

ORIGINAL ARTICLE

Towards a framework for a collaborative support model to assist infection prevention and control programmes in low- and middle-income countries: a scoping review

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Abstract

**Background:** Infection prevention and control (IPC) in low- and middle-income countries (LMIC) is reported to be poorly supported because of limits in financial, human and physical resources and competing priorities in health budgets. As a result, there is often a role for external agencies to assist in strengthening IPC. While there are reports of how these partnerships have been put into practice, there are no reported frameworks or guidance documents to support the development of such relationships.

**Aim:** The aim of this study is to identify the core elements of a collaborative support framework to assist LMIC in strengthening IPC.

**Methods:** To achieve this, a systematic scoping review of available literature was conducted based on the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA 2020). The databases MEDLINE, CINAHL, Embase and Scopus were utilised. The search strategy included different combinations of Medical Subject Heading (MeSH) terms, Emtree and keywords that are relevant to IPC collaboration in LMIC. Literature was limited to that published between 2005 and 2020 in the English language only.

**Results:** Six core elements of comprehensive IPC collaborative support were identified with five IPC programme areas as minimum requirements, namely: 1) Collaborative Projects, 2) Policies and Procedures, 3) Training and Professional Development, 4) Surveillance Systems and 5) Assessment and Feedback. The last element, 6) Partnerships, was identified as an enabling factor.

**Conclusion:** These six core elements should be considered when building a collaborative support model to assist IPC in LMIC.

Keywords: *infection control; healthcare systems; collaboration; low- and middle-income countries*

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Infection prevention and control (IPC) is a continuous quality improvement governance activity undertaken to minimise the spread of infections within the continuum of health care. The World Health Organization (WHO) defines IPC as ‘a scientific approach and practical solution designed to prevent harm caused by infection to patients and health workers ...’ (1). At health delivery ‘points of care’, IPC programmes aim to prevent and control healthcare-associated infections (HAI) and antimicrobial resistance (AMR). According to the WHO, ‘a strong, effective and sustained IPC programme ultimately strengthens health systems and supports the

delivery of high quality, people-centred and integrated health services...’ (2).

In 2016, the WHO released ‘Guidelines on Core Components of IPC Programmes’, which identify six components: 1) IPC Programmes, 2) IPC Guidelines, 3) Education and Training, 4) HAI Surveillance, 5) Multimodal Strategies for Implementing IPC Activities and 6) Monitoring and Evaluation at the national and facility level, and the additional components of 7) Workload, Staffing and Bed Occupancy and 8) Built Environment, Materials and Equipment for IPC at the facility level more specifically (2). These components work

together as a comprehensive programme to prevent current and future infectious disease threats, strengthen health services and assist in combatting AMR.

Integrating IPC programmes in health systems generally embodies a varying degree of partnerships and collaboration across disciplines within health (3–8). In low- and middle-income countries (LMICs) where health systems are weak, available support and international assistance to health projects are often fragmented and poorly coordinated, failing to achieve desired outcomes such as the successful integration, implementation and evaluation of IPC programmes. A well-structured collaboration among multidisciplinary teams and sectors is vital when embedding IPC into health systems (9). Collaborative practice for IPC programming in LMIC is thus necessary to bring health professionals and supporting agencies to render integrated services to patients, their families or carers and communities (10–12).

This collaborative process requires effective leadership and ownership by local agencies with support from external partners to assure sustainability (13). External partners from higher-resourced settings benefit from best practices and guidelines that may not be readily available in lesser-resourced settings (14–16). Identifying elements of an IPC collaborative and the types of support needed is therefore an important first step in the development of an evidence-based IPC collaborative support framework to guide IPC programmes in LMIC (17–19).

This scoping review seeks to explore available literature on IPC collaboration models and the support mechanisms available for development and improvement in IPC programmes in LMIC. By identifying elements of an IPC collaborative support framework, the review aims to provide insight and synergy in applying the WHO core components of IPC to various health settings within LMIC. The findings of this review will contribute knowledge on IPC collaborative best practices to enhance the ongoing efforts of practitioners, policymakers and researchers in LMIC.

