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An assessment of infection prevention and control implementation in Malawian hospitals using the WHO Infection Prevention and Control Assessment Framework (IPCAF) tool

Dorica Ng'ambi [a,b,*], Thomasena O'Byrne [a,b], Emmie Jingini [c,d], Hope Chadwala [d], Owen Musopole [c,d], Wala Kamchedzera [a,b], Tara Tancred [b], Nicholas Feasey [a,b,e]

[a] Malawi-Liverpool Wellcome Programme, Kamuzu University of Health Sciences, Blantyre, Malawi
[b] Department of Clinical Sciences, Liverpool School of Tropical Medicine, Liverpool, England, UK
[c] Quality Management Directorate - Ministry of Health, Lilongwe, Malawi
[d] Infection Prevention and Control Association of Malawi (IPCAM), Lilongwe, Malawi
[e] The School of Medicine, University of St Andrews, St Andrews, Scotland, UK

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SUMMARY

Background: Infection prevention and control (IPC) is important for the reduction of healthcare-associated infections (HAI). The World Health Organization (WHO) developed the IPC Assessment Framework (IPCAF) tool to assess the level of IPC implementation and to identify areas for improvement in healthcare facilities.

Methods: A cross -sectional survey was conducted using the WHO IPCAF tool from May to June 2023. The aim was to provide a baseline assessment of the IPC programme and activities within health care facilities in Malawi. Forty healthcare facilities were invited to participate. IPC teams were requested to complete the IPCAF and return the scores. The IPCAF tool scores were assessed as recommended in the WHO IPCAF tool.

Results: The response rate was 82.5%. The median IPCAF score was 445 out of 800 corresponding to an intermediate IPC implementation level. The results revealed that 66.7% facilities were at intermediate level, 26.4% at basic level, and 6.9% at advanced level. Most facilities (76%) had an IPC program in place with clear objectives and an IPC focal person. Few had a dedicated budget for IPC. The IPCAF domain "monitoring/audit of IPC practices and feedback" had the lowest median score of 15/100, and in 90% of facilities, no monitoring, audit, and feedback was done. HAI surveillance median score was 40/100, workload, staffing and bed occupancy median score was 45/100.

Conclusions: Whilst there has been some degree of implementation of WHO IPC guidelines in Malawi's healthcare system, there is significant room for improvement. The IPCAF tool revealed that monitoring/audit and feedback, HAI surveillance and workload, staffing and bed occupancy need to be strengthened. The IPCAF scoring system may need reconsidering given the centrality of these domains to IPC.

* Corresponding author. Address: Malawi-Liverpool Wellcome Programme, Kamuzu University of Health Sciences, Blantyre, Malawi.
E-mail address: dng'ambi@mlw.mw (D. Ng'ambi).

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Introduction

Healthcare-associated infections (HAIs) are infections that patients acquire while receiving care and treatment in healthcare facilities [1]. According to the World Health Organization (WHO), the burden of HAIs is estimated to be 7% in high-income countries and 5.7%—19.1% in low- and middle-income countries [2]. Affected patients tend to have longer hospital stay and are given antimicrobials that are less effective, thereby promoting antimicrobial resistance. HAIs are influenced by a complex combination of gaps in policies, infrastructure, organisation, and knowledge, as well as healthcare worker (HCW), patient, and caregiver behaviours and other factors [3].

Infection prevention and control (IPC) involves practical, evidence-based approaches to prevent infection transmission between healthcare workers, visitors, and patients within a healthcare facility [4]. IPC is a unique feature of patient safety and quality of care, universally relevant to every healthcare worker and patient, at every healthcare interaction. It requires constant action at all healthcare system levels, from policy-makers to facility managers, healthcare workers and those who access healthcare services. The WHO has identified eight core components (CC) of IPC that are essential to ensuring patient safety and improving the quality of care [5] and have developed a set of tools to implement these components (Table S1, Supplementary Materials).

