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State of the Science Review

Interventions for preventing or controlling health care–associated infection among health care workers or patients within primary care facilities: A scoping review

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Background: This review aimed to synthesize the evidence on infection prevention and control interventions for the prevention of health care–associated infection among health care workers or patients within primary care facilities.
Methods: PubMed, CINAHL, EMBASE, and CENTRAL databases were searched for quantitative studies published between 2011 and 2022. Study selection, data extraction, and quality assessment using Cochrane and Joanna Briggs tools, were conducted by independent review with additional sensitivity checking performed on study selection.
Results: Four studies were included. A randomized trial and a cross-sectional survey, respectively, found no statistical difference in laboratory-confirmed influenza in health care workers wearing N95 versus medical masks ($P = .18$) and a significant inverse association between the implementation of tuberculosis control measures and tuberculosis incidence ($P = .02$). For the prevention of surgical site infections following minor surgery, randomized trials found nonsterile gloves (8.7%; 95% confidence interval, 4.9%-12.6%) to be noninferior to sterile gloves (9.3%; 95% confidence interval, 7.4%-11.1%) and no significant difference between prophylactic antibiotics compared to placebo ($P = .064$). All studies had a high risk of bias.
Conclusions: Evidence for infection prevention and control interventions for the prevention of health care–associated infection in primary care is very limited and insufficient to make practice recommendations. Nevertheless, the findings highlight the need for future research.

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BACKGROUND

Health care–associated infections (HAI) and antimicrobial resistance (AMR) remain a major challenge to patient safety worldwide, leading to adverse patient outcomes, increased health care costs, and additional burden on the health care system[1,2]; thus, posing a substantial threat to both health care workers and patients.

Primary care plays a key role in the delivery of health care and contributes to disease prevention, improving health outcomes and health security and safety of communities.[3,4] Given the potential for infections to spread within primary care settings, where a diverse array of patients seek health care, it is imperative to ensure infection prevention and control (IPC) measures are evidence-based in these settings. Yet, limited guidance and evidence synthesis exist at the global level on IPC interventions to reduce the spread of HAI and AMR in primary care facilities.[5,6]

In 2016, World Health Organization (WHO) published guidelines on core components for IPC programs at national and local levels,[5] however, these relate primarily to acute health care settings. In recognition of this, WHO recently released minimum requirements for IPC programs which provide specific recommendations for primary care facilities[7] and resources on strengthening IPC in primary care which were developed based on the existing WHO IPC guidance relevant to primary care[6,8]; yet, the need for a tailored approach with IPC guidelines and implementation strategies specific to the primary care settings remain.

This is currently being addressed by the WHO IPC Technical and Clinical Hub, which provides leadership and technical expertise on IPC in health care by developing evidence-based guidelines, implementation strategies and tools, training resources and monitoring tools and systems.[9] The Hub is now progressing with a program of work on strengthening IPC measures in primary care in support of the WHO strategy to promote universal health coverage through a primary health care approach. To support this work and inform future directions, a scoping review of the existing evidence on IPC interventions in primary care was conducted.

A scoping review was considered the most appropriate approach as it enables capture of the breadth and extent of the existing literature and summarizing this evidence to identify gaps and inform further research, particularly given the diverse nature of interventions and limited previous synthesis of efforts.[10]

The aim of our scoping review was to provide evidence on the extent, range, and nature of existing literature on IPC interventions for preventing or controlling HAI among health care workers (HCW) or patients within primary care facilities.

METHODS

The protocol for this scoping review was registered on Open Science Framework Registries (Registration DOI https://doi.org/10.17605/OSF.IO/SBZP8).[11] The review was reported in accordance with the preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews.[12]

Search strategy

An electronic search was conducted on the seventh of June, 2022. The following four databases were searched: PubMed (including Medline), CINAHL, CENTRAL, and EMBASE. Databases were searched using index terms and free-text search terms within the titles and abstracts. These terms were related to 4 domains: (1) primary care facilities, (2) HAI and AMR context, (3) IPC interventions, and (4) outcomes. To ensure comprehensiveness, the search strategy was adjusted to meet the specific functionalities of each database. The search was limited to articles published in the previous 10 years (2011-2022) to ensure contemporary practice was taken into account. The population was delimiter, human beings only, was also applied. Furthermore, reference lists of all articles meeting the review's eligibility criteria were screened to identify additional relevant studies. Articles written in any language were included if an English language title or abstract was available. Search results were exported to EndNote reference management software, and duplicate records were removed. The full search strategy is presented in Supplementary File 1.

Study selection

Study selection was completed in 2 stages. In the first stage, 2 reviewers independently screened the titles and abstracts of retrieved records against the eligibility criteria presented in Table 1. In the second stage, articles that appeared relevant and those in which there was insufficient evidence in the title and abstract to make a decision were retrieved for full-text review by 2 independent reviewers. At both stages of the study selection, disagreements were resolved through discussion and, if required, by the involvement of a third, experienced reviewer who also confirmed the eligibility of all included studies.

Data extraction, analysis, and synthesis

Data from all studies included in the review were extracted by 1 reviewer using a pre-designed structured data extraction tool (Supplementary File 2). All extracted data were double-checked for accuracy by the second reviewer. Areas of disagreement were resolved through discussion. Extracted data included first author, year of publication, country of origin, study aim, publication language, study design, type of infection, microorganism, study population and sample, settings, intervention type, outcome measures, and key findings.