## Methods

### Design

A systematic scoping review designed to answer the research aim and based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA 2020) guidelines was undertaken (20). For this review, we operationally defined collaborative support as IPC partnerships where an organisation, which could be either a health-care facility or network, has support and assistance from an external partner – either a local or high-income source.

### Search strategy and data collection

We searched four databases and search engines for published literature: MEDLINE, CINAHL, Embase and

Scopus. The search strategy included different combinations of Medical Subject Headings (MeSH) terms, Emtree and keywords that are relevant to IPC collaboration in LMIC. All proposed MeSH, Emtree and keywords are outlined in Table 1. Terms and keywords in the columns were combined using the OR search strategy, while terms and keywords in the rows were combined using AND combinations. Records obtained from databases were exported to an EndNote™ (Version 20, Clarivate, London, UK) library for reference management, where all references were merged and duplicates removed. Titles of the initial records retained after the removal of duplicates were checked before abstract screening and full-text review. Where there were conflicts in article selection, another reviewer was involved in reaching a consensus.

### Exclusion and inclusion criteria

Inclusion criteria were structured using the Joanna Briggs Institute (JBI) manual for reporting evidence synthesis (21) to predetermine our review categories as indicated in Table 2. In addition, studies were limited by date from the year 2005 – 2020 with additional limits as described in Table 2. The year 2005 was selected to capture the period countries began to report on national IPC efforts as part of the International Health Regulations (22).

### Data extraction and analysis

Our data analysis followed what Arksey and O'Malley (25) describe as data charting. We used a narrative review approach to broadly explore the data, recording the critical processes of each collaboration and contextualising relevant outcomes in line with our research aim. We developed a descriptive-analytical frame based on study characteristics and inclusion criteria, using a Microsoft Word table (Microsoft Corporation, Redmond, WA, USA, 2018) and applied the framework to all included studies. Information extracted from each paper included: author(s), year of publication, study design, study aim/objective and type of collaborative support. The rest of the extracted information included IPC collaborative intervention/model and key findings from the included studies. We did not consider the quality of evidence nor assess the generalisability and robustness of findings because the expectation was to provide a narrative account of the literature rather than aggregating findings from different studies (25). Data extracted to inform this scoping review are displayed in Supplementary Table 1, representing information retrieved and summarised into minimum requirements. By minimum requirements, we argue that the elements identified are non-exhaustive and could be expanded.

## Results

Following the PRISMA protocol and the scoping review process, a total of 22 full-text studies were considered

