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Strengthening infection prevention and control in humanitarian settings: lessons and opportunities from Médecins Sans Frontières (2021–2023)

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ABSTRACT

Background Effective infection prevention and control (IPC) is fundamental to patient safety in low-resource settings, yet its implementation remains a challenge. Standardised tools are essential for assessing IPC programmes and guiding improvements. This study evaluates the implementation level of IPC across global Médecins Sans Frontières (MSF) supported facilities using the Stepwise Infection Prevention and Control Approach (SIPCA) assessment tool.

Methods A retrospective analysis of 374 SIPCA assessments from 173 MSF-supported facilities was conducted between August 2021 and December 2023. Overall and component-specific IPC scores were analysed and a mixed-effects logistic regression model was used to identify factors associated with higher IPC performance. Changes in scores over time were stratified by initial IPC level.

Results The overall median IPC score was 60.4%, corresponding to an 'upper-intermediate' level of implementation. The presence of a formal IPC programme (OR 6.47, p<0.001) and a bed occupancy rate below 90% (OR 2.94, p=0.001) were the strongest predictors of achieving a score above the median IPC threshold. Repeated assessments were associated with significant improvement, particularly for facilities starting at a 'basic' level (median score increase of +21.6%). However, a ceiling effect was observed, with minimal improvement in facilities already at an 'upper-intermediate' level. Key programme weaknesses were identified in healthcare-associated infections (HAIs) surveillance, particularly regarding surgical site infections (40.6%).

Conclusions The SIPCA tool is effective for monitoring IPC status and guiding IPC interventions in humanitarian contexts. To enhance patient safety, efforts must focus on establishing IPC programmes and addressing systemic pressures, such as high bed occupancy rates. Targeted strategies are necessary to strengthen HAI surveillance and help high-performing facilities overcome performance plateaus, ultimately achieving advanced levels of IPC excellence.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Infection prevention and control (IPC) is under-resourced in many low- and middle-income countries and humanitarian settings.

⇒ Existing tools, such as IPC Assessment Framework, are not always well-suited for operational use in humanitarian contexts.

WHAT THIS STUDY ADDS

⇒ Stepwise Infection Prevention and Control Approach (SIPCA) enables repeated, facility-level IPC assessments across diverse Médecins Sans Frontières operational settings.

⇒ The presence of a dedicated IPC programme and bed occupancy below 90% are strong predictors of higher IPC scores.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ SIPCA can inform global IPC benchmarking in fragile and resource-limited health systems.

⇒ Repeated assessments can drive measurable improvements in IPC, even with limited resources.

INTRODUCTION

Patient safety is a fundamental element in the delivery of high-quality healthcare services, focusing on the prevention and avoidance of any injury to patients during their treatment.[1] However, healthcare-associated infections (HAIs) pose a significant threat to the safety of both patients and healthcare staff.[2] HAIs rank among the most prevalent adverse events linked with healthcare provision.[3] These infections, frequently attributed to multidrug-resistant organisms, have repercussions not only for patients but also for visitors and healthcare workers (HCWs), imposing a substantial burden on healthcare systems through increased costs.[4] Within acute-care hospitals, 7 out of every 100 patients in high-income countries and 15 in low- and middle-income countries (LMICs) are likely to acquire at least one HAI during their hospital stay.[3]

The relationship between antimicrobial resistance (AMR) and HAIs in LMICs has been well documented.[5–8] The incidence of difficult-to-treat pathogens due to AMR is on the rise in these countries, raising alarms for both the healthcare and public health sectors globally. Projections estimate that the toll of AMR on LMICs could reach a staggering US$100 trillion by 2050.[4] In various nations, the prevalence of resistant organisms associated with antibiotic treatment is increasing[9]; as a result, approximately 1.27 million deaths worldwide in 2019 were directly linked to bacterial AMR.[10]