Quality assessment

Empirical studies included in the review were assessed for quality by 2 independent reviewers. Studies meeting the Cochrane Collaboration's Effective Practice and Organization of Care (EPOC) study design criteria[13] that is, randomized-controlled trials (RCT) and cluster randomized-controlled trials (cRCT) were assessed for quality using the recommended EPOC risk of bias criteria.[14] Studies were considered as high risk of bias if at least one of the criteria was assessed as high risk. Furthermore, studies were considered unclear risk of bias if there was insufficient information to make a judgment for at least one of the criteria, and low risk of bias if all criteria were assessed as such. For the study designs that did not meet the EPOC criteria, design-specific, Joanna Briggs Institute critical appraisal checklists[15] were used. If an answer to any item was "no", the study was assessed as high risk of bias, if insufficient information was available for any of the items the study was considered an unclear risk, and if all checklist items were answered as "yes", the study was considered low risk of bias. Disagreements between the reviewers were resolved through discussion.

RESULTS

Search results

As shown in the PRISMA Flow Diagram below (Fig 1), the electronic database search identified a total of 8,237 records, with 50 considered for the full-text review after de-duplication, and after titles, and abstracts screening. In addition, one record was identified through sensitivity checking, for the total of 51 records reviewed in full-text. Of those, 6 relevant studies were identified. However, 2 of the included studies[16,17] were systematic reviews that considered

Table 1
Reviews' eligibility criteria

	Inclusion criteria	Exclusion criteria
Participants	HCW, such as doctors, nurses, allied health professionals, and/or patients (no restriction on age).	Other than HCW or patients
Settings	PC facilities that provide first-contact, accessible patient-focused care, such as medical centers or clinics, in any country. Studies conducted in mixed settings were considered if outcome data were reported separately for PC facilities or, if more than 50% of settings were PC or more than 50% of participants were from PC facilities.	Studies based in patients' homes or in secondary or tertiary health care facilities, such as day surgery, outpatient, or long-term care facilities. Specific settings not identifiable as PC.
Interventions	Studies that reported IPC interventions for prevention of HAI in PC facilities, including, but not limited to: IPC bundles, hand hygiene interventions, training, medical device management, linen handling, blood/body fluid spillage management, environmental cleaning, education, multimodal interventions, surveillance, audit and feedback, respiratory hygiene, personal protective equipment, respiratory protective equipment, waste management, WASH, decontamination and reprocessing of medical instruments/devices, staffing levels, resources or interventions.	Antibiotic stewardship interventions
Primary outcomes	Infection rates, incidence, prevalence, or reduction of bacterial, viral, or fungal HAI. Attributable or all-cause mortality, case fatality, and morbidity outcomes were also included.	Outcomes related to sepsis, community-acquired infections, cost-effectiveness, or risk factors.
Secondary outcomes	Any secondary outcomes related to the reduction of HAI were considered alongside, but not instead of the primary outcomes.	
Design	All types of primary, quantitative research studies including: randomized-controlled trials, non-randomized trials, quasi-experimental study designs, controlled before-after studies, interrupted time series, cohort studies, case-control studies, noncontrolled before-after studies, case studies, cross-sectional studies, outbreak studies and ecological studies. Systematic reviews and meta-analyses were also included.	Qualitative studies, and nonprimary research studies, such as reviews, letters, notes, conference proceedings, protocols, thesis, clinical reports, and opinion articles that do not report primary data, economic studies, modeling studies and epidemiological studies with no intervention.

HAI, health care–associated infection; *HCW*, health care worker; *IPC*, infection prevention and control; *PC*, primary care; *WASH*, water sanitation and hygiene.

studies conducted in a variety of settings, of which in both of the reviews, only one study by Heal et al[18] was conducted in primary care facilities. However, Heal et al[18] was already identified and included in our scoping review; thus, to prevent double reporting, no studies from the 2 systematic reviews[16,17] were included in the scoping review. Searching reference lists of the relevant studies did not identify any additional relevant studies.

Characteristics of included studies

As shown in Table 2, of the 4 empirical studies, 3 used RCT[18,19] or cRCT design,[20] whereas 1 study[21] was a cross-sectional study. Two studies were conducted in the Western Pacific region,[18,19] one in the Americas region[20] and one in Africa.[21] Regarding the study participants and settings, 2 studies focused on patients undergoing minor procedures involving skin excision in general practitioner (GP) practices.[18,19] The other 2 studies[20,21] focused on HCW in mixed settings. In Radonovich et al,[20] these mixed settings included primary care, emergency care, speciality care, dental and dialysis care facilities, but most of the data (3,615 out of 5,180 HCW-seasons of observation) were derived from primary care facilities. Claassens et al[21] reported conducting their study in primary care facilities, with no further details provided. Studies were categorized per type of infection, with two studies investigating respiratory infection[20,21] and 2 investigating surgical site infection (SSI).[18,19]

Results of individual studies

Evidence from each of the included studies is summarized in Table 3 and presented narratively below according to infection type.