Table 1. Search terms

Concepts	Key Terms/Medical Subject Heading (MeSH) Terms
Collaborative Support model/ 'Collaborat*'	'cooperat*' OR 'coordinat*' OR 'collaborat*' OR 'partnership' OR 'collective action'
Infection prevention and control	'IPC' OR 'infection prevention' OR 'infection precaution' OR 'infection control' OR 'infection management' OR 'health care-associated infections' OR 'surgical site infections' OR 'central line-associated bloodstream infection' OR 'pneumonia' OR 'IPC to combat antimicrobial resistance' OR 'injection safety' OR 'nosocomial' OR 'catheter-associated bloodstream infections' OR 'catheter-associated urinary tract infections' OR 'surgical mask*' OR 'surgical mask' OR 'hand washing' OR 'surgical site infection'
Models	'models' OR 'program*' OR 'principles' OR 'framework' OR 'guidelines' OR 'strateg*' OR 'initiative' OR intervention
Primary Focus	'Health' OR 'National Health Systems' OR 'Healthcare system' OR 'Acute healthcare' OR 'Long-term healthcare' OR 'Homecare' OR 'Community Care' OR 'Community engaged space' OR "Workplace"
LMIC	Afghanistan OR Albania OR Algeria OR 'American Samoa' OR Angola OR Armenia OR Azerbaijan OR Bangladesh OR Belarus OR Belize OR Benin OR Bhutan OR Bolivia OR 'Bosnia and Herzegovina' OR Botswana OR Brazil OR Bulgaria OR 'Burkina Faso' OR Burundi OR 'Cabo Verde' OR Cambodia OR Cameroon OR 'Central African Republic' OR Chad OR China OR Colombia OR Comoros OR 'Democratic Republic of Congo' OR Congo OR 'Costa Rica' OR 'Cote d'Ivoire' OR 'Ivory Coast' OR Cuba OR Djibouti OR Dominica OR 'Dominican Republic' OR Ecuador OR Egypt OR 'Arab Republic' OR 'El Salvador' OR 'Equatorial Guinea' OR Eritrea OR Eswatini OR Ethiopia OR Fiji OR Gabon OR 'The Gambia' OR Georgia OR Ghana OR Grenada OR Guatemala OR Guinea OR 'Guinea Bissau' OR Guyana OR Haiti OR Honduras OR India OR Indonesia OR Iran OR 'Islamic Republic' OR Iraq OR Jamaica OR Jordan OR Kazakhstan OR Kenya OR Kiribati OR 'Democratic People's Republic of Korea' OR Korea OR Kosovo OR 'Kyrgyz Republic' OR 'Lao PDR' OR Lebanon OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Malaysia OR Maldives OR Mali OR 'Marshall Islands' OR Mauritania OR Mauritius OR Mexico OR Micronesia OR Moldova OR Mongolia OR Montenegro OR Morocco OR Mozambique OR Myanmar OR Namibia OR Nauru OR Nepal OR Nicaragua OR Niger OR Nigeria OR 'North Macedonia' OR Pakistan OR 'Papua New Guinea' OR Paraguay OR Peru OR Philippines OR Romania OR 'Russian Federation' OR Rwanda OR Samoa OR 'Sao Tome and Principe' OR Senegal OR Serbia OR 'Sierra Leone' OR 'Solomon Islands' OR Somalia OR 'South Africa' OR 'South Sudan' OR 'Sri Lanka' OR 'St Lucia' OR 'St Vincent and the Grenadines' OR Sudan OR Suriname OR 'Syrian Arab Republic' OR Tajikistan OR Tanzania OR Thailand OR 'Timor-Leste' OR Togo OR Tonga OR Tunisia OR Turkey OR Turkmenistan OR Tuvalu OR Uganda OR Ukraine OR Uzbekistan OR Vanuatu OR Venezuela OR Vietnam OR 'West Bank of Gaza' OR Yemen OR Zambia OR Zimbabwe OR Africa OR 'sub-Saharan Africa' OR 'low and middle income countr*' OR 'low income countr*' OR 'Low OR middle income countr*' OR 'Low and middle income countr*' OR 'LMIC*' OR 'developing country' OR 'underdeveloped country' OR 'resource limited' OR 'Central America' OR 'Latin America' OR 'Small Island States' OR 'South Asia' OR 'Middle East'

Table 2. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Language: English.	-Duplicates
Year: Published between 2005–2020.	-Studies only met external partner's needs
Region: Local partner country or region within the bloc of LMIC based on the World Bank classification of economies for analytical purpose using GNI (23).	-Studies on large-scale infectious disease and AMR outbreak responses
Study relevance based on JBI Manual for Evidence Synthesis (21).	-Studies on research and training for tropical disease management
Participants: Infection control professionals, other health workers, families, patients, communities and relevant multidisciplinary teams with stake in IPC collaboratives.	-Studies focusing on project interventions without clear reflection on partnerships
Concept: Study on collaborative models, frameworks or approaches for infection control. IPC collaborative led by local partners with local or external support.	-Studies describing community-based partnership for health delivery
Context: IPC collaborative programmes at national health systems or within health facilities in LMIC with a focus on acute and long-term care settings; community-engaged spaces including community health facilities; office-based practices settings including general practice clinics, dental clinics and paramedical settings (24).	-All other studies except those IPC collaboratives occurring across LMIC and high-income countries where local partners exercised direct control and received some sort of support in addressing a common need
Type of evidence: All types of evidence with title, abstract and full text returned by the databases as illustrated in the PRISMA flow diagram.	

for inclusion; 15 met inclusion criteria and seven were further excluded with reasons stated in Table 2 and Figure 1. Findings from the data extraction and analysis process for the 15 records are presented in two parts.