The level of implementation of these Core Components can be assessed by a tool known as Infection Prevention and Control Assessment Framework (IPCAF). The IPCAF is a systematic tool that can provide a baseline assessment and the status of IPC within a healthcare facility [6].

Malawi is a low-income country in Sub-Saharan Africa. The Malawi Ministry of Health (MoH) developed IPC guidelines in 2020 [7] and these guidelines include the implementation of the WHO Core Components (CC) of IPC, with an emphasis on the use of the multimodal improvement strategy (Core component (CC)5). However, the implementation of IPC in Malawi has not yet been systematically described. Our objective was to describe the level of implementation of IPC practices across the country using the WHO IPCAF and to identify areas for improvement.

Methods

Study design

A cross-sectional survey was conducted using a self-administered WHO IPCAF tool from May 2023 to June 2023. The aim of this survey was to provide a baseline assessment of the IPC programme and activities within healthcare facilities in Malawi. The IPCAF tool is designed to assess the level of IPC implementation in healthcare facilities providing acute care patient services. In Malawi, the aim of the survey was to understand the status of IPC implementation in secondary and tertiary healthcare facilities as providers of acute healthcare services. This is the first time the IPCAF tool has been used in Malawi. The MoH informed heads of healthcare facilities of the survey and invited them to participate.

Study sites

Malawi has 56 hospitals of which 5 are tertiary and 51 are secondary healthcare facilities. Secondary and tertiary health care services are provided by the government, the Christian Health Association of Malawi (CHAM), or private providers. CHAM facilities receive funding external to the Malawi Ministry of Health (MoH). They have a service level agreement with government in areas where there are no government facilities. They operate under the authority of and adhere to the policies of MoH. In consultation with Quality Management Directorate (QMD) under MoH and Infection Prevention and Control Association of Malawi (IPCAM), we purposively sampled 40 out of 56 hospitals to participate in the IPCAF survey. This included all five tertiary hospitals and 35 secondary-level hospitals, including 24 government, 10 out 22 CHAM hospitals, and one out of 3 private hospitals. The invitation was based on the presence of either a full time or part time IPC link or IPC focal person.

Data collection

The Excel® (Microsoft Corporation) version of the WHO IPCAF tool (henceforth referred to as IPCAF) template was shared with the hospital IPC focal person(s) digitally. The hospital IPC focal persons were trained in the use of IPCAF virtually by 3 designated members of the research project team. The training was conducted in May before the survey began. A WhatsApp Messenger group (www.whatsapp.com) was created for the IPC focal persons, IPCAM executive members, QMD leadership and Malawi-Liverpool Wellcome Programme for the purpose of communication and support. The completion of the digital IPCAF tool in Excel® was led by the IPC focal person together with support from members of each facility's IPC committee (if in place). Reminders were periodically sent for the survey to be completed. Filled-in IPCAF Excel sheets were checked for completeness by 2 members of the research team. The incomplete ones were sent back, and the team was guided on how to complete them.

IPCAF tool

The IPCAF tool was developed by the WHO to assess the IPC status at the facility and identify areas for improvement. WHO recommends a self-administered tool, which facilitates IPC focal persons or senior management in objectively assessing the level of IPC implementation at their facility [6]. IPCAF has 81 indicators that are divided into eight sections according to the CCs of IPC, with an overall score of 800, 100 for each component. The tool had structured closed-ended questions with possible pre-set answers and scores. The scores for each component are summed up to make a final score, which is then used to give a facility score. The level of IPC implementation at

the facility is then determined using the IPCAF scoring interpretation in Table I.

Data analysis

Descriptive analysis of the data was done in Excel®. The IPCAF scores were summarised using the median and the interquartile range. Additionally, the mean IPCAF scores were also calculated.

Results

Thirty-three out of forty (83%) healthcare facilities completed the IPCAF assessment, including 4/5 central hospitals (80%) and 24/25 district hospitals (96%), 4/10 CHAM hospital (40%) and 1/1 private hospital (100%).

