Antimicrobial Stewardship & Healthcare Epidemiology (2026), **6**, e283, 1–9
doi:10.1017/ash.2026.10855

Original Article

Implementation status of infection prevention and control and healthcare-associated infection surveillance in Zambian public hospitals: a WHO IPCAF tool assessment

Steward Mudenda PhD[1], Joseph Yamweka Chizimu PhD[2], Joseph Njung'e MSc[3], Malambo Mutila MSc[4], Victor Daka PhD[5], Jimmy Hangoma PhD[6], Oliver Mweso MD[2], Webrod Mufwambi MSc[1], Clyde Moono Hakayuwa MD[5], Martha Mwaba MPH[7], Ilunga Mutwale MD[8], Morreah Champo MSc[2], Adriano Focus Lubanga MD[9], Loveness Sakalimbwe MPH[2], Nathan Mugenyi MD[10], Linda Musonda BSc[11], Zoran Muhimba MD[12], Chileshe Lukwesa PhD[2], Mpela Chibi MSc[13], Priscilla Nkonde Gardner PhD[2], Sandra Diana Mwadetsa MSc[13], Maisa Kasanga PhD[2], Zachariah Mupila MSc[2], Harvey Kamboyi PhD[14], Sombo Fwoloshi MSc[11], Evelyn Wesangula PhD[15], John Bwalya Muma PhD[16], Nyambe Sinyange PhD[2] and Roma Chilengi PhD[2]

[1]Department of Pharmacy, School of Health Sciences, University of Zambia, Lusaka, Zambia, [2]Antimicrobial Resistance Coordinating Committee, Zambia National Public Health Institute, Lusaka, Zambia, [3]Digital Health, Commonwealth Pharmacists Association, Uganda, [4]Department of Digital Systems and Artificial Intelligence (DSAI), Deitaline Technology Limited, Lusaka, Zambia, [5]Department of Public Health, School of Medicine, Copperbelt University, Ndola, Zambia, [6]Department of Pharmacy, School of Health Sciences, Levy Mwanawasa Medical University, Lusaka, Zambia, [7]Department of Clinical Oncology, Cancer Diseases Hospital, Ministry of Health, Lusaka, Zambia, [8]Department of Internal Medicine, Kanyama Level 1 Hospital, Ministry of Health, Lusaka, Zambia, [9]Department of Clinical Services, Kamuzu Central Hospital, Lilongwe, Malawi, [10]Department of Community Health, Faculty of Medicine, Mbarara University of Science and Technology, Mbarara, Uganda, [11]Department of Infectious Diseases, University Teaching Hospitals, Ministry of Health, Lusaka, Zambia, [12]Department of Pathology, University Teaching Hospitals, Ministry of Health, Lusaka, Zambia, [13]Department of Health, World Health Organization, Lusaka, Zambia, [14]Department of Research, School of Medicine, Eden University, Lusaka, Zambia, [15]Pandemic Preparedness, Strengthening Pandemic Preparedness, Eastern and Southern Africa Health Communit, Arusha, Tanzania and [16]Department of Disease Control, School of Veterinary Medicine, University of Zambia, Lusaka, Zambia

Abstract

Background: Healthcare-associated infections (HAIs) remain a major global public health challenge, with a disproportionately higher burden in low- and middle-income countries (LMICs), including Zambia, where infection prevention and control (IPC) systems face resource and capacity constraints. Effective IPC programs are essential for reducing HAIs, limiting the emergence and spread of antimicrobial resistance (AMR), and improving patient safety. This study assessed the implementation status of IPC programs in Zambian hospitals.

Materials and methods: A descriptive multicenter cross-sectional survey was conducted from June 1–30, 2025, in 18 public hospitals across Zambia. The World Health Organization Infection Prevention and Control Assessment Framework (IPCAF) tool was used to evaluate IPC implementation across eight core components. Descriptive statistics and Welch's independent-samples t-test were used to compare IPC implementation levels across hospitals.

Results: The overall mean IPC score was 558 out of 800, indicating an intermediate level of implementation. Half of the hospitals (50%, n = 9) achieved advanced implementation, 39% (n = 7) intermediate, and 11% (n = 2) basic levels. Tertiary hospitals performed better than secondary hospitals (mean score 622 vs 507). The highest-scoring components were IPC programs (86%) and guidelines (88%), while the lowest were workload, staffing, and bed occupancy (60%) and IPC education and training (63%). Despite established IPC committees and guidelines, gaps remained in staff training, HAI and AMR surveillance, and infrastructure.

Conclusion: Most Zambian hospitals have achieved intermediate to advanced IPC implementation. However, sustained investment in workforce capacity, surveillance systems, and infrastructure is required to strengthen IPC practices and support national AMR containment efforts.

(Received 5 March 2026 UTC; accepted 11 August 2026 UTC)

Corresponding author: Steward Mudenda; Email: freshsteward@gmail.com
Cite this article: Mudenda S, Chizimu JY, Njung'e J, *et al.* Implementation status of infection prevention and control and healthcare-associated infection surveillance in Zambian public hospitals: a WHO IPCAF tool assessment. *Antimicrob Steward Healthc Epidemiol* 2026. doi: 10.1017/ash.2026.10855

Background

Healthcare-associated infections (HAIs) are among the most significant global public health challenges, affecting hundreds of millions of patients annually.[1,2] They contribute to prolonged

© The Author(s), 2026. Published by Cambridge University Press on behalf of The Society for Healthcare Epidemiology of America. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.