Respiratory infections

Radonovich et al[20] compared the effectiveness of N95 respirators against medical masks for preventing influenza and other viral respiratory infections among HCWs over 4 years in the USA. A cRCT was used as the study design. Each year, during the 12-week peak of viral respiratory illness, the clusters of participating sites within each of the seven medical centers were randomized to either N95 respirators or medical masks. Participants were 2,862 HCWs, some of whom participated in more than one intervention period, accounting for a total of 5,180 HCWs seasons of observation. These included 2,512 HCW-seasons of observation in the N95 respirators group, with 1,993 HCW in 189 clusters and 2,668 HCW-seasons of observation in the medical masks group, with 2,058 participants in 191 clusters. Of the 5,180 HCW seasons of observation, 3,615 were from primary care. Participants were asked to report their adherence to the intervention on a daily basis, and their adherence was monitored by study personnel during unannounced visits to the study sites. The primary outcome was the incidence of laboratory-confirmed influenza, with secondary outcomes including acute respiratory disease, laboratory-detected respiratory infections, laboratory-confirmed respiratory illness, and influenza-like illness.

The study's findings revealed the incidence of laboratory-confirmed influenza infection events occurred in 207 of the 2,512 HCW-seasons (8.2%) in the N95 respirator group and 193 of the 2,668 HCW-seasons (7.2%) in the medical mask group (difference, 1.0% [95% CI, −0.5% to 2.5%]; $P = .18$) (adjusted OR, 1.18 [95% CI, 0.95-1.45]). Similarly, the 2 groups had no statistical difference for any of the secondary outcomes.

Claassens et al[21] conducted a cross-sectional ecological study to determine the implementation of tuberculosis (TB) infection control measures at 133 primary care facilities in South Africa, the smear-positive TB incidence rate among HCW, and the association between TB infection control measures and all types of TB in HCW. A Centers for Disease Control and Prevention TB infection control audit was conducted to evaluate the TB infection control measures, with a higher score indicating better infection control. The questionnaire also captured the number of HCWs at each facility and the number of

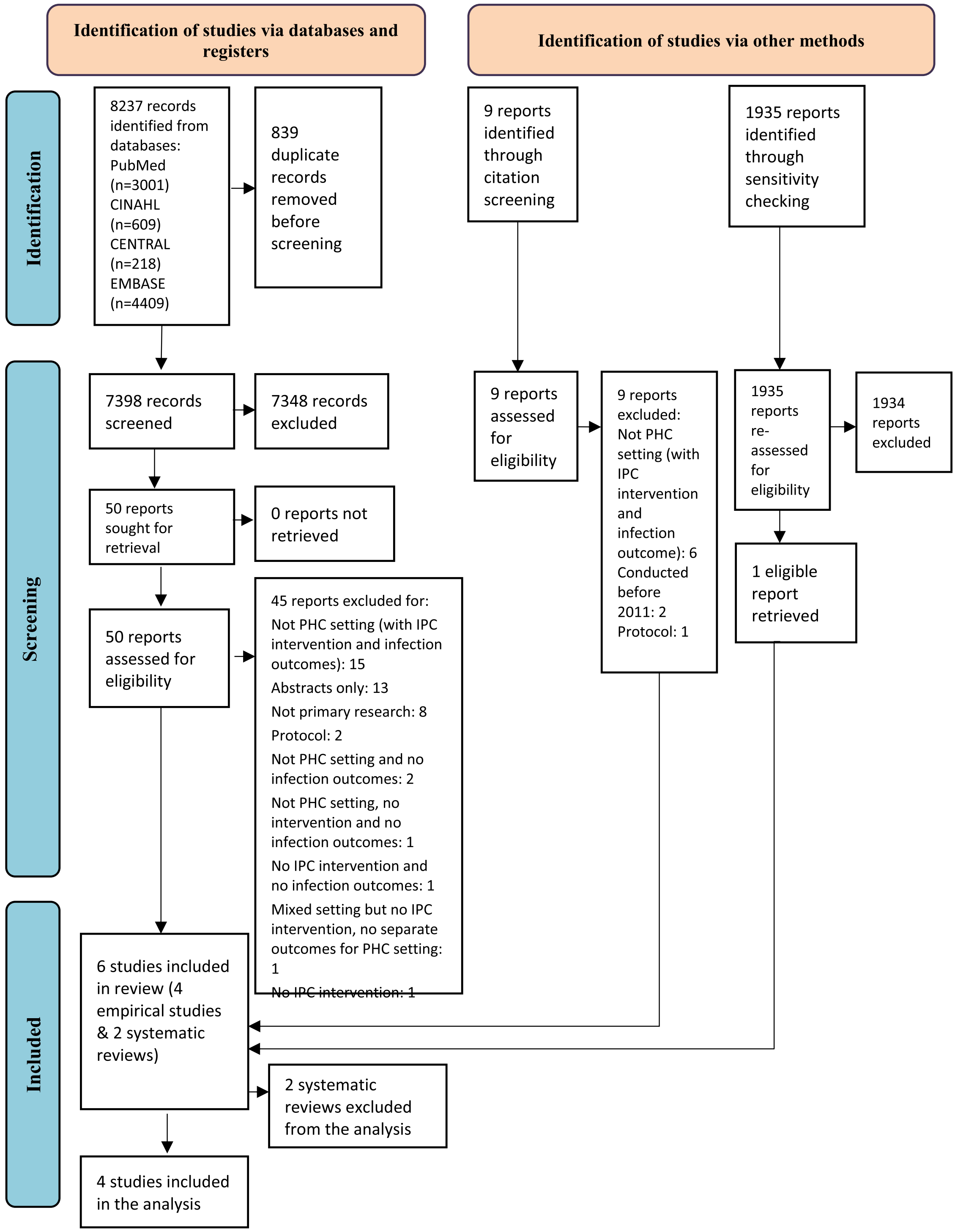

Fig. 1. PRISMA flow diagram showing the selection of studies for inclusion in the scoping review.