In response to this escalating issue, an array of guidelines and initiatives has emerged aimed at preventing HAIs. Nevertheless, despite the focus on this matter and emerging evidence showcasing effective strategies to mitigate HAI rates,[11] the challenge persists, particularly as the COVID-19 pandemic has highlighted substantial gaps in infection prevention and control (IPC) measures. Early observations during the pandemic revealed that up to 44% of SARS-CoV-2 infections were contracted within hospital settings.[12] The implementation of IPC measures in LMICs often faces significant barriers, including limited financial resources and inadequately trained personnel. Therefore, there is an urgent need for a systematic approach to identify deficiencies in IPC procedures and to implement effective and affordable interventions.

Numerous international organisations have also crafted tools to monitor and guide the prevention of the transmission of infections among patients and HCWs. For instance, the US Agency for International Development has developed the Infection Control Assessment Tool[13]; however, it is highly detailed and resource-intensive, making routine use difficult in staff-constrained settings. The US Centers for Disease Control and Prevention (CDC) has established the Infection Control Assessment and Response[10] Tool, applicable across various care settings; however, a bit limited since it was developed for rapid evaluation during outbreaks. The World Health Organisation (WHO) has presented the Assessment Tool of the Minimum Requirements for IPC Programmes at the National Level (IPCAT)[14] for primary,[15] secondary[16] and tertiary healthcare facilities.[17] IPCAT focuses on system-level indicators and may not be adequate for field hospitals, mobile structures or emergency projects.

To methodically address these gaps, Médecins Sans Frontières (MSF) developed the Stepwise Infection Prevention and Control Approach (SIPCA) in 2017. This structured tool is intended to evaluate and enhance IPC practices in secondary and tertiary healthcare facilities. SIPCA adopts a stepwise methodology, facilitating a nuanced assessment of IPC implementation, identifying shortcomings and prioritising corrective actions based on practicality and potential impact. Unlike many existing IPC assessment tools, SIPCA is not a simplistic binary checklist but rather incorporates scoring criteria that gauge the adequacy of IPC frameworks and practices, enabling facilities to monitor their advancement over time and modify their strategies accordingly. SIPCA (questionnaire available at: https://ee.msf.org/x/FhAs6Oz3) differs from the WHO's IPC Assessment Framework (IPCAF), which aims to evaluate the maturity of IPC practices. In contrast, SIPCA was developed explicitly by MSF for use in healthcare settings operating in resource-limited and conflict-affected environments, ensuring its practical applicability within MSF-supported initiatives, where infrastructure and IPC capabilities can vary considerably. This customisation makes SIPCA a more suitable tool for assessing IPC effectiveness and guiding targeted interventions at the facility level within MSF contexts.

Although extensive evaluations of the WHO IPC core components have been conducted in healthcare facilities,[18] assessments within MSF-supported healthcare settings, which are typically located in resource-limited environments, remain limited. This study aims to evaluate the state of IPC implementation in MSF secondary and tertiary healthcare facilities from 2021 to 2023, identify common gaps and explore the relationships between specific organisational factors and IPC levels. By retrospectively analysing the results of the SIPCA tool, this research seeks to provide insights into current IPC shortcomings and guide targeted improvement efforts in MSF-supported facilities. Ultimately, addressing these IPC gaps, particularly in resource-limited settings, is crucial for enhancing patient outcomes, mitigating the burden of AMR and bolstering global health security.

METHODOLOGY

SIPCA tool was conceptualised in 2017 by a panel of IPC experts from MSF. Between 2017 and 2021, the tool underwent an iterative piloting phase across diverse clinical settings. Systematic feedback was collected from both subject matter experts and end users to ensure content validity and field applicability. Following this longitudinal refinement process, the final version of the SIPCA tool was formally ratified in 2021.