Firstly, we describe the study characteristics to ascertain the main areas of interest and the geographical reach of the studies as an initial step for gap identification. Secondly, we summarised findings by identifying the

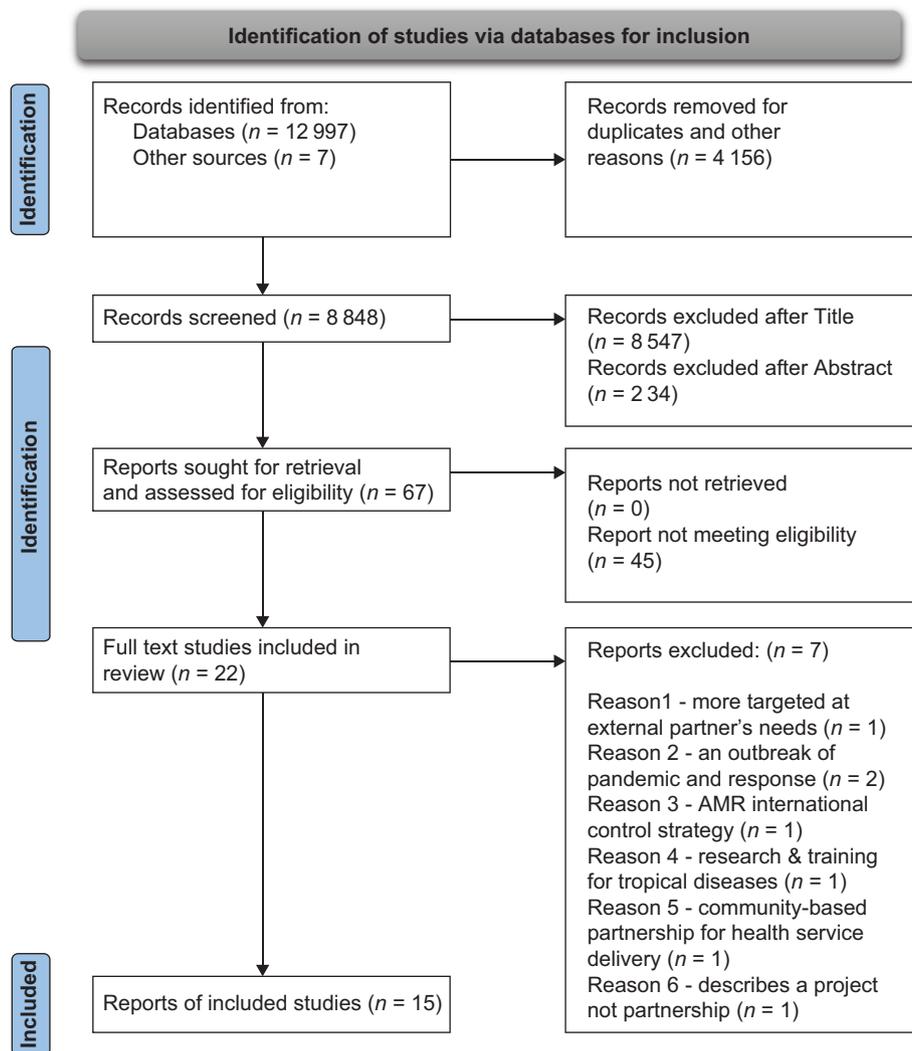


Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 Flow Chart (20).

core elements of IPC collaborative and support mechanisms.

#### Study characteristics

We found that 11 (73%) out of the 15 records published between 2005 and mid-2020 had only been published in the last 10 years. The average publication was two studies per year within that decade, and these were evenly spread across the years. When we considered study designs, most papers were identified as case reports ( $n = 12$ , 80%) and the remaining three (20%) were two mixed-method papers and one qualitative report. Most of these articles had originated from the African, South Asian, South American and Caribbean regions. There were no records from LMIC within the Pacific region, including the Small Island States.