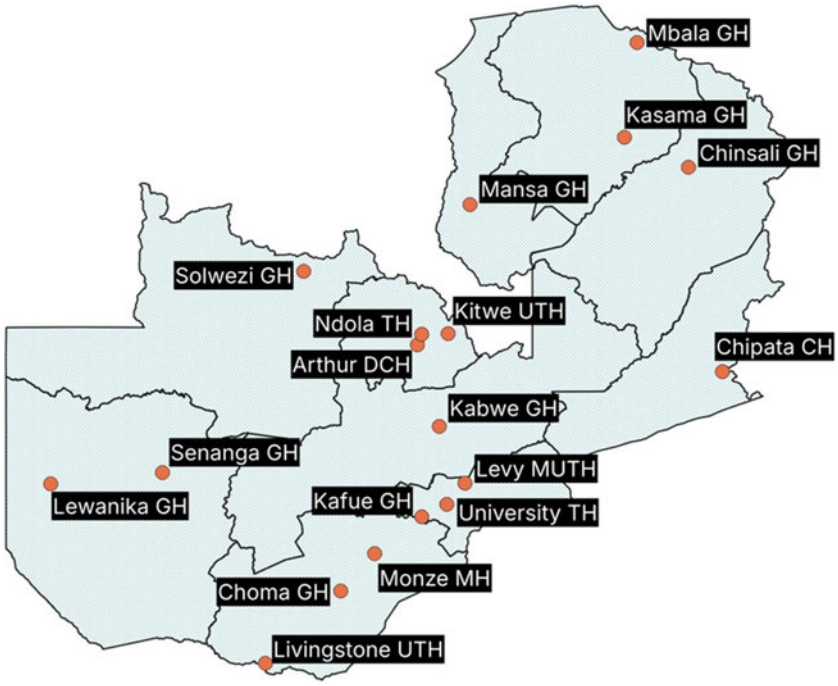


Figure 1. Geographic distribution of selected hospitals included in the IPC assessment in Zambia.

hospital stays, increased antimicrobial use (AMU), long-term disability, and substantial economic burdens on healthcare systems.[3,4] Additionally, HAIs are also among the major causes of preventable mortality globally.[3,5,6] HAIs are particularly devastating in low- and middle-income countries (LMICs), where the prevalence is estimated (approximately above 17%) to be higher than that of high-income settings due to resource limitations, weak surveillance systems, and inadequate infection prevention infrastructure.[7,8]

Infection Prevention and Control (IPC) is a cornerstone of safe, high-quality, and resilient healthcare systems.[9–11] It encompasses a range of evidence-based strategies and organizational systems designed to prevent and control the transmission of infections in healthcare settings.[12,13] Well-implemented IPC programs have proven to substantially lower HAI rates by up to 70%, curb antimicrobial resistance (AMR), and improve patient outcomes.[14–16] However, HAIs and AMR remain a huge global health issue, especially in LMICs.[6,17] Middle-income countries bear the highest burden of HAIs, accounting for an estimated 119 million cases annually.[17] The World Health Organization (WHO) guides on the core components of IPC programs to monitor and strengthen for sustainable IPC systems as key pillars of resilient healthcare systems.[18]

Worldwide, numerous countries have established national IPC programs and integrated them into their overall health security systems.[19] However, their implementation continues to vary, with significant gaps observed across Africa.[20,21] The WHO African Region faces unique challenges, including inadequate infrastructure, shortages of IPC-trained personnel, poor access to water, sanitation, and hygiene (WASH) facilities, and limited surveillance of HAIs and AMR.[22,23] According to WHO assessments, only a few African countries have functional national IPC programs aligned with WHO standards.[19] Furthermore, healthcare facilities often lack the resources and technical capacity required to sustain IPC activities, leading to high rates of preventable infections and outbreaks of healthcare-associated pathogens such as *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Acinetobacter baumannii*.[24]

In Zambia, HAIs such as surgical site infections (SSIs) remain a significant yet under-reported public health problem, with some hospitals recording prevalence rates as high as 18%.[25–27] Alarmingly, these infections are increasingly showing resistance to key antibiotics, thereby contributing to elevated morbidity, mortality, and healthcare costs.[26,27] Nonetheless, the country has made commendable progress in developing its National Action Plan (NAP) on AMR (2017–2027), which identifies IPC as one of the key strategic objectives for combating AMR. Some Zambian hospitals have designated IPC focal persons, established committees, and functional WASH programs; however, significant gaps persist in training, surveillance, resource availability, and monitoring systems.[11,28,29] The present assessment aimed to assess the status of IPC programs, identify strengths and weaknesses across the eight IPCAF core components, and guide targeted interventions for improvement.

Materials and methods

Study design, site, and population

This descriptive, multicentric cross-sectional study was conducted from June 1 to June 30, 2025, to evaluate the status of IPC implementation in selected Zambian hospitals in relation to the WHO minimum requirements for IPC programs. According to the Ministry of Health DHIS2, 2025, Zambia had a total of 11 tertiary hospitals and 25 secondary hospitals during the study period. A total of 18 public hospitals were included, comprising 8 (44%) tertiary-level and 10 (56%) secondary-level institutions. The secondary hospitals included Mansa General Hospital (MGH), Solwezi General Hospital (SoGH), Choma General Hospital (ChoGH), Lewanika General Hospital (LGH), Kafue General Hospital (KafGH), Chinsali General Hospital (CGH), Senanga General Hospital (SGH), Monze General Hospital (MoGH), Mbala General Hospital (MbGH), and Kasama General Hospital (KasGH), while tertiary hospitals included Ndola Teaching Hospital (NTH), Livingstone University Teaching Hospital (LUTH), Levy Mwanawasa University Teaching Hospital (LMUTH), University Teaching Hospital (UTH), Kabwe General Hospital (KGH), Kitwe University Teaching Hospital (KUTH), Chipata Central Hospital (CCH), and Arthur Davison Children's Hospital (ADCH), as shown in Figure 1.

Hospitals were purposively selected to achieve national geographic representation across Zambia and to include both secondary- and tertiary-level referral hospitals with established IPC committees. The inclusion criteria required hospitals to be publicly owned and managed by the Government of the Republic of Zambia and to have an established IPC Committee. Participants were healthcare professionals directly responsible for planning, coordinating, and implementing IPC activities at their respective hospitals. From each hospital, three key IPC committee members, including the chairperson, secretary, and IPC nurse, were purposively selected to participate, yielding a total of 54 respondents. The three IPC committee members completed the assessment collaboratively through consensus after reviewing supporting documentation. Where discrepancies arose, responses were reconciled through discussion and verification of institutional records, resulting in a single validated IPCAF score for each hospital.

