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[Qualitative Review]

Barriers and facilitators to healthcare workers' adherence with infection prevention and control (IPC) guidelines for respiratory infectious diseases: a rapid qualitative evidence synthesis

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ABSTRACT

Background

This review is one of a series of rapid reviews that Cochrane contributors have prepared to inform the 2020 COVID-19 pandemic.

When new respiratory infectious diseases become widespread, such as during the COVID-19 pandemic, healthcare workers' adherence to infection prevention and control (IPC) guidelines becomes even more important. Strategies in these guidelines include the use of personal protective equipment (PPE) such as masks, face shields, gloves and gowns; the separation of patients with respiratory infections from others; and stricter cleaning routines. These strategies can be difficult and time-consuming to adhere to in practice. Authorities and healthcare facilities therefore need to consider how best to support healthcare workers to implement them.

Objectives

To identify barriers and facilitators to healthcare workers' adherence to IPC guidelines for respiratory infectious diseases.

Search methods

We searched OVID MEDLINE on 26 March 2020. As we searched only one database due to time constraints, we also undertook a rigorous and comprehensive scoping exercise and search of the reference lists of key papers. We did not apply any date limit or language limits.

Selection criteria

We included qualitative and mixed-methods studies (with a distinct qualitative component) that focused on the experiences and perceptions of healthcare workers towards factors that impact on their ability to adhere to IPC guidelines for respiratory infectious diseases. We included studies of any type of healthcare worker with responsibility for patient care. We included studies that focused on IPC guidelines (local, national or international) for respiratory infectious diseases in any healthcare setting. These selection criteria were framed by an understanding of the needs of health workers during the COVID-19 pandemic.

Data collection and analysis

Four review authors independently assessed the titles, abstracts and full texts identified by our search. We used a prespecified sampling frame to sample from the eligible studies, aiming to capture a range of respiratory infectious disease types, geographical spread and data-rich studies. We extracted data using a data extraction form designed for this synthesis. We assessed methodological limitations using an adapted version of the Critical Skills Appraisal Programme (CASP) tool. We used a 'best fit framework approach' to analyse and synthesise the evidence. This provided upfront analytical categories, with scope for further thematic analysis. We used the GRADE-CERQual (Confidence in the Evidence from Reviews of Qualitative research) approach to assess our confidence in each finding. We examined each review finding to identify factors that may influence intervention implementation and developed implications for practice.

Main results

We found 36 relevant studies and sampled 20 of these studies for our analysis. Ten of these studies were from Asia, four from Africa, four from Central and North America and two from Australia. The studies explored the views and experiences of nurses, doctors and other healthcare workers when dealing with severe acute respiratory syndrome (SARS), H1N1, MERS (Middle East respiratory syndrome), tuberculosis (TB), or seasonal influenza. Most of these healthcare workers worked in hospitals; others worked in primary and community care settings.

Our review points to several barriers and facilitators that influenced healthcare workers' ability to adhere to IPC guidelines. The following factors are based on findings assessed as of moderate to high confidence.

Healthcare workers felt unsure as to how to adhere to local guidelines when they were long and ambiguous or did not reflect national or international guidelines. They could feel overwhelmed because local guidelines were constantly changing. They also described how IPC strategies led to increased workloads and fatigue, for instance because they had to use PPE and take on additional cleaning. Healthcare workers described how their responses to IPC guidelines were influenced by the level of support they felt that they received from their management team.

Clear communication about IPC guidelines was seen as vital. But healthcare workers pointed to a lack of training about the infection itself and about how to use PPE. They also thought it was a problem when training was not mandatory.

Sufficient space to isolate patients was also seen as vital. A lack of isolation rooms, anterooms and shower facilities was a problem. Other important practical measures described by healthcare workers included minimising overcrowding, fast-tracking infected patients, restricting visitors, and providing easy access to handwashing facilities.

A lack of PPE, and equipment that was of poor quality, was a serious concern for healthcare workers and managers. They also pointed to the need to adjust the volume of supplies as infection outbreaks continued.

Healthcare workers believed that they followed IPC guidance more closely when they saw the value of it. Some healthcare workers felt motivated to follow the guidance because of fear of infecting themselves or their families, or because they felt responsible for their patients. Some healthcare workers found it difficult to use masks and other equipment when it made patients feel isolated, frightened or stigmatised. Healthcare workers also found masks and other equipment uncomfortable to use. The workplace culture could also influence whether healthcare workers followed IPC guidelines or not.