#### Core elements of infection prevention and control collaborations

The analysis of the current literature on IPC collaboration revealed six core elements of comprehensive IPC

collaborative support. Of the six core elements, we identified five minimum requirements: 1) Collaborative Projects, 2) Policies and Procedures, 3) Training and Professional Development, 4) Surveillance Systems and 5) Assessment and Feedback. The last element, 6) Partnerships, was identified as an enabling factor. The core elements are illustrated in Figure 2.

#### Collaborative projects

Collaborative projects were cited as the immediate outcome of IPC training and professional development activities, often marking the beginning of IPC at facility levels (26–27). These articles discussed project design in terms of knowledge assessment, assessing knowledge, learning modules development and dissemination, piloting and assessing effectiveness. They also addressed hazard identification, assessment and audits at the workplace and the provision of training in IPC as prerequisites to IPC project implementation, particularly for those that were hospital

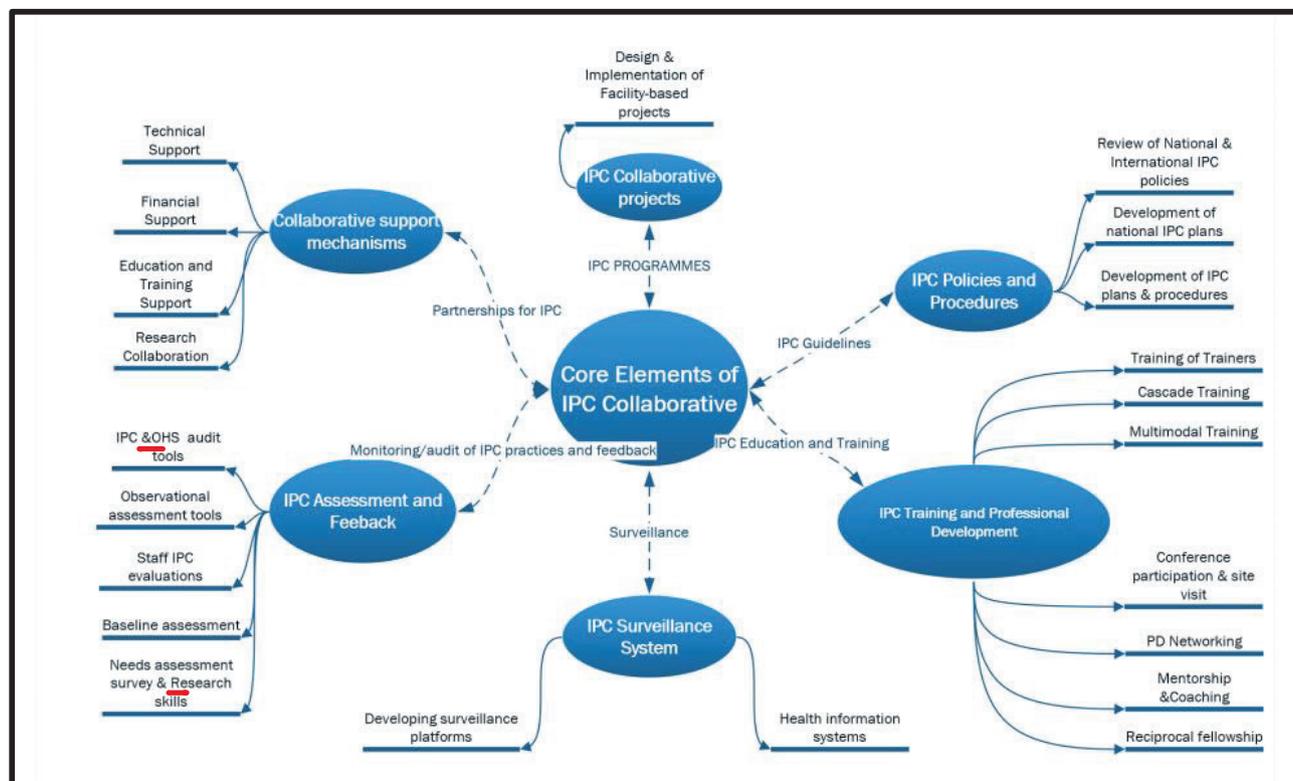


Fig. 2. Core elements of Infection Prevention and Control Collaborative Support.