Levels of IPC implementation

Overall, the median IPCAF score was 445/800, which corresponds to an intermediate IPC implementation level. Using the total IPCAF scores, 22/33 (66.7%) facilities had an intermediate-level score (401—600), 9/33 facilities (26.4%) had a basic-level score (201—400) and two of the 33 facilities had an advanced-level score (601—800) as shown in Figure 1. The median scores according to facility type are shown in Figure 2. The private hospital had a higher IPCAF score of 605 followed by the CHAM hospitals with a median score of 513.75/800.

Evaluation of IPC by Core Component (CC)

The Core Component (CC) score distribution (Table II and Figure 3) revealed the highest median scores were 87.5/100 for IPC guidelines (CC 2) and 72.5/100 for the IPC programme (CC 1). However, the lowest median score of 15/100 (range 0—22.5) was for monitoring, audit of IPC practices, and feedback (CC 6). The other low median scores were for HAI surveillance (CC 4) 40/100. The summary of the CC and the IPCAF tool and scores against the indicators from the facilities are in Tables S1 and S2, respectively (Supplementary Data).

Core Component 1. IPC program

The IPC program (CC 1) had an overall median score of 72.5/100. Twenty-five (76%) facilities reported having a program in place with clear objectives, with 29/33 (88%) having an IPC team with IPC professionals. The IPC focal person was available in 20/33 (61%) of the facilities for more than 250 beds. Only 8/33 (24%) of the facilities had no dedicated IPC focal person. IPC committees, which included nurses and doctors, were present in 30/33 (91%) of the facilities, and 29/33 (88%) of these IPC committees included a senior staff member. However, 22/33 (67%) of the facilities had no allocated budget for the IPC program. Twenty-three (70%) reported having a reliable microbiology laboratory, however only 7/33 (21%) had reliable delivery of microbiology results.

Core Component 2. IPC guidelines

The overall median score for CC 2 was 87.5/100. Thirty (90%) of the facilities had IPC guidelines, of which 32/33 (97%) facilities were consistent with the national guidelines and indicated that implementation was adapted to local needs. In total 23/33 (70%) of the facilities had guidelines specific for prevention of device-associated infections and 29/33 (88%) of facilities reported training healthcare workers on the new guidelines and indicated that they monitor the implementation of guidelines regularly.

Core Component 3. IPC training and education

The overall median score for CC 3 was 65/100. It was reported in 31/33 (94%) of the facilities that they had personnel with expertise leading IPC training. Training was offered to new HCW employees in 17/33 (52%) of the facilities and for cleaners in 20/33 (60%) of the facilities at least annually. In 22/33 (67%) of the facilities, the administration staff received general IPC training. In 22/33 (67%) of the facilities the training was offered using different methods. Sixteen (48%) of the facilities reported training patients or families on IPC to minimise the potential of HAIs. IPC was integrated into health-related courses as reported by 18/33 (55%) of the facilities, and 19/33 (58%) of the facilities reported to have ongoing skills development training offered for IPC staff. Most (28/33 (85%) of the facilities reported that they rarely monitored the effectiveness of the IPC training given to HCWs.

Core Component 4. Healthcare-associated infection (HAI) surveillance

The overall median score for CC 4 was 45/100, with 21/33 (63%) of the facilities having no professionals trained in basic

Table I
IPCAF scoring interpretation

Score	Level	Interpretation
0—200	Inadequate	IPC CC implementation is deficient. Significant improvement is required
201—400	Basic	Some aspects of the IPC CCs are in place, but not sufficiently implemented. Further improvement is required.
401—600	Intermediate	Most aspects of IPC CC are appropriately implemented. Continue to improve the scope and quality of implementation and focus on the development of long-term plans to sustain and further promote the existing IPC program
601—800	Advanced	The IPC CCs are fully implemented according to the WHO recommendations and appropriate to the needs of your facility