Data collection

All the data used in this study were collected from June 1 to June 30, 2025, using the WHO IPCAF tool, a globally validated and standardized self-assessment instrument designed to evaluate IPC programs at facility and national levels.[18] The tool consists of structured questions covering eight core components of IPC implementation. For this study, the original WHO IPCAF questionnaire was applied without any modifications to maintain global comparability, though brief clarifications were provided by the IPC Technical Working Group (TWG) where necessary to ensure contextual understanding during administration.

Eighteen data collectors, comprising medical doctors, pharmacists, nurses, public health professionals, and biomedical scientists, were recruited from the IPC TWG under the Zambian Antimicrobial Resistance Coordinating Committee (AMRCC). All data collectors underwent a three-day intensive training conducted by IPC experts drawn from the AMRCC. The training focused on standardizing data collection procedures, the use of the IPCAF tool, ethical principles, and ensuring data accuracy. Practical sessions on data entry using the Kobo Toolbox electronic platform were also included, with mock entries performed during training to test system functionality and data consistency. The mock entries were removed from the database before the actual data collection.

The data collection teams were organized into six groups of three, each assigned to three hospitals. Data collection involved face-to-face interviews with IPC committee members and document reviews to validate the responses. The IPCAF tool automatically generated scores for each of the eight core components, resulting in a total score ranging from 0 to 800. The scores were categorized as follows: Inadequate (0–200): IPC core components are poorly implemented and require substantial improvement. Basic (201–400): Some elements are in place but require strengthening. Intermediate (401–600): Most components are adequately implemented, though further improvement and sustainability planning are needed. Advanced (601–800): IPC systems are well-established and fully aligned with WHO recommendations.[18]

Data analysis

All completed questionnaires were reviewed for accuracy and completeness before analysis. Data were analyzed using Python 3.10.11, pandas 2.3.1, and Matplotlib 3.10.3 with reference to the WHO IPCAF tool. Descriptive statistics were generated to summarize the overall and component-specific IPCAF scores, presented as means, standard deviations, frequencies, and percentages. The distribution of hospitals across the four IPC implementation levels (inadequate, basic, intermediate, and advanced) was described. Differences in overall IPCAF scores between secondary (n = 10) and tertiary (n = 8) hospitals were assessed using the Mann–Whitney U test because of the relatively small number of hospitals and the non-parametric nature of the data. Differences in mean overall IPCAF scores between secondary and tertiary hospitals were also assessed using Welch's independent-samples t-test, which does not assume equal variances. Statistical significance was assessed using two-sided tests with $P < .05$.

Ethical considerations

The study was approved by the National Health and Research Training Institute (NHRTI) Ethics Committee (Reference No: TRC/C4/09/2023) and conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all respondents and facility management before participation. Participants were assured of confidentiality, and all hospitals consented to the publication of anonymized results in scientific outlets.

Results

In this study, we included 18 public hospitals and assessed the status of implementation of IPC core components and HAI surveillance. Overall, this study revealed that the implementation of IPC across the 18 public hospitals was intermediate, with an average score of 558 out of 800. The facility-level interpretation categorized nine hospitals as Advanced, seven as Intermediate, and two as Basic. Notably, no hospitals were classified at the inadequate level. Across the core components, IPC Programs (average 78) and HAI Surveillance (average 76) achieved the highest overall mean scores. In contrast, IPC Education and Training (average 63), Multimodal Strategies for IPC (average 68), and Workload Staffing and Bed Occupancy (average 60) were consistently low-performing areas (Figure 2). Substantial differences in IPC implementation were observed across hospitals (Figure 2), with the highest-performing facility scoring more than twice that of the lowest (707 *vs*. 286), $P = 2.67 \times 10^{-10}$. The strong statistical significance despite relatively small sample sizes (n = 1 per facility) indicates robust and consistent performance patterns within each institution.

Table 1 shows that tertiary hospitals achieved a higher mean score in seven out of the eight core components compared to secondary hospitals, leading to a significantly higher overall IPC score (622 *vs*. 507), as evidenced by the Mann–Whitney: $P = .021$ and Welch's t-test: $P = .018$. The largest disparities were observed in IPC Guidelines (Tertiary: 88 vs Secondary: 64) and IPC programs (Tertiary: 86 *vs*. Secondary: 72), suggesting tertiary hospitals have more comprehensive and formalized IPC policy frameworks. The smallest gap, where secondary hospitals outperformed tertiary hospitals, was in workload, staffing, and bed occupancy (Secondary: 62 *vs*. Tertiary: 57), indicating relatively greater strain on staffing and bed capacity in the higher-level hospitals (Table 1).

The IPC interpretation capacity data (N = 18) indicate a strong overall proficiency across the surveyed hospitals, suggesting their ability to analyze and understand surveillance findings is robust. The vast majority (89%) demonstrated either Advanced (n = 9,

All Facilities

Core Components/Facilities	LUTH	MGH	CCH	UTH	NTH	LMUTH	KafGH	MoGH	KGH	ADCH	CGH	KUTH	SoGH	ChoGH	KasGH	LGH	MbGH	SGH	Average
IPC Programmes	93	90	90	85	100	95	85	83	80	75	68	70	100	75	73	63	75	13	78
IPC Guidelines	100	100	93	93	65	83	70	93	90	88	53	90	80	80	58	45	8	48	74
IPC Education and Training	95	60	75	75	95	75	95	70	70	70	65	35	30	50	50	70	45	15	63
HAI Surveillance	88	78	95	93	75	63	75	70	88	88	90	83	50	45	83	85	68	60	76
Multimodal Strategies for IPC	95	90	75	75	80	80	85	85	70	80	60	65	45	90	45	35	15	45	68
IPC Monitoring and Feedback	93	100	98	90	73	73	83	88	70	78	75	85	68	63	50	60	45	30	73
Workload Staffing and Bed Occupancy	65	90	50	55	60	75	60	50	75	40	80	35	85	35	65	55	55	45	60
Built Environment and Equipment	78	85	78	75	78	75	63	70	61	64	68	78	50	68	40	49	53	30	65
Total/800	**707**	**693**	**654**	**641**	**626**	**619**	**616**	**609**	**604**	**583**	**559**	**541**	**508**	**506**	**464**	**462**	**364**	**286**	**558**
Interpretation	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**I**	**I**	**I**	**I**	**I**	**I**	**I**	**B**	**B**	**I**

Figure 2. IPC core component score and interpretation level for all participating hospitals (N = 18).