We performed a retrospective analysis of all routinely collected SIPCA assessment data from January 2021 to December 2023. A questionnaire-based method was utilised to collect data on organisational aspects and overall IPC performance within selected hospitals. The SIPCA assessment tool was not modified during the study period. The sample consisted of all secondary and tertiary healthcare facilities within MSF projects that had their IPC status assessed using the SIPCA assessment tool every six months or at least once a year during the study period. The total available sample was 374 SIPCA assessments from 173 MSF health facilities worldwide.

Data collection was conducted by the IPC focal persons, who gathered responses to SIPCA questions over a period. Data entries were recorded either through the web version of KoboToolbox or the KoboCollect Android app. The collected data were exported directly from the KoboCollect server into a Microsoft Office Excel spreadsheet and securely stored on a SharePoint site, maintaining confidentiality and anonymity throughout the research process.

The SIPCA assessment tool comprises nine components, each with stepwise questions that range from 2 to 5 options. On this scale, option 1 indicates a false or non-existent statement. In contrast, the final option signifies the ideal condition, with each step representing a progressive level of improvement (questionnaire available at: https://ee.msf.org/x/FhAs6Oz3). Total SIPCA scores were converted to percentage scores and categorised into five IPC performance levels: inadequate (level 1: <40%), basic (level 2: 40%–49%), intermediate (level 3: 50%–64%), upper-intermediate (level 4: 65%–79%) and advanced (level 5: ≥80%) (online supplemental table S1).

For this study, the presence of a functional IPC programme was defined using a slightly adapted version of the WHO's minimum requirements for IPC programmes.[14] The criteria included: (1) at least one full-time trained IPC focal point, (2) an IPC programme aligned with the MSF strategy (and national programme where applicable) and (3) a multidisciplinary IPC committee/team. The 'dedicated budget' requirement, as per the WHO, was not considered, as MSF provides the required budget for project activities, including IPC activities. These criteria were assessed through specific questions within the SIPCA organisational component and verified through facility documentation during the assessment process.

SIPCA evaluates the presence, structure, and processes of both HAI prevention practices and surveillance systems, including the incidence of surgical site infections (SSIs) and catheter-related bloodstream infections (CRBSIs). SSI and CRBSI are prioritised above other HAIs due to the nature of MSF's interventions and patients. SSI was defined as an infection occurring in the part of the body where the intervention took place: (1) occurring within 30 days after the operative procedure (where day 1=the procedure date) for superficial SSI that involves the skin or subcutaneous tissue, or (2) up to 90 days for deep or organ/space SSI and (3) until 1 year after an implant procedure for implant-associated infections.[19] CRBSI was defined as a clinical and laboratory-confirmed diagnosis where a bloodstream infection is identified as originating specifically from an intravascular catheter.[20]

Descriptive statistics were employed to summarise the results, including frequencies and percentages for the number of assessments, individual component scores and total SIPCA scores. Trends in IPC performance over time were assessed visually using line and box plots. Spearman's rank correlation was used to evaluate the relationship between organisational and non-organisational IPC component scores.

To identify predictors of higher IPC performance, we defined higher non-organisational IPC scores as those greater than 120 (representing above-median performance). A multivariable mixed-effects logistic regression model was conducted to identify factors independently associated with higher scores. Variables tested included the functional IPC programme (as defined by the WHO's minimum requirements), bed occupancy rate (BOR) (<90% vs ≥90%), geographical region, year of assessment and baseline organisational IPC component scores. For the regression model, adjusted odds ratios (aORs), 95% confidence intervals (CIs) and p-values were reported, with statistical significance established at p<0.05. Missing data were dealt with by limiting analyses to completed surveys overall or by specific components.

Data analysis was conducted using R version 4.3.0. The deduplication process involved keeping one submission per day for each facility while selecting the first and last surveys of each year to meet the annual deadline of 31 December.

RESULTS

Study population and assessment overview

This analysis included 374 SIPCA assessments submitted by 173 MSF health facilities worldwide, covering the period from 9 August 2021 to 31 December 2023. After the deduplication steps—retaining one submission per day and selecting the first survey overall and the last survey per year for each facility—all 374 assessments were included.