based. Health facilities participating in the planning of IPC collaborative projects reported that practice variations between health disciplines were particularly challenging, especially when the desired outcome was to have an IPC project that captures IPC practices and data uniformly across the various institutions. Another associated difficulty was obtaining ethical approval across multiple institutions. However, the integration of different levels of stakeholders in capacity building and the institutionalisation of IPC measures were described as essentially helpful in designing nationwide programme dissemination (26–28). It was also found that engaging local staff in the development of IPC interventions within health facilities promoted local ownership and sustainability (27–29).

#### Policies and procedures

The literature notes an extensive review of national and international IPC guidelines as a prerequisite for developing national policies and procedures (28, 30–32). It also affirms that the effectiveness of an IPC programme depends on the use of multimodal strategies, which involves a regular review of plans, policies and procedures along with continuous improvements, monitoring, commitment and cooperation (31). Other miscellaneous components of guidelines, policies and procedures included forming working groups. It was noted that working groups of multidisciplinary stakeholders in IPC collaborations

provide opportunities for information exchange and support the lead agency in developing educational or training materials and resources (28). In some cases, interdisciplinary international collaboration was cited as a critical contributing factor to producing practical tools, frameworks and products associated with national IPC programmes (7).

#### Training and professional development

The core element of training and professional development was identified as the mainstay of IPC collaborative support accounting for 80% ( $n = 12$ ) of articles included in this review. While the ‘training of trainer’ activities using face-to-face interaction were the preferred training methods for in-country IPC collaborations, the evidence suggests training via virtual learning platforms is a preferred capacity-building modality in collaboratives involving out-of-country external partners (33, 34). This was particularly common in practices where online platforms are created with technological support from external partners for reciprocal fellowships, mentorship and feedback and the provision of educational resources, among others (31, 33–35). Training via virtual learning platforms in virtual collaborations was cited to promote knowledge sharing between and across teams from different settings, particularly in LMIC. These virtual collaborations were cited as an excellent alternative to bringing quality

improvement methods and evidence-based IPC interventions to LMIC at a lower cost (33). They were also regarded as the approach to provide the groundwork for uniform data collection to monitor improvements and to facilitate the dissemination of new information as well as ongoing initiatives (33, 34).

#### Surveillance systems

Surveillance emerged as one of the critical elements of IPC collaborations that were discussed in three articles included in the review. More specifically, this included the development of surveillance platforms and co-development of health information systems (34, 36). Surveillance platforms were described as part of the learning health system (LHS) for evaluating patient outcomes, developing prognostic models, conducting observational studies and facilitating quality improvements using real-time feedback systems in acute care settings in LMIC (36). Health information systems were discussed as the product of partnerships aimed at building IPC infrastructure using evidence-based information to support decision-making (34). Training and mentorship that combine pre-workshop activities and multidisciplinary grouping were considered pre-conditional activities necessary for promoting collaboration and engagement, which are needed to enhance surveillance and research skills in support of co-developed surveillance platforms (34, 37).

#### Assessment and feedback

Our analysis found that assessment and feedback mechanisms, including monitoring and evaluation activities and/or tools, are essential components of an IPC collaboration framework. These could be categorised into a set of baseline assessments, workplace needs assessments and staff IPC evaluation surveys that are implemented before the onset of an IPC project. To further improve and monitor adherence to standardised health procedures in evidence-based collaborative practices, various methods such as standardised data collection, safety audits and observational tools are used. In terms of feedback, it was found that collaborative taskforces used coaching and engagement to sustain and provide ongoing support and mentorship to an IPC collaboration (27, 28–33).