Table 1. Comparison of mean IPC core component scores between secondary and tertiary hospitals

IPC core component	Secondary hospitals (mean score), n = 10	Tertiary hospitals (mean score), n = 8
1. IPC programs	72	86
2. IPC guidelines	64	88
3. IPC education and Training	55	74
4. HAI surveillance	70	84
5. Multimodal strategies for IPC	60	78
6. IPC monitoring and feedback	66	82
7. Workload staffing and bed occupancy	62	57
8. Built environment and equipment	58	73
Overall IPC score by level of care	507	622

Note: IPC, Infection Prevention and Control; HAI, healthcare-associated infections.

50%), meaning their IPC core components are fully implemented, or Intermediate (n = 7, 39%) capacity, suggesting most aspects are appropriately implemented, and the focus should be on sustaining and promoting activities. Only a small fraction of hospitals were categorized at the Basic level (n = 2, 11%), where some aspects are in place, but not sufficiently implemented, and none were found to have Inadequate capacity, indicating a high baseline capacity for managing and sustaining IPC programs (Figure 3).

Table 2 shows that the IPC surveillance programs demonstrate strong organizational and methodological foundations, with 88.9% of the hospitals reporting a defined program component, dedicated personnel (100%), trained professionals (88.9%), and adherence to standardized data collection methods (94.4%). However, a critical gap exists in prioritization, as only 50% conduct an exercise to determine local HAI targets, correlating with alarmingly low surveillance of device-associated infections (16.7%). Furthermore, while surveillance data is generally used for improvement (72.2%) and feedback to clinical leaders (94.4%), more than half (55.6%) regularly analyze AMR, and administrative engagement is limited, with only 50% of non-clinical management receiving surveillance feedback (Table 2).

Discussion

This national assessment provides a comprehensive overview of the status of IPC implementation in Zambian public hospitals using the WHO IPCAF tool.

The overall mean IPCAF score of 558/800 indicates that Zambia has achieved considerable progress toward strengthening IPC systems in line with WHO recommendations. The findings demonstrate encouraging progress in establishing IPC structures across both secondary and tertiary hospitals, with most hospitals achieving intermediate to advanced levels of IPC implementation. Similarly, a previous study in Zambia also found that IPC implementation in some Zambian hospitals was at an intermediate level with an average IPCAF score of 594, slightly higher than the current finding.[11] This finding aligns with similar assessments from other LMICs, where median IPCAF scores often fall within the intermediate range (401–600).[30,31] The presence of established IPC committees, focal persons, and integration of IPC into quality improvement structures across most hospitals reflects successful national efforts led by the Ministry of Health (MoH) and the AMRCC. These achievements are attributable to recent initiatives, including the NAP on AMR (2017–2027), IPC training programs, and technical support from WHO and partners. Nevertheless, continued efforts are needed in LMICs, including Zambia, in order to achieve high IPC scores in secondary and tertiary hospitals as observed in some high-income countries.[13,32]

In our study, the strongest performance across the IPC core components was seen in the areas of IPC programs, HAI surveillance, and IPC guidelines. This is consistent with earlier research from Zambia, which also reported that IPC programs achieved the highest scores among the eight core components.[11] These results suggest that many hospitals in Zambia have well-established IPC programs aimed at preventing the development and spread of infections, including HAIs. The present study findings, to some extent, reflect those reported in other LMICs where most hospitals have established IPC programs, developed IPC guidelines, and conduct HAI surveillance, although with some variations.[30,33]

Our study showed that tertiary hospitals had more advanced IPC implementation than secondary hospitals, which generally achieved intermediate IPCAF scores. Tertiary hospitals also demonstrated stronger IPC programs and better implementation of IPC guidelines, likely reflecting greater availability of specialized

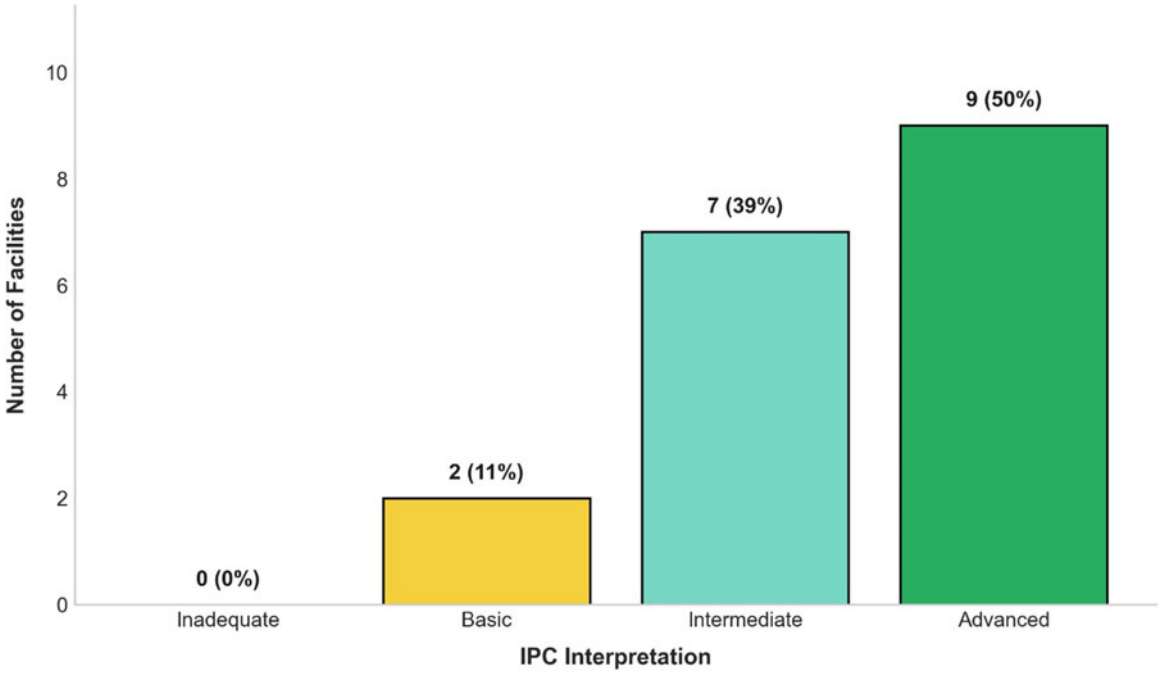


Figure 3. Facility IPC implementation capacity based on IPCAF core component levels (N = 18).

personnel, infrastructure, and institutional resources. These findings are consistent with those of Kabego et al., who similarly reported higher IPC performance among tertiary healthcare facilities, with a median IPCAF score of 70%.[34] An intermediate IPCAF classification indicates that most IPC core components are in place but require further strengthening to achieve full compliance. These findings underscore the need for sustained investment in workforce development, surveillance systems, infrastructure, and continuous quality improvement, particularly in secondary hospitals, to reduce disparities in IPC implementation and improve healthcare quality.