The overall distribution of included assessments by WHO Region and by year is shown in online supplemental figure S1). The highest number of assessments was recorded in 2022 (n=160). The Africa region consistently accounted for the largest share of assessments each year (n=199, 53%). The Eastern Mediterranean region was the second largest contributor (n=135, 36%). Other regions, including South-East Asia (n=20), the Americas (n=10), Europe (n=7) and the Western Pacific (n=3), had comparatively smaller numbers of assessments (online supplemental figure S1).

Patterns of repeat assessments

Out of the 173 facilities, 52 (30%) submitted only one assessment, while 121 (70%) submitted multiple assessments. Among those with multiple submissions, 103 (59.5%) submitted across different years, and 18 (10.4%) submitted multiple surveys within a single year. 40 facilities (23%) submitted at least one assessment in each of the 3 years (2021–2023) (figure 1).

Overall IPC score distribution

The overall median IPC percentage score across all 374 assessments was 60.4% (IQR: 48.4%–70.6%; Range: 24.3%–98.2%). The distribution of the dataset within each IPC level was as follows: 44.1% at upper-intermediate (level 4), 37.4% at intermediate (level 3), 11.5% at basic (level 2) and 7% at advanced (level 5)

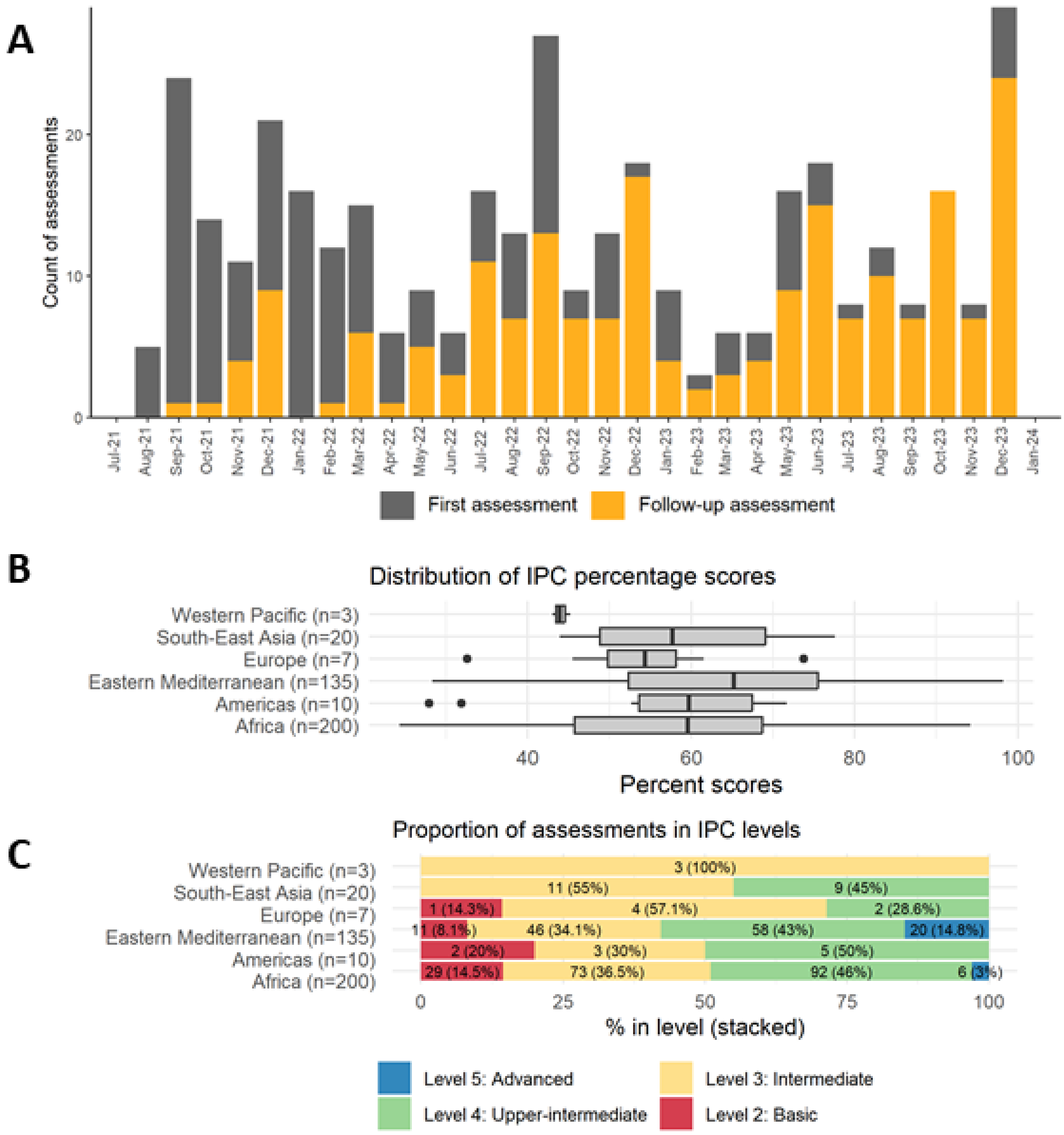

Figure 1 (A) Number of assessments by month and whether first/follow-up. (B) Distribution of IPC percentage scores and proportion of assessments in IPC levels by WHO Region. (C) Proportion of assessments by IPC levels. IPC, infection prevention and control.