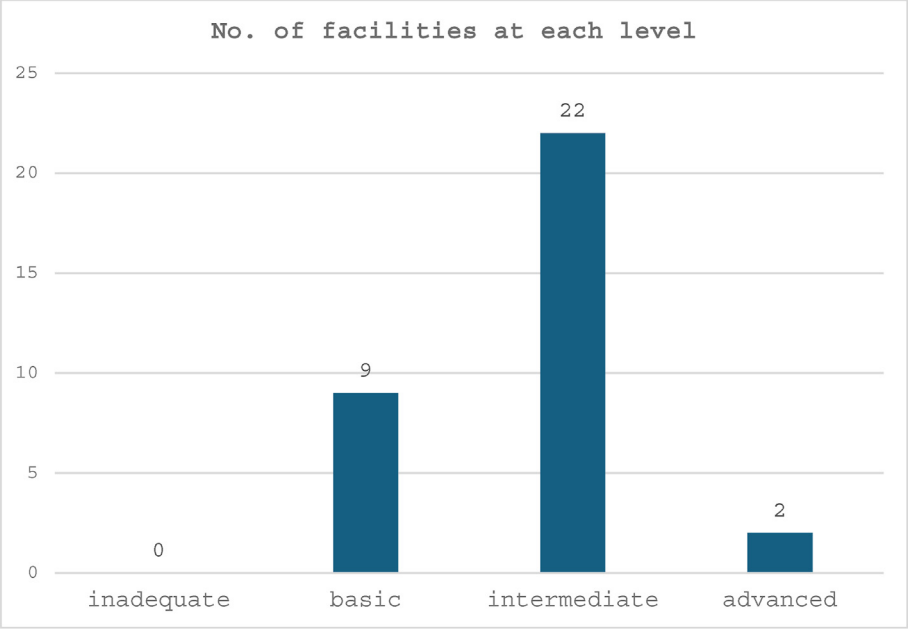

Figure 1. Distribution of facility IPCAF scores.

epidemiology, surveillance, and IPC. There was no prioritisation exercise to monitor HAIs in 25/33 (76%) of facilities. Twenty-three (70%) of the facilities do not conduct surveillance for HAIs, and 19/33 (58%) of the facilities had no clear HAI definitions. Twenty-four (73%) of the facilities did not have processes to review data regularly and 21/33 (64%) do not use surveillance data to make tailored plans. Microbiology support was reported in 13/33 (40%) of the facilities. Only 8/33 (24%) of the facilities conducted antibiotic drug resistance surveillance on a regular basis. All facilities that conducted surveillance gave feedback on surveillance.

Core Component 5. Multimodal strategies (MMS)

The overall median score for CC 5 was 65/100. The use of the multimodal strategy to implement IPC interventions was reported in 26/33 (79%) of the facilities, with 7/33 (21%) using system change, 17/33 (52%) education and training, 9/33 (27%) monitoring and evaluation, 5/33 (15%) communication and reminders and 6/33 (18%) using safety climate and culture change. Twenty-seven (82%) of the facilities indicated that they use a multidisciplinary team to implement multimodal strategies, and 25/33 (76%) link with quality and patient safety to develop and promote IPC multimodal strategies. HAI-specific care bundles are included in the multimodal strategy in 18/33 (55%) of the facilities.

Core Component 6. Monitoring, audit, and feedback

CC 6 had the lowest overall median score of 15/100 among all the components. However, 22/33 (67%) of the facilities reported having trained personnel responsible for monitoring/audit and feedback of IPC practices. Seventeen (52%) of the facilities reported having a well-defined monitoring plan with