Another prominent finding in the present study was the significant disparity in IPC implementation between tertiary (mean IPCAF score 622) and secondary (mean IPCAF score 507) hospitals reflect ongoing health system inequities and technical capacity, as tertiary hospitals have more specialized human resources, better infrastructure investments, and greater access to partner support, whereas secondary hospitals, which often serve large rural populations, face shortages of trained IPC personnel, erratic supply of essential materials, and infrastructural limitations. Secondary-level hospitals, particularly those in remote districts, reported shortages of dedicated isolation spaces, limited laboratory capacity, and frequent stockouts of essential supplies, including disinfectants and personal protective equipment (PPE). This imbalance in capacity across hospitals is consistent with findings from Malawi and Rwanda, where tertiary or central hospitals tend to have higher IPC performance than secondary or peripheral hospitals.[20,30] Furthermore, this demonstrates that IPC resources must be decentralized to support all the appropriate lower levels of care in each context.[16,35,36] These findings underscore the need for a tiered national IPC strengthening strategy that prioritizes lower-level hospitals through equitable resource distribution, targeted supervision, and integration of IPC indicators into performance monitoring frameworks. Therefore, deliberate policy efforts should be implemented to ensure that secondary hospitals receive equitable investments in IPC in order for all patients to benefit from standardized IPC prevention measures.

Our study found that the surveillance of HAIs and AMR remains another major gap. Although most hospitals reported collecting infection-related data, few conducted systematic HAI surveillance or analyzed antimicrobial susceptibility trends. Similarly, although most hospitals had established HAI surveillance programs and dedicated surveillance personnel, important gaps remained. Only half of the hospitals prioritized HAIs for surveillance, surveillance of device-associated infections was limited (16.7%), regular AMR data analysis was conducted by only 55.6% of hospitals, and surveillance feedback to non-clinical management was inconsistent. These findings indicate that HAI surveillance systems are established but remain inconsistently implemented, highlighting the need to strengthen surveillance coverage, AMR data utilization, and feedback mechanisms to support evidence-based IPC improvement. This limitation hampers early outbreak detection and evidence-based decision-making. Similar challenges have been observed in other LMICs, where weak surveillance systems and limited microbiology capacity constrain the detection and reporting of HAIs.[37,38] Consequently, countries can strengthen their HAI surveillance by implementing the protocols as guided by the WHO.[39] Strengthening laboratory infrastructure, enhancing data management systems, and linking facility-level surveillance with the national AMR surveillance network would be critical to improving infection monitoring and control in Zambia.

Despite the abovementioned progress, the study revealed persistent weaknesses in several core components. Notably, IPC education and training, multimodal strategies, and workload, staffing, and bed occupancy were the lowest-performing areas. The absence of structured, routine IPC training for all healthcare workers undermines the sustainability of infection prevention practices, particularly in hospitals with high staff turnover. These gaps are consistent with findings from studies conducted in

Table 2. Assessment of healthcare-associated infection (HAI) surveillance in selected hospitals (N = 18)

Question	Answer	n (%)
Organization of surveillance		
Is surveillance a defined component of your IPC program?	No	2 (11.1)
	Yes	16 (88.9)
Do you have personnel responsible for surveillance activities?	No	0 (0.0)
	Yes	18 (100)
Have the professionals responsible for surveillance activities been trained in basic epidemiology, surveillance and IPC (that is, capacity to oversee surveillance methods, data management and interpretation)?	No	2 (11.1)
	Yes	16 (88.9)
Do you have informatics/IT support to conduct your surveillance (for example, equipment, mobile technologies, electronic health records)?	No	2 (11.1)
	Yes	16 (88.9)
Do you go through a prioritization exercise to determine the HAIs to be targeted for surveillance according to the local context (that is, identifying infections that are major causes of morbidity and mortality in the facility)?	No	9 (50.0)
	Yes	9 (50.0)
In your facility, is surveillance conducted for:		
Surgical site infections?	No	6 (33.3)
	Yes	12 (66.7)
Device-associated infections (for example, catheter-associated urinary tract infections, central line-associated bloodstream infections, peripheral-line associated bloodstream infections, ventilator-associated pneumonia)?	No	15 (83.3)
	Yes	3 (16.7)
Clinically-defined infections (for example, definitions based only on clinical signs or symptoms in the absence of microbiological testing)?	No	4 (22.2)
	Yes	14 (77.8)
Colonization or infections caused by multidrug-resistant pathogens, according to your local epidemiological situation?	No	8 (44.4)
	Yes	10 (55.6)
Local priority epidemic-prone infections (for example, norovirus, influenza, tuberculosis [TB], severe acute respiratory syndrome [SARS], Ebola, Lassa fever)?	No	3 (16.7)
	Yes	15 (83.3)
Infections in vulnerable populations (for example, neonates, intensive care unit, immunocompromised, burn patients)?	No	4 (22.2)
	Yes	14 (77.8)
Infections that may affect health care workers in clinical, laboratory, or other settings (for example, hepatitis B or C, human immunodeficiency virus [HIV], influenza)?	No	6 (33.3)
	Yes	12 (66.7)
Do you regularly evaluate if your surveillance is in line with the current needs and priorities of your facility?	No	3 (16.7)
	Yes	15 (83.3)
Methods of surveillance		
Do you use reliable surveillance case definitions (defined numerator and denominator according to international definitions [e.g. CDC NHSN/ECDC] or, if adapted, through an evidence-based adaptation process and expert consultation?	No	2 (11.1)
	Yes	16 (88.9)
Do you use standardized data collection methods (for example, active prospective surveillance) according to international surveillance protocols (for example, CDC NHSN/ECDC) or, if adapted, through an evidence-based adaptation process and expert consultation?	No	1 (5.6)
	Yes	17 (94.4)
Do you have processes in place to regularly review data quality (for example, assessment of case report forms, review of microbiology results, denominator determination, etc.)?	No	2 (11.1)
	Yes	16 (88.9)
Do you have adequate microbiology and laboratory capacity to support surveillance?	No	1 (5.6)
	Yes, can differentiate gram-positive/negative strains, but cannot identify pathogens	0 (0.0)
	Yes, can reliably identify pathogens (for example, isolate identification) promptly	4 (22.2)
	Yes, can reliably identify pathogens and antimicrobial drug resistance patterns (that is, susceptibilities) promptly	13 (72.2)