#### Partnerships

The partnerships identified through the analysis of included studies revealed two main themes: 1) collaborative models and 2) collaborative support mechanisms.

#### Collaborative models

The identified studies used different taxonomies to describe the collaborative activities commonly associated with IPC programmes in LMIC and two defined collaboration models. Selected collaborative activities include

forming an IPC joint task force, creating IPC working groups, establishing inter-disciplinary collaboration to promote professional development networking and creating the necessary conditions for local hospital collaboration to reduce HAI incidence (26, 28, 33, 35, 38). Of the articles included in our study, two described specific collaborative models for improvements in healthcare. These models include 1) the Breakthrough Series (BTS) collaborative model for the adoption of IPC bundles of care by the Institute of Health Improvement (IHI) (33) and 2) the previously mentioned LHS approach to improving care developed by the United States Institute of Medicine (34). The former found adaptation of the BTS model to virtual learning platform cost-effective in the LMIC context. The latter, however, described the LHS model as an effective tool for creating opportunities to reflect on challenges and best practices, set priorities and promote joint project development with avenues for ongoing support (33, 34).

#### Collaborative support mechanisms

We found that IPC programmes in LMIC were commonly associated with some form of development assistance or support among collaborating partners. The partners involved local or primary institutional stakeholders and their collaborating partners, mostly international organisations collaborating either through their local offices or remotely. Analysis of the types of collaborative support shows that five (33%) of the studies referred to financial support for collaborative ventures (26, 29, 33, 38–39). Financial support in local funding was almost absent, but external funding featured as the standard form of support received or given in IPC collaboratives.

The most preferred support type provided to an IPC collaborative is technical support, which was also discussed across 80% ( $n = 12$ ) of our included studies. Technical support was described in line with sharing educational resources, providing capacity-building support and providing educational assistance and advice. Further reference to technical support included providing quality training materials and feedback to countries and some facilities (7, 27–29, 31, 33–35, 37, 40–42). Technical support or assistance was delivered primarily via north-south collaborations and sometimes through a south-south partnership or an integrated international collaboration, also described as north-south-south collaboration (7).

Collaborative support mechanisms and partnership types were described closely in the included studies. For instance, some technical assistance to IPC collaboratives was executed using integrated international collaboration principles. This form of partnership is described as a successful collaboration between a donor country and a recipient counterpart extended to another recipient country or agency within a country, continental or a regional bloc (7). The north-south partnership model,

also appearing as a frequently used partnership model, accounted for about 46% ( $n = 7$ ) of included studies (27–29, 31, 35, 41, 37). Very few studies (13%,  $n = 2$ ) reported ‘homegrown’ partnerships where there was no external support or outside country support. This was mainly a partnership between local institutions (multidisciplinary stakeholders) or among local hospitals (26, 38).

## Discussion

Our findings provide a snapshot of how IPC collaborative support models in LMIC health systems are conceptualised in the current literature. We introduce six essential elements required to be present in an IPC collaborative within the LMIC context, namely: 1) Collaborative Projects, 2) Policies and Procedures, 3) Training and Professional Development, 4) Surveillance Systems, 5) Assessment and Feedback and 6) Partnerships. We present these core elements as fundamental components of an IPC collaborative support framework to guide partners desiring to support the design and implementation of IPC projects at various national and health facility levels in LMICs. Our findings are consistent with and confirm the WHO’s holistic approach to improving IPC by reducing HAI and AMR.

As mentioned previously, the WHO Guidelines on Core Components of Infection Prevention and Control Programmes (WHO Core Components) guide the establishment and improvement of IPC at the national and health facility levels, with six and eight core components, respectively, for these levels of health governance (2). The WHO also provides a supporting stepwise implementation model for these components, which includes: 1) Preparing for action, 2) Baseline assessment, 3) Developing and executing the plan, 4) Evaluating impact and 5) Sustaining the programme over the long term. This stepwise implementation approach aligns with the six core elements identified in this study as well.