(online supplemental Table S1) for IPC level definitions). The Eastern Mediterranean region demonstrated the strongest performance, with a median of 65.2% (14.8% at the advanced level and 43% at the upper-intermediate level). In contrast, the Western Pacific region showed the lowest median score (43.9%). The Africa region exhibited significant heterogeneity, with a median of 59.4% (ranging from 45.7% at the upper-intermediate level to 14.6% at the basic level) (figure 1).

Component-specific IPC scores

Table 1 presents the median percentage scores for each IPC component. Overall, the Hand Hygiene component had the highest median percentage score (76.7%), followed by organisational factors (65.6%) and built environment (61.5%). Diagnostics and ancillary also performed well (both 60%). The lowest median scores were in transmission precautions (55.3%) and SSI (40.6%).

Regional analysis revealed notable disparities. The Eastern Mediterranean region showed higher median scores in Organisational Factors (68.8%), Built Environment (66.7%) and Hand Hygiene (83.3%). In contrast, the Western Pacific region exhibited lower median scores, notably in Organisational Factors (31.2%) and Diagnostics (20%). Europe and South-East Asia presented comparatively lower scores in SSIs (9.4% and 18.8%, respectively), and CRBSI monitoring was reported in a limited number of facilities, although performance was comparatively high.

Facilities that initially scored level 2 (basic) experienced the most significant improvement in median IPC percentage scores between first and most recent

Table 1 Median percentage scores for IPC components by time since first SIPCA assessment