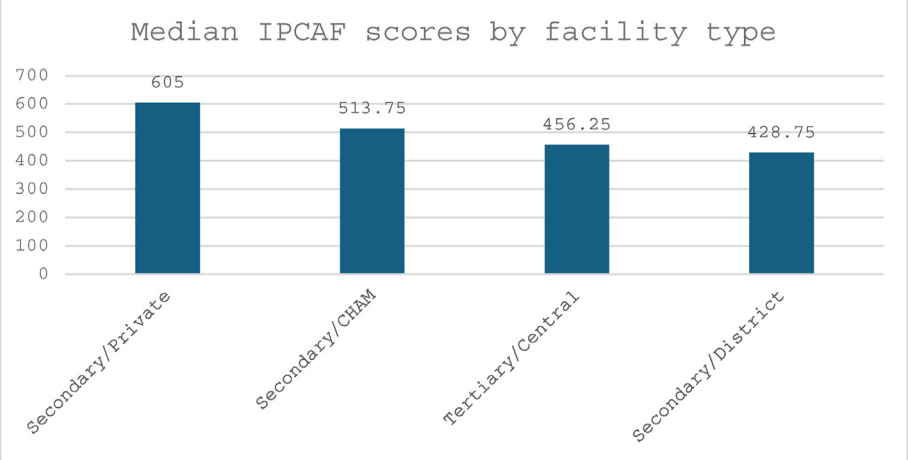

Figure 2. IPCAF scores according to the type of facility.

Table II
Overall Facility IPCAF scores

Core Components (CC)	Maximum score %	Average facility score %	Median score (IQR)
1. Infection Prevention and Control (IPC) programme	90	72.7	72.5 (66.25—78.75)
2. Infection Prevention and Control (IPC) guidelines	97.5	90	87.5 (81.25—97.5)
3. Infection Prevention and Control (IPC) education and training	90	62.9	65 (50—90)
4. Healthcare-associated infection (HAI) surveillance	85	34.7	40 (12.5—50)
5. Multimodal strategies for implementation of infection prevention and control (IPC) interventions	100	59.8	65 (50—80)
6. Monitoring/audit of IPC practices and feedback	52	17.4	15 (7.5—22.5)
7. Workload, staffing and bed occupancy	100	51.8	45 (35—72.5)
8. Built environment, materials, and equipment for IPC at the facility level	97.5	62.0	61 (54.25—70)

clear goals, targets, and activities. Only 3/33 (9%) of the facilities reported monitoring some of the indicators such as cleaning of the environment, hand hygiene practices, or wound dressing, and 2/33 (6%) facilities monitored disinfection and sterilization. Only 2/33 (6%) reported using the WHO hand hygiene self-assessment survey annually with 11/33 (34%) using it periodically and 20/33 (60%) not using it at all. In 31/33 (94%) of the facilities, auditing reports were not shared with staff as feedback, 20/33 (60%) of the facilities did not report monitoring data, and of the facilities in which reporting of monitoring data was done, 24/33 (73%) indicated that monitoring and feedback were done in a blame-free way. Safety cultural factors were not assessed in 24/33 (73%).

Core Component 7. Staffing, workload, and bed occupancy

The overall median score for CC 7 was 45/100. It was reported in 18/33 (55%) of the facilities that staffing needs were not assessed according to the WHO Workload Indicators Staffing Needs, with 24/33 (73%) of facilities indicating that their staffing level did not meet required national ratios. In 24/33 (73%) of the facilities, there was a system in place to act on the staffing level when deemed too low. In 18/33 (55%) of the facilities, some wards were designed according to international standards and 8/33 (24%) of the facilities reported that in all departments, the wards were designed according to international standards. In 16/33 (48%) of the facilities reported that they maintained one patient per bed in some of the units. In 26/33 (79%) of the facilities indicated that they did not have beds standing in the corridors, while only 10/33 (31%) had adequate spacing between beds. Of the 10/33 (31%) of the facilities that reported that they had a system in place when bed capacity was exceeded, this was the responsibility of the head of the department.