TB cases per calendar year, covering the period between 2006 and 2008. Findings of the univariable logistic model revealed that the infection control audit score was significantly positively associated with reported cases of TB among HCW (OR = 1.04, 95% CI 1.01-1.08, $P = .02$). As the incidence of TB increased with the audit score, the authors suggest the audit was ineffective at assessing TB acquisition risk in these settings and possible nosocomial spread between staff. Positive, significant associations were also observed for environmental controls (OR = 1.12, 95% CI 1.01-1.23; $P = .03$), the number of staff at a facility (OR = 3.78, 95% CI 1.77-8.08; $P < .01$), and the presence of a TB room/area (OR = 3.24, 95% CI 1.37-7.65; $P = .01$). However, in the multivariate analysis, only the number of staff remained significant (OR = 3.33, 95% CI 1.37-8.08; $P = .01$).

Surgical site infections

Heal et al[18] conducted a prospective randomized-controlled single-center trial regarding the incidence of infection following minor surgery performed in primary care facilities in Australia. The

Table 2
Study characteristics of empirical studies

Study characteristics		4 studies (Year 2011-2019) N (%)
Designs	Randomized trial	2 (50)
	Cluster Randomized Trial	1 (25)
	Cross-sectional study	1 (25)
Geographical location	Western Pacific (Australia)	2 (50)
	Africa (South Africa)	1 (25)
	The Americas (USA)	1 (25)
Participants	Health care workers	2 (50)
	Patients	2 (50)
Settings	GP practices	2 (50)
	Nonspecified PC facilities	1 (25)
	Mixed (with 69% of studies settings being PC clinics)	1 (25)
Themes and intervention types	Respiratory infections	2 (50)
	Face masks	
	Tuberculosis IPC interventions	
	Surgical Site Infections	2 (50)
	Gloves	
	Antibiotic prophylaxis	

GP, general practitioner; *IPC*, infection prevention and control; *PC*, primary care.

IPC intervention included using nonsterile clean boxed gloves compared to sterile gloves in the control group, with wound infection present at suture removal as the outcome. A total of 493 consecutive patients who presented for minor skin excisions were randomized to the intervention group (n = 250) or control group (n = 243). Findings revealed that compared to the incidence of infection in the control group (9.3%; 95% CI, 7.4%-11.1%), the incidence in the nonsterile gloves group (8.7%; 95% CI, 4.9%-12.6%) was significantly noninferior. The −0.6% differences in the infection rates between the study arms (two-sided 95% CI, −4.0 to 2.9%) did not reach the predetermined 7% margin assumed as the noninferiority limit.

A prospective double-blinded randomized placebo-controlled trial by Smith, Heal, and Buttner[19] involving 52 patients undergoing lower limb skin excision in Australian primary care facilities determined the effectiveness of a single perioperative prophylactic cephalexin in preventing SSI following lower limb skin excision. The incidence of SSI in the cephalexin group was 12.5% (95% CI 2.7%-32.4%), and 35.7% (95% CI 18.6%-55.9%) in the placebo group (P = .064), representing a relative decrease of 65.00% (95% CI 12.70%-89.13%) and an absolute decrease of 23.21% (95% CI 0.39%-46.82%); however, the study lacked sufficient statistical power.

It is worth noting that the incidence of SSI was high in both studies. This could be due to factors related to patient morbidity, operative site or surgery-related IPC measures. Furthermore, in both studies, SSIs were identified using case definition criteria adapted from the Centers for Disease Control and Prevention.[22] Although these criteria were consistently applied by trained observers, it is possible that true infection rates were overestimated.

METHODOLOGICAL QUALITY OF THE INCLUDED STUDIES

Three of the 4 included studies used robust study designs meeting the EPOC study design criteria.[13] However, as shown in Table 4, the overall risk of bias in these studies was assessed as high. In the Smith, Heal and Buttner[19] study, a high risk of bias was associated with insufficient protection against contamination resulting from the allocation of study groups at the patient level and differences in the baseline characteristics of the study and control group that were not adjusted for in the analysis. Furthermore, in all 3 studies that met EPOC criteria, other risks of bias were identified. These included studies being underpowered,[19,20] infection status outcomes determined using subjective means, such as infection definitions,[18,19] and possible problems with participants' adherence to the intervention.[20] Additionally, all studies had at least one unclear risk of bias. This was related to the lack of sufficient information regarding baseline outcome measures[18–20] or protection against contamination resulting from the allocation of professionals within a single general practice where communication between intervention and control professionals could have occurred.[18]

One of the studies included in the review was a cross-sectional study design; thus, it did not meet the EPOC study design criteria.[13] Therefore, by the nature of the study design, EPOC consider this design to be at high risk of bias. Furthermore, a quality assessment conducted using the Joanna Briggs critical appraisal tool (Table 5) for analytical cross-sectional studies,[15] identified a high risk of bias related to a lack of use of a valid and reliable instrument for the measurement of exposure and self-reported scales used for measuring infection outcomes. This study also had 2 items reported as unclear risks. These were related to the lack of clearly defined eligibility criteria and insufficient description of the study subjects and settings.

