there is little awareness of their impact on IPC. (observations)

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		Patients' carers (e.g. mothers) play a very limited role in IPC and engage in risky behaviours when at the unit (n=8**)	Mixed / Barrier?	Some staff offer education to mothers that covers some aspects of IPC *	8	Enabler	"We practise hand hygiene, we do damp dusting, we change the baby's linen, and we educate the mothers on the importance of hand washing and the importance of diaper changing." (MN6)
				Mothers are at the lower levels of social hierarchy and have limited communication with staff	**	Barrier	Mothers at the lower end of pecking order; Mothers are rarely seen to speak up to nurses or to enforce IPC positive behaviour towards their babies. (observations)
				The feeding time of neonates can be a source of infections due to few IPC provisions (e.g. very limited hand hygiene among mothers; mothers handle different objects without hand washing, such as benches)**	**	Barrier	Mothers are rarely seen to speak up to nurses or to enforce IPC positive behaviour towards their babies (observations)
		IPC practices are applied equally to all patients regardless their background, but staff engage in less stringent IPC practices when handling babies (9*)	Mixed	IPC practices are applied equally to all patients regardless their background [MADP]	9	Enabler	"No, when you are dealing with patients we assume that everyone should be treated fairly, equally we do just merely look and say this one no, maybe the one you are looking at is infectious and you say she doesn't have infection and the one you think is safe is the one with infection, so we just try to take them at the same level." (MN9) "Are there any factors that you look at a particular patient and say aah for this one I cannot wash my hands, that one looks clean? R: No K: There are none? R: because we cannot see microbes with our eyes, we cannot see." (MN10)
				Staff cuddle neonatal patients with no barrier nursing that could lead to infection transmission	**	Barrier	"Doctors often carry babies from their cots to the procedure bench without wearing gloves. The midwives soothe babies by carrying them around without gloves, pressed towards their uniforms. This indicates that behaviour around the babies which is associated with (maternal) care, i.e. feeding, carrying, soothing is not connected with disgust and therefore leads to less careful hygiene behaviour." (observations)

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				Bodily fluids of neonatal patients are treated as less dangerous than those of adults*	*	Barrier	different emotional reactions. Mother's vomit, faeces and blood are always met with gloves, this behaviour points to the disgust associated with these different bodily fluids. However, the babies' vomit and mother's milk are often touched without gloves, e.g. babies are fed by the midwives without gloves on. (observations)
Opportunity-Physical (15)	Environmental Context and Resources (15)	Severe shortage of resources that are key for IPC	Barrier	Unreliable availability of resources directly relevant for IPC (e.g. water, sanitisers, protective equipment and uniforms)*	15	Barrier	"Do you ever think of what will happen to the patients/to you or your family is these IPC tasks are not performed?" "Yes, we know exactly what happens but sometimes like I said earlier on the situation is at time beyond our control for example, if there is no water and I want to wash my hands what do I use, what do I do, I am forced to go home like that or go to the next patient without washing my hands because there is no water.." (MN8)
				Shortage of other hospital resources indirectly related to IPC impact on IPC (e.g. recycled tubes, lack of cannulation tubes)*	10	Barrier	"at times you wouldn't have strapping so you would whatever you could to keep the cannula in place, you are using bandaging, dirty things that could fester infection" (PH16)
		Although the unit was designed with IPC in mind, the infrastructure has aged, and there are insufficient facilities to adhere to different IPC guidelines (n=15**)	Barrier	Limited space leads to overcrowding and hinders patient isolation*	15	Barrier	"The cubicles themselves are not well categorised or bundling babies into one cubicle and that can be a source of Hospital acquired infections." (MN17)
				Suboptimal facilities in the unit that impact on IPC (e.g. lack of facilities for staff, location and congestion of the sluice room)*	15	Barrier	"And even the basins that we use they are not ideal for hand washing, they are small and few and as you can see you have to hold the tap and ideally we need elbow taps for hand washing but we do not have those." (PH3)
				Babies' cots are used as temporary desks or placeholders during routine procedures**	**	Barrier	Due to special constraints, tasks are performed in different locations, e.g. the babies' cots are often used as "desks", the nursing care plans are written there, or staplers are placed on top of babies blankets etc. (observations)