(*Continued*)

Table 2. (*Continued*)

Question	Answer	n (%)
Information analysis and dissemination/data use, linkage, and governance		
Are surveillance data used to make tailored unit/facility-based plans for the improvement of IPC practices?	No	5 (27.8)
	Yes	13 (72.2)
Do you analyze antimicrobial drug resistance on a regular basis (for example, quarterly/half-yearly/annually)?	No	8 (44.4)
	Yes	10 (55.6)
Do you regularly provide (for example, quarterly/half-yearly/annually) up-to-date surveillance information to?		
Frontline health care workers (doctors/nurses)?	No	5 (27.8)
	Yes	13 (72.2)
Clinical leaders/heads of department	No	1 (5.6)
	Yes	17 (94.4)
IPC committee	No	2 (11.1)
	Yes	16 (88.9)
Non-clinical management/administration (chief executive officer/chief financial officer)?	No	9 (50.0)
	Yes	9 (50.0)
How do you feedback up-to-date surveillance information? (at least annually)	No feedback	4 (22.2)
	By written/oral information only	6 (33.3)
	By presentation and interactive problem-oriented solution finding	8 (44.4)
Total (N)		18 (100)

Note: IPC, Infection Prevention and Control; HAI, healthcare-associated infections; CDC NHSN/ECDC, Centers for Disease Control and Prevention's National Healthcare Safety Network and the European Centre for Disease Prevention and Control.

Burkina Faso and the DRC, where irregular training and limited mentorship were cited as major barriers to IPC compliance.[33] To address this, Zambia's IPC programs need to institutionalize regular capacity-building using the national IPC and AMS curriculum, supported by periodic refresher sessions and practical mentorship.

Infrastructure-related barriers also contribute to inconsistent IPC performance. Inadequate isolation hospitals, overcrowded wards, and unreliable water, sanitation, and hygiene (WASH) systems were common across several hospitals. Such challenges not only increase the risk of HAI transmission but also undermine compliance with hand hygiene and environmental cleaning protocols. Investment in facility infrastructure, WASH improvements, and supply chain resilience must therefore be prioritized to sustain IPC progress and ensure safe healthcare environments. The present study also revealed weaknesses in monitoring, audit, and feedback mechanisms, with limited documentation and the absence of standardized audit tools. Continuous monitoring and feedback are essential for sustaining IPC improvements, as demonstrated in countries where routine auditing led to measurable reductions in HAIs.[40] Introducing national IPC audit tools and integrating them into existing hospital quality assurance systems could enhance accountability and promote a culture of continuous improvement.

We are aware of the limitations of this study. Its cross-sectional design provides only a snapshot of IPC implementation and cannot establish causality or assess changes over time. Although the WHO IPCAF is a validated assessment tool, it relies partly on self-reported information, which may be subject to reporting bias despite document verification. In addition, the study included only selected public hospitals with established IPC committees, limiting the generalisability of the findings to private and lower-level healthcare facilities. Future longitudinal studies incorporating direct observations and healthcare-associated infection surveillance are needed to evaluate the effectiveness and sustainability of IPC programs.

Overall, IPC structures are in place but require strengthened coordination, regular training, and sustainable resource support for effective implementation (Table 3). Collectively, these findings have important implications for national policy and practice. Zambia's current progress toward advanced IPC implementation demonstrates a strong foundation upon which to build a resilient, evidence-based IPC program. To accelerate progress, the MoH and partners should strengthen training systems, expand surveillance coverage, improve infrastructure, and ensure a consistent supply of IPC commodities. Moreover, IPC should remain central to the broader One Health approach to AMR, complementing initiatives in AMS, water and sanitation, and infection surveillance.

Conclusion

This assessment provides the first comprehensive national evaluation of IPC implementation in Zambian hospitals since the launch of the AMR National Action Plan. The findings show notable progress toward strengthening IPC structures and practices; however, achieving universal compliance with WHO standards will require sustained investment in workforce training, infrastructure, and surveillance systems. Continued prioritization of IPC is vital to reduce HAIs, curb AMR, and enhance patient safety. Integrating IPC indicators into hospital performance

Table 3. Strengths and weaknesses of IPC implementation in selected hospitals in Zambia