SENSITIVITY CHECKS

Given the small number of included studies, additional sensitivity checking of the study selection process was conducted to ensure no relevant studies had been missed. This was achieved by conducting a search within the 8,237 records identified during the database search, which were stored in EndNote. The following keywords or phrases were used to search the titles and abstracts of the stored search records: "primary care" OR "primary health"—to cover for different word variations of primary health care facilities, OR family OR GP OR "general practice"—to cover for different phrases related to GP or family practice or clinics, OR outpatient. Although outpatient settings, understood as settings based in hospitals and delivering care to patients who do not need to stay in a hospital overnight were excluded from our review, during screening we noticed that the term "outpatient settings" was occasionally used to describe primary health care settings outside of the hospital. Thus, we wanted to ensure that such studies were not accidentally excluded. Furthermore, the sensitivity checks had the added benefit of also providing a "snapshot" of what other evidence on IPC interventions for the prevention of HAI in primary care facilities was in the search results. The sensitivity checks identified 1,935 records, which were screened by 2 independent reviewers. One relevant study,[21] meeting the reviews' eligibility criteria was identified through this process and was included in the review.

With regard to other evidence contained within the search results, 16 additional studies[23–38] focusing on IPC interventions to prevent HAI in primary care facilities were identified. These were not included in the scoping review because the outcomes (n = 16) and/or study designs (n = 3) did not meet the review's eligibility criteria. These 16 studies included HCW or patients as the study participants and were all conducted in primary care settings focusing on different HAIs, including respiratory infections, SSI, bloodborne infections and HAIs in general. The outcome measures of these 16 studies included compliance with IPC measures, vaccination rates, and barriers/facilitators to IPC practices.

Detailed findings of the sensitivity checks are reported in Supplementary File 1. Nevertheless, it is important to note that the scoping review search strategy was designed based on the scope of the review and included a search domain capturing outcomes related to HAI, attributable or all-cause mortality, case fatality, morbidity, and no other outcomes. Thus, it is highly likely that there is more evidence of IPC interventions for preventing HAI in primary

Table 3
Evidence table

First author, year of publication, country	Aim	Study design	Type of microorganism	Sample	Settings	Intervention type	Relevant outcome measure (s) and findings
Respiratory infections							
Radonovich et al[20] (2019) USA	To compare the effect of N95 respirators versus medical masks at protecting HCWs from acquiring viral respiratory illnesses.	cRCT	Influenza viruses and other microorganisms that cause respiratory infections or influenza-like illness	2862 HCW (5,180 HCW-seasons of observation, with 3,615 from PC)	Mixed (137 study sites at 7 medical centers)	N95 respirator versus medical masks	No significant difference in the incidence of laboratory-confirmed infections among HCW with the use of N95 respirators (8.2%) versus medical masks (7.2%)
Claassens et al[21] (2013) South Africa	To investigate the implementation of TB IPC measures at PC facilities, the smear-positive TB incidence rate among HCWs and the association between TB IPC measures and all types of TB in HCW.	Cross-sectional study	Mycobacterium tuberculosis	1,439 HCW in the year 2006; 1,649 HCW in the year 2007; 1,917 HCW in the year 2008	133 PC facilities	TB IPC measures	Univariable analysis: a significant, positive association between the IPC audit score & reported TB cases (OR = 1.04, 95% CI 1.01-1.08, P = .02). Significant associations were observed for environmental controls (OR = 1.12, 95% CI 1.01-1.23; P = .03), the number of staff at a facility (OR = 3.78, 95% CI 1.77-8.08; P < .01), and the presence of a TB room/area (OR =3 .24, 95% CI 1.37-7.65; P = .01). Multivariable analysis: the number of staff remained significantly associated with TB cases in HCW (OR = 3.33, 95% CI 1.37-8.08; P = .01).
Surgical Site Infection (SSI)							
Heal et al[18] (2015) Australia	To compare the incidence of infection after minor surgery conducted using nonsterile clean boxed gloves versus sterile gloves	RCT	Not specified	493 patients undergoing minor skin excision	Single general practice	Nonsterile clean boxed gloves vs. sterile gloves	The incidence of superficial SSI in the clean boxed gloves group (8.7%; 95% CI, 4.9%-12.6%) was not significantly inferior compared with the sterile gloves group (9.3%; 95% CI, 7.4%-11.1%).
Smith, Heal and Buttner[19] (2014) Australia	To determine the effectiveness of a single perioperative prophylactic 2 g dose of cephalexin in preventing SSI following excision of skin lesions from the lower limb.	RCT	Not specified	52 patients undergoing lower limb skin excision	2 general practices	Prophylactic antibiotic (2 g dose of cephalexin) administered 30–60 min before an excision vs. placebo control	The incidence of SSI was 12.5% (95% CI 2.7%-32.4%) in the cephalexin group versus 35.7% (95% CI 18.6%-55.9%) in the placebo group (P = .064).