Across many of the findings, healthcare workers pointed to the importance of including all staff, including cleaning staff, porters, kitchen staff and other support staff when implementing IPC guidelines.

Authors' conclusions

Healthcare workers point to several factors that influence their ability and willingness to follow IPC guidelines when managing respiratory infectious diseases. These include factors tied to the guideline itself and how it is communicated, support from managers, workplace culture, training, physical space, access to and trust in personal protective equipment, and a desire to deliver good patient care. The review also highlights the importance of including all facility staff, including support staff, when implementing IPC guidelines.

PLAIN LANGUAGE SUMMARY

Factors that influence whether healthcare workers follow infection prevention and control guidelines for respiratory infectious diseases

What is the aim of this review?

This review is one of a series of rapid reviews that Cochrane contributors have prepared to inform the 2020 COVID-19 pandemic. The aim of this Cochrane review of qualitative research ("qualitative evidence synthesis") is to explore factors that influence whether healthcare workers follow infection prevention and control (IPC) guidelines for respiratory infectious diseases. To answer this question, we searched for and analysed qualitative studies about this topic.

Key messages

Healthcare workers point to several factors that influence their ability and willingness to follow IPC guidelines when managing respiratory infectious diseases. These include factors linked to the guideline itself and how it is communicated, support from managers, workplace culture, training, physical space, access to and trust in personal protective equipment (PPE), and a desire to deliver good patient care. The review also highlights the importance of including all facility staff, including support staff, when implementing IPC guidelines.

What was studied in this review?

When respiratory infectious diseases become widespread, such as during the COVID-19 pandemic, healthcare workers' use of IPC strategies becomes even more important. These strategies include the use of PPE such as masks, face shields, gloves and gowns; separating patients with respiratory infections from others; and stricter cleaning routines. Exploring how healthcare workers view and experience these strategies can help authorities and healthcare facilities learn more about how best to support healthcare workers to implement them..

What are the main findings of this review?

We found 36 relevant studies and sampled 20 of these studies for analysis. Ten studies were from Asia, four from Africa, four from North America and two from Australia. The studies explored the views and experiences of nurses, doctors and other healthcare workers when dealing with SARS, H1N1, MERS, tuberculosis, or seasonal influenza. Most of these healthcare workers worked in hospitals; others worked in primary and community care settings.

Our review pointed to several factors that influenced healthcare workers' adherence to IPC guidance. The following factors are based on findings assessed as of moderate to high confidence.

Healthcare workers felt unsure when local guidelines were long, unclear or did not match national or international guidelines. They could feel overwhelmed because local guidelines were constantly changing. They also described how IPC strategies led to increased workloads and fatigue, for instance because they had to use PPE and take on additional cleaning. Healthcare workers described how their responses to IPC guidelines were affected by the level of support they felt they received from their management team.

Clear communication about IPC guidelines was seen as vital. But healthcare workers pointed to a lack of training about the infection itself and about how to use PPE. They also thought it was a problem when training was not compulsory.

Having enough space to isolate patients was seen as vital. Too few isolation rooms, anterooms (small rooms leading from a corridor into an isolation room) and shower facilities was a problem. Other important practical measures described by healthcare workers included minimising overcrowding, fast-tracking infected patients, restricting visitors, and providing easy access to handwashing facilities.

A lack of PPE, or PPE that was of poor quality, was a serious concern for healthcare workers and managers. They also highlighted the need to adjust the amount of supplies as infection outbreaks continued.

Healthcare workers believed that they followed IPC guidance more closely when they saw the value of it. Other healthcare workers felt motivated to follow the guidance because of fear of infecting themselves and their families, or because they felt responsible for their patients. Some healthcare workers found it difficult to use masks and other equipment when it made patients feel isolated, frightened or stigmatised. Healthcare workers also found masks and other equipment uncomfortable to use. The workplace culture could also influence whether healthcare workers followed IPC guidelines or not.

Across many of the findings, healthcare workers pointed to the importance of including all staff, including cleaning staff, porters, kitchen staff and other support staff when implementing IPC guidelines.

How up-to-date is this review?

We searched for studies that had been published up to March 2020.

BACKGROUND

Description of the topic

The novel coronavirus (COVID-19), caused by SARS-CoV-2 (severe acute respiratory syndrome coronavirus), was first isolated in December 2019 in Wuhan, China. COVID-19 infection ranges in symptoms from asymptomatic to severe pneumonia with acute respiratory distress syndrome (ECDC 2020). The virus is carried in the small droplets that emerge from the nose or mouth when a person with COVID-19 speaks, coughs or sneezes. Infection can also happen when a person touches a surface or object that has the virus on it, then touches their eyes, nose or mouth (WHO 2020).