Time since first SIPCA assessment	0 to <6 months	6 to <12 months	12 to <18 months	18 to <24 months	2 to <3 years	First	Last	Total
Total assessment	7	34	30	35	15	121	121	242
Total score	50.2% (111)	59.5% (144.5)	60.8% (154.5)	70.3% (170)	71.5% (169)	55.7% (134)	64.2% (157)	61% (145)
Organisational factors (7q, max 32 pts)	59.4% (19)	62.5% (20)	62.5% (20)	75% (24)	71.9% (23)	62.5% (20)	68.8% (22)	65.6% (21)
Built env. (8q, max 39 pts)	53.8% (21)	65.4% (25.5)	57.7% (22.5)	66.7% (26)	71.8% (28)	56.4% (22)	64.1% (25)	61.5% (24)
Ancillary (8q, max 30 pts)	40% (12)	60% (18)	61.6% (18.5)	70% (21)	73.3% (22)	56.7% (17)	63.3% (19)	60% (18)
Hand hygiene (6q, max 36 pts)	60% (18)	73.3% (22)	78.3% (23.5)	86.7% (26)	90% (27)	70% (21)	80% (24)	76.7% (23)
Env. cleaning (8q, max 36 pts)	50% (19)	54% (20.5)	60.5% (23)	68.4% (26)	76.3% (29)	52.6% (20)	57.9% (22)	55.3% (21)
Transmision precautions (9q, max 40 pts)	50% (20)	56.2% (22.5)	60% (24)	70% (28)	70% (28)	57.5% (23)	62.5% (25)	60% (24)
Diagnostics (1q, max five pts)	20% (1)	40% (2)	60% (3)	60% (3)	60% (3)	40% (2)	60% (3)	60% (3)
Surgical site infections (N with surgery)	3	12	13	19	8	57	55	112
Surgical site infections (7q, max 32 pts (calc if surgery performed)	34.4% (11)	39% (12.5)	37.5% (12)	53.1% (17)	48.5% (15.5)	37.5% (12)	46.9% (15)	40.6% (13)
CRBSI (N with CRBSI registration)	0	8	11	15	6	25	40	65
CRBSI (6q, max 30 pts (calc if CRBSI registered))	NA (NA)	63.4% (19)	66.7% (20)	96.7% (29)	90% (27)	66.7% (20)	71.7% (21.5)	70% (21)

Changes in IPC Scores over time.
CRBSI, catheter-related bloodstream infections; Env, environment; IPC, infection prevention and control; NA, not available; SIPCA, Stepwise Infection Prevention and Control Approach.

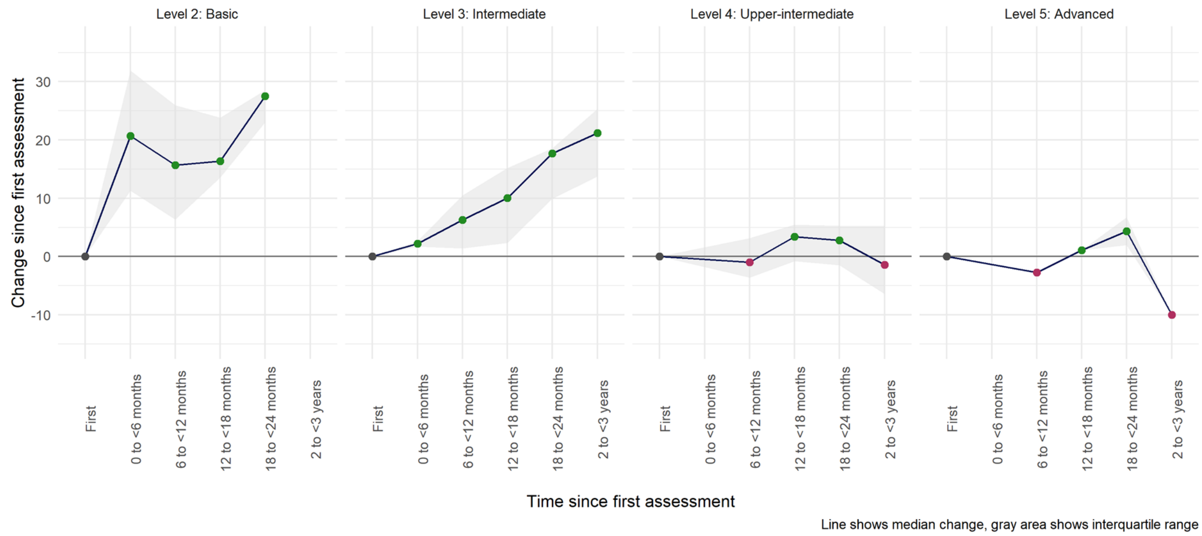

Figure 2 Change in IPC scores (Median percentage score difference) by starting level and time since first assessment. IPC, infection prevention and control.

assessments, with a median increase of 21.6%. Those beginning at level 3 (intermediate) had a more modest positive median improvement of 5.5%. In contrast, facilities initially at level 4 (upper-intermediate) and level 5 (advanced) showed slight median declines (−0.4% for both). Across all repeat assessments, the overall median difference was a 5.5% increase (figure 2).