CI, confidence intervals; *cRCT*, clustered randomized control trial; *HCW*, health care workers; *IPC*, infection prevention and control; *OR*, odds ratio; *PC*, primary care; *RCT*, randomized control trial; *SSI*, surgical site infection; *TB*, tuberculosis.

Table 4
Risk of bias of studies meeting the EPOC criteria

	Radonovich et al.[20]	Heal et al.[18]	Smith, Heal and Buttner[19]
Random sequence generation	L	L	L
Allocation concealment	L	L	L
Baseline outcome measurements similar	U	U	U
Baseline characteristics similar	L	L	H
Incomplete outcome data	L	L	L
Knowledge of the allocated interventions	L	L	L
Protection against contamination	L	U	H
Selective outcome reporting	L	L	L
Other risks of bias?	H	H	H
Overall risk of bias	H	H	H
H=high risk; U=unclear risk; L=low risk			

Table 5
Risk of bias of study not meeting the EPOC criteria

	Claassens et al.[21]
Were the inclusion criteria in the sample clearly defined?	U
Were the study subjects and the settings described in detail?	U
Was the exposure measured in a valid and reliable way?	N
Were objective, standard criteria used for measurement of the condition?	N
Were confounding factors identified?	Y
Were strategies to deal with the confounding factors stated?	Y
Were the outcomes measured in a valid and reliable way?	N
Was appropriate statistical analysis used?	Y
Overall risk of bias	H
Y=yes; N=no; U=unclear	

care facilities with outcomes not related to those specified in our eligibility criteria, that were not picked up by our search.

DISCUSSION

Primary health care is a vital part of the health care system, which contributes to the prevention of HAI, given that its primary goal is the prevention of disease and, consequently, the avoidance of unnecessary hospital admissions.[4] This scoping review provided evidence on the extent, range, and nature of existing literature on IPC interventions for preventing or controlling HAI within primary care facilities; however, the extent of the evidence is limited in terms of the number and quality of the studies. The findings identified only four empirical studies with two focusing on respiratory infections among HCWs, and 2 on SSI among patients; however, the IPC interventions were different in each study, resulting in a lack of the body of evidence to support specific interventions.

For the prevention of respiratory illness in HCW, an American RCT,[20] and a South African cross-sectional survey,[21] respectively, found no statistical difference in the rate of laboratory-confirmed influenza in those wearing N95 versus medical masks, and a significant inverse association between the implementation of TB control measures and the incidence of TB.[20,21] For the prevention of SSI, 2 Australian RCT studies[18,19] found the use of nonsterile gloves to be noninferior to sterile gloves,[18] and prophylactic antibiotic provided a nonsignificant reduction in infections ($P = .064$)[19] in minor surgery. However, all 4 studies were assessed as high risk of bias, and although the majority of the included studies used a randomized study design,[18–20] two[19,20] were underpowered. Furthermore, 3 out of 4 studies were carried out in high-income countries and only 1 was conducted in an upper-middle-income country. This is surprising given the global commitment to strengthening primary health care to ensure health for all.[39]

There were a number of challenges related to the conduct of this review and in relation to evidence available, that may help to explain the limited number of studies available for the review. This review sought to evaluate IPC interventions implemented in primary care facilities with these considered to be facilities that offered health care services that are typically the initial point of contact with a health professional,[3] such as those given by general practitioners, dentists, and pharmacists. It was noted that there was often insufficient detail in the reporting of the settings of the reviewed studies to clearly identify their setting as primary care, with terms such as ambulatory, outpatient, and dental settings being non-specific or without definitions or further explanations. Consequently, several studies that could have been pertinent for this review were excluded because primary care settings could not be confirmed from the study report.

Finally, the term "HAI" originally referred to infections that were associated with admission to a hospital (formerly known as "hospital-acquired infections"), but is now used to describe infections that emerge in various settings where patients receive health care, including primary care settings.[40] However, there are challenges related to identifying HAI in primary care.[4] An essential factor in evaluating if an infection is health care-associated, is whether it was present or incubating at the time of the person's interaction with health care. Although care in primary health care is constant throughout time, each interaction is brief, leading to uncertainty about whether the identified infection is health care-associated or community-associated.[4] This was evident in the current review in relation to respiratory infection measurement in the context of wider community prevalence, where studies focused on IPC interventions in primary care, but needed a clear indication of whether the infection was health care-associated or community-associated. The attribution of the infection to the intervention in primary care is less confounded in the surgical infection studies.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This scoping review identified a limited number of heterogeneous studies on IPC interventions for preventing HAI in primary care.[18–21] More extensive evidence exists on the IPC interventions for preventing HAI in primary care facilities but with outcomes other than rates, incidence, prevalence, or reduction of HAI, attributable or all-cause mortality, case fatality, or morbidity. Hence, a scoping review focusing on a wider range of outcomes is worth considering. Alternatively, systematic reviews focusing on IPC interventions for preventing HAI in particular care settings (eg, dental, TB, surgical care) could be helpful for providing evidence for IPC interventions. Furthermore, more research to evaluate the effectiveness of specific IPC interventions on HAI-related outcomes in primary care is required, and a more detailed reporting of settings is recommended to allow identification of the primary care context. Finally, consideration must be given to the difficulty of defining HAIs in primary care settings and differentiating them from community-acquired infections.