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				The unit's IPC infrastructure has aged has aged**	**	Enabler	<p>When studying the layout of the NNU it becomes clear that it was planned with IPC in mind, e.g. entrance doors which swing open, two sinks before entering the wards etc. [ethnographic observations]</p> <p>"But if you see in the ICU unit we have broken windows, the windows are always open, so we get a lot of draught infection from outside, so our ventilation is definitely not ideal for a neonatal unit" (PH3)</p>
		Outbreaks in the unit can temporarily improve IPC resources and practices (e.g. of cholera)	Enabler	Outbreaks in the unit can temporarily improve IPC resources and practices (e.g. of cholera)	11	Enabler	"I:Do you have alcohol gel dispensers?" "We have only seen those now because of the cholera outbreak, all these other times we have not seen these..." (CL13)
		Staff shortages and high workload hinders IPC practices and outcomes (9)*		Staff shortages and high workload hinders IPC practices and outcomes (9)*	9	Barrier	"Yes, that is the major challenge, no water at times we have limited supply of soap, alcohol is out of stock and we have just few cleaners so they are overwhelmed and so cleaning is at times a challenge." (MN8)

Appendix F – Linking barriers in COM-B components with recommended intervention functions

Table F1: Linkage between identified barriers across COM-B components, elaborated on by the Theoretical Domains Framework (), and suggested intervention functions as suggested by the BCW (Michie et al, 2014).

COM-B Components	TDF Domains	Details of Barriers identified in phase 1	Recommended Intervention Functions
Psychological Capability	Knowledge	There were gaps in knowledge regarding what is IPC, its importance and impact in the unit. Participants were not aware of guidelines, standards and monitoring data.	Education
Psychological Capability	Memory, Attention & Decision Processes	IPC lost priority and was likely to being forgot when there were competing demands	Training, Enablement, Environmental Restructuring
Psychological Capability	Behavioural Regulation	Participants gave up on IPC practices. There was a need for unit formal processes, regular feedback and spaces to discuss IPC	Education, Training, Modelling, Enablement
Physical Capability	Skills	No recurrent training	Training
Reflective motivation	Beliefs about Capabilities	IPC practices were difficult to implement when resources were not available	Education, Persuasion Modelling. Enablement
Reflective Motivation	Intentions	Participants motivation decreased when facing challenging situations.	Education, Persuasion, Incentivisation, Coercion, Modelling
Physical Opportunity	Environmental Context and Resources	Shortage of supplies and staff, improper facilities and equipment, heavy workload and overcrowding.	Training, Restriction, Environmental Restructuring, Enablement
Social Opportunity	Social Influences	Poor communication and collaboration between the staff. High traffic and improper practices of relatives and patients. Deficient skills and knowledge of colleagues.	Restriction, Environmental Restructuring, Modelling, Enablement

Appendix G – linkage of intervention functions with BCTs and the appraisal of the intervention function according to APEASE criteria

Table G1: Possible behaviour change techniques that could be used to deliver the different intervention functions, together with example of activities promoted and their assessed in light of APEASE criteria (Michie et al, 2014)

Intervention Functions	Most Frequently Used BCTs According to the BCW Guide Michie et al. (2014)	Example of activities promoted by the intervention function	Does it meet the APEASE criteria?
Education	Information about health consequences, information about social and environmental consequences, feedback on behaviour, feedback on outcomes of the behaviour, self-monitoring of the behaviour, prompts and cues.	Increasing the knowledge and understanding about IPC and HAIs, guidelines and standards among staff and patients' families	Yes, it is practical and affordable if using onsite mentoring and supervision, as well as affordable printed and online materials.
Training.	Demonstration of Behaviour; Instruction on how to perform a behaviour; Feedback on the behaviour; Feedback on outcome(s) of behaviour; Self-monitoring of behaviour; Behavioural practice/rehearsal	Improving the IPC skills of staff members and patients' family members (e.g. training sessions on IPC practices relevant for the Unit for all new staff and visitors, for patient's carers (mothers) and other family members, as well as refresher sessions for senior staff)	Yes, especially if supported by video resources and supervised exercises in the unit.
Modelling	Demonstration of the behaviour.	providing an example for people to aspire to or imitate (e.g. discussions of successful strategies already implemented within the unit and other similar hospitals).	Yes, likely to be effective as staff is highly influenced by their colleagues and role models are important source of influence in this context.
Persuasion	Persuasion about capabilities; Credible source; Information about social and environmental Consequences; Information about health consequences; Feedback on behaviour; Feedback on outcome(s) of the behaviour	Using different communication channels to encourage and induce positive feeling around IPC practices and outcomes among staff, patients' relatives and visitors.	Yes, but as staff are already motivated to engage in IPC practices, the focus of persuasive activities should be on encouraging staff to continue perform IPC practices in the absence of key resources, as well as on involving patients' family members (particularly mothers) to engage in IPC while at the hospital