Association between organisational ipc scores and overall IPC level

Organisational IPC components including the presence of IPC supervisor and manager, their qualifications and experience, and active IPC committee, a rational IPC action plan, available IPC guidelines, bed occupancy management, IPC training programmes and visitors policies were strongly correlated with the total score on non-organisational IPC components (figure 3). The positive correlation statistically significant association (ρ=0.82, p<0.001), suggests that facilities with stronger organisational systems tend to perform better across all other IPC components.

Factors Associated with Higher Non-Organisational IPC Scores. Multivariable logistic regression analysis identified several significant factors associated with higher IPC scores (defined as scores >120 points). compared with the baseline (first survey), subsequent surveys showed a strong association with higher scores: the second survey had 3.63 times the odds (95% CI 1.82 to 7.24, p<0.001), and the third survey had 15.8 times the odds (95% CI 5.23 to 47.5, p<0.001).

Furthermore, facilities with a bed occupancy score corresponding to a rate <90% showed significantly increased odds (aOR=2.94, 95% CI 1.52 to 5.68, p=0.001) of higher scores. Most notably, the presence of an IPC programme was strongly associated with higher scores (aOR=6.47, 95% CI 2.56 to 16.3, p<0.001) (table 2).

Figure 3 Relationship between organisational factors and other components.

Table 2 Factors associated with higher non-organisational IPC scores: multivariable analysis

Variable	Adjusted OR (95% CI)	95% CI	P value
Survey number			
1 (Reference)	1.00		
2	3.63	1.82 to 7.24	<0.001
3	15.8	5.23 to 47.5	<0.001
4	1.72	0.22 to 13.5	0.6
Survey year			
2021 (Reference)	1.00		
2022	0.25	0.10 to 0.59	0.002
2023	0.20	0.07 to 0.58	0.003
Bed occupancy rate ≥3	2.94	1.52 to 5.68	0.001
The IPC programme	6.47	2.56 to 16.3	<0.001

IPC, infection prevention and control.

DISCUSSION

This comprehensive survey, analysing 374 assessments from 173 MSF facilities between 2021 and 2023, indicates that overall IPC performance across MSF projects is at an 'intermediate' to 'upper-intermediate' level (levels 3 and 4). However, this general alignment masks notable deficiencies, particularly in SSIs, which had the lowest median score of 40.6%, and transmission precautions (55.3%). These two components consistently underperformed across most WHO regions, with particularly low scores observed in Europe (SSI: 9.4%) and South-East Asia (SSI: 18.8%). A primary finding of this research is the clear benefit of repeated IPC assessments; facilities that began at a 'basic' level showed the most significant improvement on reassessment (median increase of 21.6%), suggesting the SIPCA tool acts as a mechanism for change rather than just evaluation. Moreover, the results also noted a performance plateau among facilities that initially scored level 4 (upper-intermediate) or level 5 (advanced). This suggests that reaching excellence once foundational IPC is in place requires more advanced programmes, potentially including further system strengthening, robust HAI surveillance, and behavioural change interventions.

Our findings align closely with the global picture. A 2021 WHO report[2] analysing IPCAF data from 81 countries found the global median score to be 'intermediate', a level also reported in national studies from Kazakhstan[15] and China.[16] The specific deficiencies we identified mirror patterns documented in other resource-limited settings. Studies from Afghanistan[17] reported similarly low scores in HAI surveillance and surgical care practices, while assessments from Pakistan[18] identified transmission-based precautions as a critical gap. In Uganda[19] and Papua New Guinea,[20] researchers documented similar challenges in maintaining isolation precautions and surgical antibiotic prophylaxis. This convergence of findings suggests these are not isolated deficiencies but rather reflect common programmatic weaknesses in implementing complex, resource-intensive IPC interventions in humanitarian contexts.[21] Our study identified a substantial regional heterogeneity; there was an overall lower performance of the Western Pacific region and very low SSI scores in Europe and South-East Asia. These differences may reflect variations in the project typologies (surgical, neonatal, etc), staff stability, access to supplies, different levels of security, etc.