CONCLUSIONS

This scoping review aimed to provide evidence on the extent, range, and nature of existing literature on IPC interventions within primary care facilities. The study findings showed that with regard to the extent of existing literature, the evidence is very limited, with only four empirical studies identified. Regarding the range of evidence, 3 out of 4 studies were conducted in high-income countries and only one in an upper-middle-income country. Concerning the nature of the evidence, 2 studies focused on respiratory infections among HCW and the other 2 on SSI among patients. However, the IPC interventions were heterogeneous and all studies were assessed as high risk of bias; thus, the evidence is insufficient to support specific recommendations for practice. Nevertheless, the findings of this review set the agenda for future research focusing on IPC interventions for the prevention of HAI in primary care and highlight the need for improvements in research designs and methods in this area and for higher quality of reporting. Finally, there is a need for specific case definitions of HAI in primary care, taking account of the context-specific confounding.

DISCLAIMER

The opinions expressed in this article are those of the authors and do not reflect the official position of WHO. WHO takes no responsibility for the information provided or the views expressed in this article.

APPENDIX A. SUPPORTING INFORMATION

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ajic.2023.10.011.

References

1. Cassini A, Plachouras D, Eckmanns T, et al. Burden of six healthcare-associated infections on European population health: estimating incidence-based disability-adjusted life years through a population prevalence-based modelling study. *PLoS Med.* 2016;13:e1002150.
2. World Health Organization. *Report on the Burden of Endemic Health Care-Associated Infection Worldwide*. WHO; 2011. Accessed October 26, 2023. ⟨https://iris.who.int/bitstream/handle/10665/80135/9789241501507_eng.pdf?sequence=1⟩.
3. World Health Organization & United Nations Children's Fund (UNICEF). *Operational Framework for Primary Health Care: Transforming Vision Into Action*. WHO; 2020. Accessed October 5, 2023. ⟨https://iris.who.int/bitstream/handle/10665/337641/9789240017832-eng.pdf?sequence=1&isAllowed=y⟩.
4. Padoveze MC, Figueiredo RMd. The role of primary care in the prevention and control of healthcare associated infections. *Rev Esc Enferm USP.* 2014;48:1137–1144.
5. World Health Organization. Guidelines on Core Components of Infection Prevention and Control Programmes at the National and Acute Health Care Facility Level. WHO; 2016. Accessed October 26, 2023. ⟨https://iris.who.int/bitstream/handle/10665/251730/9789241549929-eng.pdf?sequence=1⟩.
6. World Health Organization. *Strengthening Infection Prevention and Control in Primary Care: A Collection of Existing Standards, Measurement and Implementation Resources*. WHO; 2021. Accessed October 26, 2023. ⟨https://iris.who.int/bitstream/handle/10665/345276/9789240035249-eng.pdf?sequence=1⟩.
7. World Health Organization. *Minimum Requirements for Infection Prevention and Ccontrol Programmes*. WHO; 2019. Accessed October 25, 2023. ⟨https://iris.who.int/bitstream/handle/10665/330080/9789241516945-eng.pdf?sequence=1⟩.
8. World Health Organization. Infection Prevention and Control in Primary Care: A Toolkit of Resources. WHO; 2021. Accessed October 5, 2023; ⟨https://www.who.int/publications/i/item/9789240037304⟩.
9. World Health Organization. Infection prevention and control: The WHO IPC Hub [Internet]. *WHO*; 2023. Accessed October 25, 2023; https://www.who.int/teams/integrated-health-services/infection-prevention-control/about.
10. Peters MDJ, Godfrey C, McInerney P, Munn Z, Tricco AC, Khalil H. Chapter 11: scoping reviews (2020 version). In: Aromataris E ZM, ed. *JBI Manual for Evidence Synthesis*. JBI; 2020.
11. Price L., Gozdzielewska L., KC D., Barr L., Butcher J., Davis K.A. A scoping review on infection prevention and control (IPC) interventions within primary healthcare facilities. 2022.
12. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ.* 2021;10:1–11.
13. Effective Practice and Organisation of Care (EPOC). What study designs should be included in an EPOC review and what should they be called? EPOC Resources for review authors. Cochrane Collaboration. 2017. Accessed October 20, 2023. ⟨https://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/Resources-for-authors2017/what_study_designs_should_be_included_in_an_epoc_review.pdf⟩.
14. Effective Practice and Organisation of Care (EPOC). Suggested risk of bias criteria for EPOC reviews. EPOC resources for review authors. *Cochrane Collaboration.* 2017. Accessed October 20, 2023. ⟨https://epoc.cochrane.org/sites/epoc.cochrane.org/files/public/uploads/Resources-for-authors2017/suggested_risk_of_bias_criteria_for_epoc_reviews.pdf⟩.
15. Moola S, Munn Z, Tufanaru C, et al. Aromataris E ZM, ed. *Chapter 7: Systematic Reviews of Etiology and Risk*. JBI Manual for Evidence Synthesis: JBI; 2020 (Available at: ⟨https://synthesismanual.jbi.global⟩).
16. Brewer JD, Gonzalez AB, Baum CL, et al. Comparison of sterile vs nonsterile gloves in cutaneous surgery and common outpatient dental procedures: a systematic review and meta-analysis. *JAMA Dermatol.* 2016;152:1008–1014.
17. Steen K. Sterile eller rene hansker ved småkirurgi i allmennpraksis [Sterile or non-sterile gloves in minor surgical procedures in general practice]. *Tidsskr Nor Laegeforen.* 2017;137:885–889.
18. Heal C, Sriharan S, Buttner PG, Kimber D. Comparing non-sterile to sterile gloves for minor surgery: a prospective randomised controlled non-inferiority trial. *Med J Aust.* 2015;202:27–31.