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Intervention Functions	Most Frequently Used BCTs According to the BCW Guide Michie et al. (2014) <i>IN progress</i>	Example of activities promoted by the intervention function	Does it meet the APEASE criteria?
Enablement	Social support (unspecified), social support (practical), problem solving, action planning, goal setting (behaviour), goal setting (outcome), review behaviours goal, review outcome goal, adding objects to the environment, self-monitoring of the behaviour.	increasing means and reducing barriers to increase capability and opportunity (e.g. support a safe space to discuss concerns within and between different staff members, co-design of coping plans to deal with competing demands, conduct audit, feedback and team building).	Yes, it could increase psychological capability and teamwork. Not expensive, sustainable and less time consuming.
Environmental Restructuring	Adding objects to the environment, restructuring the physical environment, prompts and cues.	changing the physical environment (e.g. the layout, the supply chain, and the objects or resources available to staff) to support or prompt IPC practices	Yes, it is a necessary condition considering behavioural diagnosis and empirical evidence. However, as it can be costly, potential changes are limited. In future, stakeholders might clarify the viability of this function.
Restriction	No BCTs identified as the most common	Using rules to reduce opportunities to engage with competing demands (e.g. control and regulate traffic and behaviours of patients and relatives).	Yes, there is a need to regulate the organisation and control within the ward. Likely to be acceptable as formalisation was positively valued by participants.
Incentivisation	Rewards; Incentives; Feedback on behaviour; Feedback on outcome(s) of behaviour; Monitoring of behaviour by others without evidence of feedback; Monitoring outcome of behaviour by others without evidence of feedback; Self-monitoring of behaviour	Create expectations of a reward for performing IPC practices or adherence to IPC guidelines or otherwise contributing to the support of IPC; Monitor and provide feedback with an appropriate reward.	Not affordable to implement extrinsic financial rewards and potentially have side effects as can undermine intrinsic motivation and the maintenance of the behaviour in future. Individuals can habituate to rewards quickly. However, non-financial and other social rewards and incentives may be sustainable in the context should be considered.
Coercion	Introduce financial or other punishment for poor IPC performance and non-adherence to IPC guideline,	Create expectations of punishment for not adhering to IPC guidelines (e.g. introduce a transparent system of incentives for perming IPC practices).	No, unlikely to be acceptable to staff

BARRIERS AND FACILITATORS TO INFECTION PREVENTION AND CONTROL IN A NEONATAL UNIT IN ZIMBABWE – A THEORY-DRIVEN QUALITATIVE STUDY TO INFORM DESIGN OF A BEHAVIOUR CHANGE INTERVENTION.

Author Declaration

I declare the following:

1. All named authors have seen and agreed to the submitted version of the paper; that all who are included in the acknowledgements section, or as providers of personal communications, have agreed to those inclusions; and that the material is original, unpublished and has not been submitted elsewhere
2. I declare I have no conflicts of interest.
3. This study was funded by the Healthcare Infection Society (reference SRG 2018 02 004).
4. I am supported through core support from the Medical Research Council UK to the MRC Clinical Trials Unit [MC_UU_12023/22] through a concordat with the Department for International Development and the UK National Institute of Health Research through a Senior Investigator award.
5. The study was approved by Harare Central Hospital Ethics Committee (HCHC 070618/58), the Biomedical Research and Training Institute in Harare (AP148/2018), Medical Research Council of Zimbabwe (MRCZ/A/2354), and UCL Research Ethics Committee (5019/004). Participants provided informed consent before the interviews commenced and prior to shadowing.
6. Authorship contributions were as follows:
 - a. Study concept and design: FF, FL, SM, SW, NK, GC, SC
 - b. Data collection: KS, FR
 - c. Data analysis: AH, JRP
 - d. Data interpretation: AH, FR, JPR, FF, FL, GC, SC
 - e. Preliminary draft: AH, JRP, FF
 - f. Final draft: all authors

I declare that the above is true and complete to the best of my knowledge.

Signed: 

Name: Ann Sarah Walker

Date: 20 June 2020