Aspect	Strengths	Weaknesses
IPC program and governance	• Most hospitals have established IPC programs and functional committees. • IPC is integrated into facility management and quality improvement systems.	• Inconsistent implementation of IPC activities across departments. • Some hospitals lack formalized IPC plans and policies.
Training and capacity building	• IPC focal persons are appointed in most hospitals. • Occasional training is conducted with partner support.	• No structured or regular training program for all healthcare workers. • Limited refresher courses and induction training on IPC.
Guidelines and policies	• Most hospitals possess national or facility-level IPC guidelines.	• Incomplete dissemination and limited adherence to guidelines. • Lack of regular updates and monitoring of policy implementation.
Surveillance of HAIs and AMR	• Some hospitals collect data on infection trends.	• HAI surveillance is not systematically implemented. • Lack of tools, personnel, and feedback mechanisms for data reporting.
Multimodal strategies	• Some hospitals use multimodal approaches in specific areas like hand hygiene.	• Weak or absent facilitywide multimodal improvement strategies. • Limited monitoring of behavioral and system changes.
Infrastructure and resources	• The majority of hospitals have decontamination and sterilization units. • Functional waste management and segregation systems.	• Inadequate isolation areas and handwashing facilities in some hospital wards. • Limited space and infrastructure for IPC activities.
Supplies and equipment	• Reliable availability of sterile and disposable items in most hospitals. • Availability of essential hand hygiene materials.	• Periodic stockouts of disinfectants, PPE, and cleaning materials. • Poor maintenance and calibration of sterilization equipment.
Monitoring, audit, and feedback	• Some hospitals conduct internal IPC reviews.	• Inconsistent monitoring, weak documentation, and a lack of feedback to staff. • No standardized audit tools in use.
Staffing and resource allocation	• Designated IPC personnel in most hospitals.	• Limited dedicated staff exclusively for IPC roles. • Inadequate funding for IPC activities.

Note: IPC, Infection Prevention and Control; HAI, healthcare-associated infections.

assessments, securing dedicated funding, and promoting multisectoral collaboration will be key to sustaining long-term AMR containment and advancing healthcare quality and safety in Zambia.

Supplementary material. The supplementary material for this article can be found at http://doi.org/10.1017/ash.2026.10855.

Data availability statement. Data can be made available on request from the corresponding author.

Acknowledgements. The authors would like to acknowledge the hospital management teams and infection prevention and control focal persons at the participating public hospitals for their cooperation and support during data collection. We also thank the Ministry of Health, Zambia, for facilitating access to study sites and for their continued commitment to strengthening infection prevention and control systems. We are grateful to all individuals who contributed their time and expertise to this assessment.

Author contribution. Conceptualized the study: SM, JYC and RC; Methodology: SM, JYC, IM, LM, EW, NS, and RC; Data collection: SM, JYC, WM, IM, MC, LM, LS, MK, ZM, EW, JBM, NS, and RC; Validation: SM, JYC, AFL, LS, NM, LM, ZM, CL, MC, PNG, SDM, MK, ZM, HK, SF, EW, JBM, NS, and RC; Data analysis: SM and MM; Interpretation of results: SM, JC, SKM, BC, MK, PKM, and BG; Data curation: SM, MM, and BG. Writing first draft: SM, JYC, JN, MM, VD, JH, OM, WM, CMH, MM, IM, MC, NS, and RC; Editing and reviewing the draft manuscript: SM, JYC, JN, MM, VD, JH, OM, WM, CMH, MM, IM, MC, AFL, LS, NM, LM, ZM, CL, MC, PNG, SDM, MK, ZM, HK, SF, EW, JBM, NS, RC; Supervision: NS and RC; All authors reviewed and approved the final version for submission.

Financial support. No financial support was provided relevant to this article.

Competing interests. All authors report no conflicts of interest relevant to this article.

References

1. World Health Organization. *The burden of health care-associated infection worldwide*, 2019. https://www.who.int/news-room/feature-stories/detail/the-burden-of-health-care-associated-infection-worldwide.
2. Raoofi S, Kan FP, Rafiei S, *et al.* Global prevalence of nosocomial infection: a systematic review and meta-analysis. *PLoS One* 2023;18:e0274248.
3. Gidey K, Gidey MT, Hailu BY, Gebreamlak ZB, Niriayo YL. Clinical and economic burden of healthcare-associated infections: a prospective cohort study. *PLoS One* 2023;18:e0282141.
4. Garlasco J, D'Ambrosio A, Vicentini C, Quattrocolo F, Zotti CM. Impact of hospital-related indicators on healthcare-associated infections and appropriateness of antimicrobial use according to a national dataset. *Sci Rep* 2024;14:31259.
5. Naghavi M, Kyu HH, Bhoomadevi A, *et al.* Global burden of 292 causes of death in 204 countries and territories and 660 subnational locations, 1990–2023: a systematic analysis for the Global Burden of Disease Study 2023. *Lancet* 2025;406:1811–1872.
6. Abban MK, Ayerakwa EA, Mosi L, Isawumi A. The burden of hospital acquired infections and antimicrobial resistance. *Heliyon* 2023;9:e20561.
7. Mudenda S, Hakayuwa CM, Lubanga AF, *et al.* Global antimicrobial stewardship, surveillance, and infection prevention and control programs: leveraging one health, nanotechnology, and artificial intelligence to combat antimicrobial resistance in a climate-impacted world. *Pharmacol Pharm* 2025;16:197–291.