Core Component 8. Built environment

The overall median score for CC 8 was 61/100. A total of 15/33 (46%) of the facilities had water available, but not consistently while 14/33 (42%) had water all the time. In 17/33 (52%) of the facilities had reliable drinking water stations

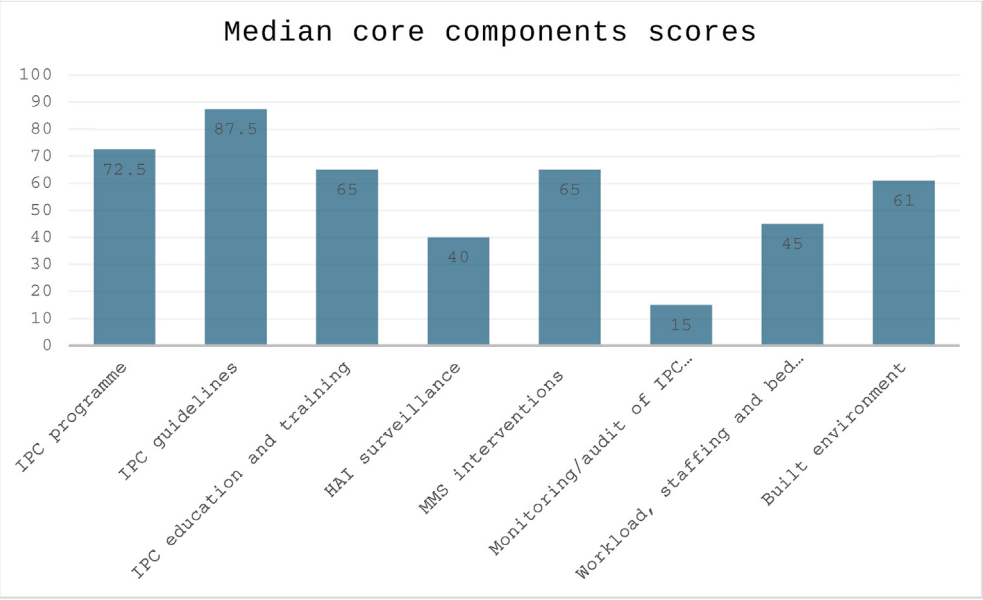

Figure 3. Median IPCAF scores out of 100 by the eight core components (CC).

accessible to all users, while 14/33 (42%) had water in some areas and available for all users. Functional hand hygiene stations were found in 29/33 (88%) of facilities, but hand cleaning supplies were not reliably available.

Only 5/33 (15%) of the hospitals had sufficient and functional toilets, while 15/33 (46%) had enough, though some toilets were not functional. In 13/33 (39%) of the facilities had less than the required number of toilets available.

The majority (94%) of the facilities had adequate ventilation, while 19/33 (58%) of the hospitals had sufficient energy and power supply in all critical areas, and 14/33 (42%) had power supply sometimes or only in some of the critical areas.

In 21/33 (64%) of the hospitals, no record of cleaning signed by the cleaners was identified, while 12/33 (36%) had records, but these were not completed or were outdated. About 22/33 (67%) had appropriate cleaning materials but were not well maintained, and 29/33 (88%) had personal protective equipment available, though not continuously available in sufficient quantities.

17/33 (52%) had functional waste containers, while 15/33 (45%) had either lids missing or only two instead of three waste containers as required. Sixty-three percent had burial pits or municipal pick-up for non-infectious waste, 29/33 (88%) had incinerators for the treatment of infectious waste, and 23/33 (70%) had a wastewater treatment system functioning reliably.

There was a dedicated decontamination area and sterile supply department in 21/33 (64%) of the facilities, while 7/33 (21%) reported a less reliable decontamination and sterile supply department. Only 15/33 (45%) had reliable sterile and disinfected equipment ready for use, while 18/33 (52%) only had it sometimes, and 20/33 (60%) had disposable items available whenever necessary.

Discussion

The level of IPC implementation in Malawi was found to be at an intermediate level according to the WHO IPCAF tool. These findings are slightly inconsistent with those of the Global Report on IPC [8], which found that most low-income countries had a basic level of IPC. Despite having an intermediate level of IPC implementation, our survey revealed some key areas that require attention. These areas are the monitoring/audit of IPC practices and feedback, the surveillance of healthcare associated infections, workload, staffing and bed occupancy and the built environment for IPC. The other areas that require strengthening are the multimodal strategy, IPC guidelines and IPC program. Of the two facilities found to have advanced IPC implementation, one was a CHAM-owned hospital and the other a private-owned one. This could explain the importance of leadership and management in IPC implementation, as both facilities reported to have a senior member of staff in the IPC committee, but also the role of budget allocation for IPC activities.