19. Smith SC, Heal CF, Buttner PG. Prevention of surgical site infection in lower limb skin lesion excisions with single dose oral antibiotic prophylaxis: a prospective randomised placebo-controlled double-blind trial. *BMJ Open.* 2014;4:e005270.
20. Radonovich LJ, Simberkoff MS, Bessesen MT, et al. N95 respirators vs medical masks for preventing influenza among health care personnel: a randomized clinical trial. *JAMA.* 2019;322:824–833.
21. Claassens MM, van Schalkwyk C, du Toit E, et al. Tuberculosis in healthcare workers and infection control measures at primary healthcare facilities in South Africa. *PLoS One.* 2013;8:e76272.
22. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR, Committee HICPA. Guideline for prevention of surgical site infection, 1999. *Infect Control Hosp Epidemiol.* 1999;20:247–280.
23. Al Abri Z, Al Zeedi M, Al Lawati AA. Risk factors associated with COVID-19 infected healthcare workers in Muscat Governorate, Oman. *J Prim Care Community Health.* 2021;12:1–8.
24. Al-Hazmi AH. Knowledge, attitudes and practice of dentists concerning the occupational risks of hepatitis B virus in Al Jouf Province, Saudi Arabia. *Niger J Clin Pract.* 2015;18:276–281.
25. AlMarzooqi LM, AlMajidi AA, AlHammadi AA, AlAli N, Khansaheb HH. Knowledge, attitude, and practice of influenza vaccine immunization among primary healthcare providers in Dubai health authority, 2016-2017. *Hum Vaccin Immunother.* 2018;14:2999–3004.
26. Arjona MAO, Elaziz KMA, Lanzas JMC, Allam MF. Coverage and side effects of influenza A(H1N1) 2009 monovalent vaccine among primary health care workers. *Vaccine.* 2011;29:6366–6368.
27. Cho H.S., Tao G.D., Winter A. Achieving appropriate design for developing world heath care: the case of a low-cost autoclave for primary health clinics. *2012 Annual International Conference of the IEEE Engineering in Medicine and Biology Society*. 2012;2012:2400–2403.
28. Jiee SF, Jantim A, Mohamed AF, Emiral ME. COVID-19 pandemic: determinants of workplace preventive practice among primary healthcare workers in Sabah, Malaysia. *J Prev Med Hyg.* 2021;62:605–612.
29. Kumar A, Gautam A, Dey A, Saith R, Uttamacharya, Achyut P, et al. Infection prevention preparedness and practices for female sterilization services within primary care facilities in Northern India. *BMC Health Serv Res.* 2019;20:1–8.
30. Mahjoub M, Ezzi O, Ammar A, Elomri N, Achach HS, Njah M. Good hygiene practice application in the private sector, Tunisia. *East Mediterr Health J.* 2021;27:764–771.
31. Malangu N, Mngomezulu M. Evaluation of tuberculosis infection control measures implemented at primary health care facilities in Kwazulu-Natal province of South Africa. *BioMed Central.* 2015;15.
32. Naidoo S, Seevnarain K, Nordstrom DL. Tuberculosis infection control in primary health clinics in eThekwini, KwaZulu-Natal, South Africa. *Int J Tuberc Lung Dis.* 2012;16:1600–1604.
33. Papageorgiou C, Mazeri S, Karaiskakis M, et al. Exploring vaccination coverage and attitudes of health care workers towards influenza vaccine in Cyprus. *Vaccine.* 2022;40:1775–1782.
34. Petek D, Kamnik-Jug K. Motivators and barriers to vaccination of health professionals against seasonal influenza in primary healthcare. *BMC Health Serv Res.* 2018;18:853.
35. Rezende KCAD, Tipple AFV, Siqueira KM, Alves SB, Salgado Td.A, Pereira MS. Adhesion to hand hygiene and use of personal protective equipment for nursing professionals in primary health care. *Ciencia Cuidado e Saude.* 2012;11:343–351.
36. Tischendorf JS, Temte JL. Face mask use by patients in primary care. *Wis Med J.* 2012;111:13–16.
37. Zhang ZN, Zhang XP, Lai XQ. Model of healthcare-associated infection control in primary health care institutions: a structural equation modeling. *Curr Med Sci.* 2019;39:153–158.
38. Zinatsa F, Engelbrecht M, van Rensburg AJ, Kigozi G. Voices from the frontline: barriers and strategies to improve tuberculosis infection control in primary health care facilities in South Africa. *BioMed Central.* 2018;18:269.
39. World Health Organization. Declaration of Astana. World Health Organization and United Nations Children's Fund; 2018. https://www.who.int/docs/default-source/primary-health/declaration/gcphc-declaration.pdf.
40. Haque M, Sartelli M, McKimm J, Bakar MA. Health care-associated infections–an overview. *Infect Drug Resist.* 2018;11:2321–2333.