8. Maki G, Zervos M. Health Care–Acquired Infections in Low- and Middle-Income Countries and the Role of infection prevention and control. *Infect Dis Clin North Am* 2021;35:827–839.
9. Allegranzi B, Aiken AM, Zeynep Kubilay N, *et al.* A multimodal infection control and patient safety intervention to reduce surgical site infections in Africa: a multicentre, before–after, cohort study. *Lancet Infect Dis* 2018;18:507–515.
10. Hill B, Lamichhane G, Wamburu A. Infection prevention and control: critical strategies for nursing practice. *Br J Nurs* 2024;33:804–811.
11. Mudenda S, Chizimu JY, Ndegwa L, *et al.* Evaluating infection prevention and control programs in Zambian hospitals using the WHO infection prevention and control assessment framework tool. *Front Public Heal* 2025;13:1642119.
12. Haigh KA, Liuzzi F, Irvine S, *et al.* A 'train the trainers' approach to infection prevention and control training in pandemic conditions. *Clin Infect Pract* 19:2023;100228.
13. Rüther FD, Gropmann A, Hansen S, Behnke M, Geffers C, Aghdassi SJS. Assessing infection prevention and control structures in German hospitals after the COVID-19 pandemic using the WHO infection prevention and control assessment framework (IPCAF): results from 660 hospitals and comparison with a pre-pandemic survey. *Antimicrob Resist Infect Control* 2024;13:103.
14. Villanueva P, Coffin SE, Mekasha A, McMullan B, Cotton MF, Bryant PA. Comparison of antimicrobial stewardship and infection prevention and control activities and resources between low-/middle- and high-income countries. *Pediatr Infect Dis J* 2022;41:S3–S9.
15. Gilbert GL, Kerridge I. Hospital infection prevention and control (IPC) and antimicrobial stewardship (AMS): dual strategies to reduce antibiotic resistance (ABR) in hospitals. In: *Ethics and Drug Resistance: Collective Responsibility for Global Public Health*. Cham: Springer;2020:89–108.
16. Borodova A, Diallo AA, Songbono CT, *et al.* Context specific challenges of the WHO infection prevention and control core components in the Faranah region: a mixed methods approach. *Front Public Heal* 2025;13:1605425.
17. Balasubramanian R, Van Boeckel TP, Carmeli Y, Cosgrove S, Laxminarayan R. Global incidence in hospital-associated infections resistant to antibiotics: An analysis of point prevalence surveys from 99 countries. *PLoS Med* 2023;20:e1004178.
18. World Health Organization. *Infection prevention and control assessment framework at the facility level*, 2018. https://www.who.int/publications/i/item/WHO-HIS-SDS-2018.9.
19. Tomczyk S, Twyman A, de Kraker MEA, *et al.* The first WHO global survey on infection prevention and control in health-care facilities. *Lancet Infect Dis* 2022;22:845–856.
20. Irakiza JJ, Mazimpaka C, Ndatimana D, *et al.* Status of infection prevention and control programs in 25 facilities of Rwanda: results from the WHO infection prevention and control assessment framework. *Public Heal Challenges* 2024;3:e183.
21. Gomes DJ, Hazim C, Safstrom J, *et al.* Infection prevention and control initiatives to prevent healthcare-associated transmission of SARS-CoV-2, East Africa. *Emerg Infect Dis* 2022;28:S225–S261.
22. Magadze TA, Nkhwashu TE, Moloko SM, Chetty D. The impediments of implementing infection prevention control in public hospitals: Nurses' perspectives. *Heal SA Gesondheid* 2022;27:2033.
23. Moyo P, Moyo E, Mangoya D, *et al.* Prevention of antimicrobial resistance in sub-Saharan Africa: what has worked? What still needs to be done? *J Infect Public Health* 2023;16:632–639.
24. Haque M, Sartelli M, McKimm J, Bakar MA. Health care-associated infections – An overview. *Infect Drug Resist* 2018;11:2321–2333.
25. Clyde MH, David M. Burden and associated risk factors for surgical site infections in general surgery department of Ndola Teaching Hospital (NTH) from January to December 2021: a hospital-based retrospective study. *Int J Sci Technol Res Arch* 2023;4:293–302.
26. Kazuma SME, Chalwe M, Chirengendure B, *et al.* Prevalence and risk factors for surgical site infections at three tertiary hospitals in the Copperbelt Province. *Zambia East Cent African J Surg* 2025;30:5–12.
27. Kasanga M, Chileshe M, Mudenda S, *et al.* Antibiotic prescribing patterns and prevalence of surgical site infections in caesarean section deliveries at two tertiary hospitals in Lusaka. *Zambia Pharmacol Pharm* 2022;13:313–330.
28. Mudenda S, Chizimu J, Chabalenge B, *et al.* Knowledge, attitude, and practices toward infection prevention and control among undergraduate pharmacy students in Zambia: findings and implications. *Antimicrob Steward Healthc Epidemiol* 2023;3:e154.
29. Mukwato K, Ngoma C, Maimbolwa M. Compliance with infection prevention guidelines by health care workers at Ronald Ross General Hospital Mufulira district. *Med J Zambia* 2009;35:110–116.
30. Ng'ambi D, O'Byrne T, Jingini E, *et al.* An assessment of infection prevention and control implementation in Malawian hospitals using the WHO Infection Prevention and Control Assessment Framework (IPCAF) tool. *Infect Prev Pract* 2024;6:100388.
31. Asgedom AA. Status of infection prevention and control (IPC) as per the WHO standardised Infection Prevention and Control Assessment Framework (IPCAF) tool: existing evidence and its implication. *Infect Prev Pract* 2024;6:100351.
32. Aghdassi SJS, Hansen S, Bischoff P, Behnke M, Gastmeier P. A national survey on the implementation of key infection prevention and control structures in German hospitals: results from 736 hospitals conducting the WHO Infection Prevention and Control Assessment Framework (IPCAF). *Antimicrob Resist Infect Control* 2019;8:73.
33. Wood R, Tembele W, Hema A, *et al.* Implementation of the WHO core components of an infection prevention and control programme in two sub-Saharan African acute health-care facilities: a mixed methods study. *Antimicrob Resist Infect Control* 2024;13:4.
34. Kabego L, Balde T, Barasa D, *et al.* Analysing the implementation of infection prevention and control measures in health care facilities during the COVID-19 pandemic in the African region. *BMC Infect Dis* 2023;23:824.
35. Storr J, Twyman A, Zingg W, *et al.* Core components for effective infection prevention and control programmes: new WHO evidence-based recommendations. *Antimicrob Resist Infect Control* 2017;6:6.
36. Leong M, Picton R, Wratten M, Mahe A, Zimmerman PA. Baseline evaluation of the World Health Organization (WHO) infection prevention and control (IPC) core components in Pacific Island countries and territories (PICTs). *Antimicrob Resist Infect Control* 2024;13:108.
37. Matee M, Mshana SE, Mtebe M, *et al.* Mapping and gap analysis on antimicrobial resistance surveillance systems in Kenya, Tanzania, Uganda and Zambia. *Bull Natl Res Cent* 2023;47:12.
38. Yamba K, Chizimu JY, Mudenda S, *et al.* Assessment of antimicrobial resistance laboratory-based surveillance capacity of hospitals in Zambia: findings and implications for system strengthening. *J Hosp Infect* 2024;148:129–137.
39. World Health Organization. *Surveillance of health care-associated infections at national and facility levels*. 2024. https://www.who.int/publications/i/item/9789240101456.
40. Allegranzi B, Kilpatrick C, Storr J, Kelley E, Park BJ, Donaldson L. Global infection prevention and control priorities 2018–22: a call for action. *Lancet Glob Heal* 2017;5:e1178–e1180.