Despite the finding that most of the facilities had an IPC program in place, most of the facilities had no dedicated budget. This finding is consistent with findings in other studies and the Global Report on IPC [8—11]. Only a few facilities had reliable microbiology support, which could explain why surveillance is not happening in most of the facilities. Without adequate microbiology support and dedicated budget support, surveillance cannot be performed. It is difficult to run any IPC activities without resources—there is a clear need for dedicated financial support.

Whilst IPC guidelines are available in Malawi, there is little evidence of their implementation. For example, monitoring and feedback are well documented in the guidelines, but it is rarely done. The facilities reported that they conduct monitoring of the implementation of the guidelines, but this was not observed in the scoring of the other core components. Healthcare workers should be trained on IPC guidelines and monitoring of the implementation of guidelines should be done regularly, which has been shown to improve other indicators of IPC [1,12].

The WHO guidelines recommend that IPC training and education should be in place for all healthcare workers utilizing team and task-based strategies [5]. IPC training should be provided for everyone in the facility using different packages for different disciplines, administration, patients and guardians to reduce HAI and improve IPC [1,12—14]. The Malawi MoH has a motto, "infection prevention a responsibility for all"; to prevent the transmission of HAIs, it is important to involve everyone in IPC as they all contribute to the triad of infection transmission [7,15,16]. It is important to engage senior management through training them to enhance their IPC understanding. In other studies, training and engaging senior management proved to be valuable in enlisting resources for IPC [12]. Furthermore, authors have discussed the importance of providing IPC training on a scheduled basis to healthcare workers to keep them updated on the new practices to improve IPC [9,17,18].

Routine HAI surveillance is important in establishing the rate of HAIs and preventing them in healthcare facilities [1,5,19]. Our survey revealed that HAI surveillance is rarely conducted in the facilities, and microbiology support was lacking in most facilities. IPC interventions to prevent and reduce the HAIs cannot be effectively designed without knowing what the HAIs are [9]. HCWs should be trained on how to conduct HAI surveillance appropriately [5]. When surveillance of HAIs is not conducted, there is nothing to feedback to healthcare workers and other stakeholders to help change practice.

Our survey revealed that multimodal strategies are not well implemented, and this is consistent with a similar finding in other low-resource settings [10]. Use of multimodal strategies are recommended to improve implementation of IPC in facilities by the WHO [5]. Despite facilities reporting that they use multimodal strategies to implement IPC interventions, only one element (education and training) out of the five elements was consistently used. Ensuring that staff understand what multimodal strategies are and how they work would likely be of value.

Our survey revealed that the lowest score was in IPC monitoring and evaluation (CC 6), consistent with findings from Ivory Coast, Uganda, and Pakistan [8,9,20,21]. This activity paired with feedback is effective for increasing adherence to IPC practices and reducing HAIs [5,8]. Our survey observed that any indicator asking for guidelines or plans was scored reasonably well, but when it came to actual implementation or action for the same guidelines or plans the scores were low. This finding is in line with what Zingg *et al.* [12] found; that dissemination of guidelines does not change behaviour. Dissemination of guidelines should be combined with training and monitoring of their implementation.

It was interesting to note that most facilities had a system in place to act on low staffing levels, despite not having staffing levels according to national standards. Adequate staffing levels

are very important to reduce HAIs [22,23]. Very few facilities had wards designed according to international standards. However, it was noted that most facilities had no beds in the corridors, despite only a few (31%) facilities maintaining adequate spacing between beds—these facilities had a plan in place when the ward capacity was exceeded. This means most facilities were congested, which increases the risk and spread of HAIs. This finding calls for facilities to have plans in place on how to decongest their wards. This is mainly a policy and funding issue, and it requires support from the national level.