The finding of Partnership for IPC, for instance, identified examples of collaborative activities crucial to the success of IPC programmes. Activities such as forming an IPC joint task force, creating IPC working groups and establishing inter-disciplinary collaboration to promote professional development networking were essential to facilitating interdisciplinary discussions. These were critical functions of Collaborative Projects and Training and Professional Development elements of IPC Collaboratives consistent with the WHO Core Components 1 and 3 (2). We argue that interdisciplinary discussions can be a necessary and valuable avenue for planning and coordinating activities, setting up infrastructure and forming teams (involving opinion leaders) to achieve Step 1 of the WHO implementation model. Such discussions are crucial when ‘Preparing for action’ and fundamental to the overall programme set-up. However, this will not be without

challenges, especially in the absence of clear roles and responsibilities of stakeholders.

Our findings suggest that IPC project implementers must be aware of the potential challenges that may arise from disciplinary variations among interdisciplinary teams and the possibility of effectively integrating various disciplinary stakeholders in executing IPC projects (26–27). We argue that the lack of clear guidance on managing disciplinary variations in teams could be addressed through further research to examine partnerships for IPC to identify factors for integrating various disciplinary stakeholders in IPC collaborative support (1, 17–18).

The second, third and fourth steps of the WHO implementation model are implementing interventions through testing and collecting data and improving plan development and execution to monitor and evaluate progress. We speculate that the implementation steps listed above and the core elements we identified of Policies and Procedures, Surveillance Systems and Assessment and Feedback also share a common ground with the following WHO Core Components: 2) Policies and Procedures, 4) Surveillance Systems, 5) Assessment and Feedback and 6) Partnership (2).

The fifth and final step of the WHO implementation model, sustaining the IPC programme over the long term, can be achieved by combining all six of our identified elements using multimodal approaches such as virtual learning platforms and professional development networking. In addition, opportunities for mentorship, reciprocal fellowships and study tours involving site visits and exchanges are beneficial and allow improvements. These link to the six national WHO Core Components through the Partnership element, which found various support mechanisms with local ownership of the countries involved. The possible explanation for the usefulness of these elements of our framework is enshrined in the combination of multimodal strategies and multidisciplinary teams with multimodal thinking to consolidate a range of strategies for effecting policy changes (1–2).

This scoping review of the literature also identified a paucity of reported studies with a distinct absence of work in LMIC within the Pacific region, including the Small Island States. We attribute this to the lack of investment for IPC collaboratives in that region, especially in research and development. However, it was not surprising because the majority of the studies considered in this scoping review were case reports and very few empirical studies were present, suggesting lower research outputs and investments for IPC collaboratives within the LMIC context.

This review had some limitations, such as the absence of a quality appraisal of the evidence, which is a general limitation of scoping studies. This led to a limitation in accounting for the methodological strengths and weaknesses. In addition, restricting the review to only published

literature, specifically in English, may have led to missing key operational reports that have the potential to account for practice-based features of collaboration. We believe this may have led to missing out on some findings and gaps. That notwithstanding, the core elements of IPC collaboration identified through our systematic scoping process were consistent with the WHO Core Components of Infection Prevention and Control Programmes at a national level and aligned with their stepwise approach to implementation. This suggests that the systematic scoping process is inclusive of the best available evidence. On the other hand, we also recognise the predominance of case reports in the included studies as a limitation that could have influenced the empirical quantity and quality of the included studies.

### Conclusion

This scoping review has identified six core elements to guide the design, delivery, evaluation and sustainability of IPC collaborative partnerships in LMIC settings. These elements were found to align with the WHO Core Components of Infection Prevention and Control Programmes at a national level and the associated stepwise approach to implementation. Through embracing these elements, collaborative relationships between partner organisations at all levels could be achieved. Creating a support framework of equitably empowered partnership using these elements is the next step in developing sustained improvement and capacity in IPC in LMIC settings.

### Ethical approval

Ethics approval was not required as this involved no human or animal subjects or data.

### Conflicts of interest and funding

There are no notable conflicts of interest from any authors. The authors have not received any funding or benefits from industry or elsewhere to conduct this study.

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