This is the first multicountry analysis of SIPCA implementation within MSF-supported facilities, providing evidence from settings where data reporting is often scarce. The demonstration that repeated assessments are associated with improvements suggests that SIPCA functions not only as a measurement tool but also as a driver of change.

The strong positive correlation between organisational factors and non-organisational IPC performance observed in this study provides empirical evidence for the critical role of organisational commitment. The multivariable regression analysis identified the presence of a functional IPC programme as the strongest independent predictor of higher scores (aOR=6.47, p<0.001). This demonstrates that organisational factors such as the presence of an IPC supervisor, manager, and committee, their level of qualification and possibility to follow dedicated training programmes, the existence of an IPC action plan, IPC guidelines, visitors and caretakers policy, and a controlled BOR are the foundational framework that enables effective implementation of technical IPC practices.

Furthermore, this study highlights the significant impact of systemic pressures. Facilities with a BOR below 90% were significantly more likely to achieve higher IPC scores (aOR=2.94, p=0.001). This corroborates global data linking 'workload, staffing and bed occupancy' to lower IPC performance.[2] High occupancy rates strain resources, reducing the time available for essential tasks such as environmental cleaning and patient isolation.

The primary strength of this study lies in its large and diverse dataset, comprising 374 assessments from 173 facilities across multiple WHO regions, which allows for the robust identification of trends in varied resource-limited contexts. However, the SIPCA tool has not undergone formal external validation against independent IPC performance indicators, which may limit the precision of performance estimates. Other limitations include the use of self-reported questionnaires, which introduces potential reporting bias and variability in interpretation. In addition, the absence of a formal assessment of inter-rater reliability or construct validity may introduce measurement error in component scoring. Such measurement error could influence the magnitude of observed associations in the regression analysis. Also, there is a potential selection bias as the facilities that completed SIPCA might represent those with stronger IPC engagement and support. Conversely, most challenging environments might be underrepresented. Furthermore, the retrospective, cross-sectional design limits the ability to make causal inferences. While we identified associations between organisational factors and IPC performance, we cannot definitively rule out confounding variables such as facility size or external support mechanisms, and findings should therefore be interpreted with caution. Additionally, incomplete optional questions in the SSI and CRBSI sections limited the analysis for those specific components.

This study confirms that the SIPCA tool is highly valuable for systematically evaluating IPC implementation. The evidence underscores that establishing and maintaining a formal, well-resourced IPC programme is the single most influential factor for success. Our findings provide a clear framework for policymakers and implementing partners to prioritise action: addressing systemic gaps such as bed occupancy and building capacity for HAI surveillance are urgent priorities.

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Contributors AB designed the study. AB, MP, AM and PGV conducted data extraction and analysis. AB drafted the first version of the manuscript. All authors contributed to the interpretation of results, critical revisions and approved the final manuscript. AB is the guarantor. No, I have not used AI.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involved secondary analysis of routinely collected programme data and did not include identifiable patient-level information. According to Médecins Sans Frontières (MSF) Ethics Review Board guidance, analyses of routine, anonymised operational data are exempt from formal ethical review. Permission to use and analyse SIPCA assessment data was obtained from the MSF Operational Centre Amsterdam (OCA).

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Data availability statement Data are available on reasonable request. Data are available on request in accordance with the MSF Data Sharing Policy, see http://fieldresearch.msf.org/msf/handle/10144/306501. Requests can be directed to data.sharing@msf.org .

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