Patient care activities should occur in a clean and hygienic environment that facilitates IPC practices to prevent and reduce HAIs [5,24]. The state of water, sanitation and hygiene in the facilities is inadequate. Water is crucial in preventing transmission of infections in the facilities, as it is used for hand hygiene, environmental cleaning, decontamination, sterilization, and so on. Toilets are very important in the prevention and control of infections, as well as the dignity of the patients, staff, and visitors [7]. There must be systems in place for preventive maintenance of toilets and plans to build more. There were no cleaning records found, this could also contribute to the lack of maintenance of toilets, as records could include information on functional and non-functional toilets and actions taken. It was encouraging to note that most of the facilities had incinerators for the treatment of infectious waste and had functional wastewater treatment systems.

Given the centrality of all the core components to effective IPC, it is concerning that it is possible to have such low scores in some domains of the IPCAF assessment tool and still be considered to have an intermediate or even basic level of IPC implementation. The WHO describes all the components as "core" because without some level of implementation across all domains, an entire IPC programme is at risk of failure. Our data suggest that the IPCAF scoring framework needs to be reconsidered so that the tool does not give false reassurances about the state of IPC in an institution or across a country. Serious consideration must be given to the correct description of facilities which fail to meet a minimum set of IPC requirements across all core components. It should perhaps not be possible for scoring highly in one domain (for example, IPC guidelines present) to compensate for a low score across others (for example, no formal HAI surveillance, or no implementation of multimodal strategy).

Implications for policy and practice

- There is need for allocation of budgetary resources to IPC programs by the Ministry of Health
- There is a need to establish processes to implement monitoring/audit of IPC practices and feedback to all stakeholders.
- The Quality Management Directorate should work collaboratively with relevant departments in the MoH to strengthen microbiology laboratories in healthcare facilities to enhance HAI surveillance.
- Standardised processes to conduct HAI surveillance and review data regularly should be developed.

Areas for future research

- Research should be done to analyse the implementation strategies that could be routinely conducted to improve monitoring/audit and feedback of IPC practice.
- A qualitative inquiry to explore healthcare workers' perceptions towards HAI prevention and surveillance in the facilities in identifying what might motivate them to positively shift IPC behaviours.

This study had some limitations. First, there is potential bias from self-reporting. The IPCAF tool was self-administered by the IPC committees in the facilities, which may have led to over-scoring or under-scoring for some of the indicators. To reduce this self-reporting bias, it was emphasised during training that the results were for facilities to use for future improvement and not for punitive action. Second, there may have been some misinterpretation of the questions due to the IPCAF tool's abundance of questions and footnotes, which may have resulted in inaccurate responses being recorded. However, to mitigate this challenge, the survey team provided training and guidance throughout the process of the survey. Third, the survey did not invite all the secondary hospitals due to lack of IPC focal person in the invited hospitals which were not invited to participate.

Conclusions

The study identified that there was some degree of implementation of WHO IPC guidelines in Malawi's healthcare system. However, there was significant room for improvement to prevent HAIs. Some of these improvements may be led within facilities, for example, improving monitoring, audit, and feedback of IPC. However, higher-level support through increased IPC budgets, laboratory provision to enable HAI surveillance and to strengthen the water and sanitation infrastructure in the facilities, staffing, and bed occupancy is needed.

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We would like to acknowledge all the hospitals IPC focal persons who took part in the survey.

Ethics

Infection prevention and control is under the mandate of Quality Management Directorate in the Ministry of Health — Malawi. The IPCAF survey, as a WHO tool, was conducted under the guidance of QMD, hence no ethics was required. Ethical approval to publish the findings was done through COMREC P.02/23/3993.

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Authors' contributions

DN: conception and design, acquisition, analysis and interpretation of data, drafting and revision of the manuscript. TOB: conception and design. EJ: acquisition and interpretation of data. OM: conception and design. HC: conception and design. WK: analysis of data. NF: conception and design. NF, TT: critically revised the manuscript for its scientific contents.

Conflict of interest statement

There are no competing interests to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.infpip.2024.100388.

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