How the health condition might affect people

Infectious respiratory diseases are highly transmissible and pose a risk to healthcare workers; their patients; and their relatives and friends. Outbreaks such as severe acute respiratory syndrome (SARS) in 2003 have shown us that there are organisational, environmental and individual factors that healthcare workers view as crucial in protecting themselves and others from infectious respiratory diseases (Moore 2005a). Infection prevention and control (IPC) strategies include early recognition and source control, administrative controls, environmental and engineering controls and personal protective equipment (PPE) (WHO 2014). While healthcare workers rely on these strategies, it may sometimes be difficult to adhere to IPC guidelines, particularly when working in critical conditions.

Why is it important to do this review?

The recent COVID-19 pandemic has prompted concern about the compatibility of IPC guidelines with healthcare workers' working practices and behaviours. For example, consistent use of full-body PPE can diminish the risk of infection for healthcare workers (Verbeek 2020). However, while healthcare workers may value the use of IPC guidelines, such as wearing PPE, these are not always available, adequate for purpose or they are uncomfortable.

By identifying barriers and facilitators to IPC guideline adherence, we can more easily identify strategies that will support healthcare workers to undertake the IPC measures needed at such a critical time in health care internationally.

We carried out this qualitative evidence synthesis as a rapid review in response to an urgent demand for rigorously synthesised evidence to assist in addressing the COVID-19 pandemic.

OBJECTIVES

To identify barriers and facilitators to healthcare workers' adherence to IPC guidelines for respiratory infectious diseases.

METHODS

Criteria for considering studies for this review

Types of studies

We included primary studies that used qualitative study designs such as ethnography, phenomenology, case studies, grounded theory studies and qualitative process evaluations. We included studies that used both qualitative methods for data collection (e.g. focus group discussions, individual interviews, observation, diaries, document analysis, open-ended survey questions) and qualitative methods for data analysis (e.g. thematic analysis, framework analysis, grounded theory). We excluded studies that collected data using qualitative methods but did not analyse these data using qualitative analysis methods (e.g. open-ended survey questions where the response data were analysed using descriptive statistics only). We excluded publications that were not reporting on primary research.

We included mixed-methods studies where it was possible to extract the data that were collected and analysed using qualitative methods. We did not exclude studies based on our assessment of methodological limitations. We used the information about methodological limitations to assess our confidence in the review findings.

Due to time constraints, we included published studies only.

We included studies published in any language (see also section on ‘language translation’ of studies below). There were no year limits in the search strategy. However, as this was conducted as a rapid review, in the interest of timeliness and relevance, we only included studies published after 2002. We chose this date as the SARS outbreak was in 2003. Therefore, by including studies published after 2002 we aimed to capture studies undertaken in response to a 'global outbreak', as well as studies that incorporated more contemporary IPC guidelines.

Topic of interest

We included studies where there was a focus on barriers and facilitators to healthcare workers’ adherence to IPC guidelines for respiratory infectious diseases. We excluded studies that were considered 'hypothetical', in that participants did not have experience of working in the context of respiratory infectious diseases.

Types of participants

We included studies that focused on the experiences and perceptions of healthcare workers with regards to IPC guidelines for respiratory infectious diseases. By healthcare workers we mean any healthcare worker, including clinicians (e.g. doctors, nurses, midwives, clinical managers, allied health professionals, pharmacists) or other staff members (e.g. porters, healthcare assistants), with responsibility for patient care in any hospital, long-term care, primary care or community setting (adapted from Moralejo 2018).

Types of interventions

We included studies that focused on acute respiratory IPC guidelines (local, national or international) in any healthcare setting including primary care settings, acute hospital settings, long-term care or community settings. We used the term 'guideline' to represent systematically developed statements, that include recommendations, to assist decisions about appropriate healthcare (Field 1990, Graham 2011)

For the purpose of this review, we defined respiratory infectious diseases as those that:

- cause acute respiratory tract infection, including pneumonia and acute respiratory distress syndrome;

- cause severe disease in susceptible people with apparently normal immune systems; and
- may constitute a public health emergency of international concern (WHO 2014)

Therefore we included the following respiratory infectious diseases:

- COVID-19
- SARS
- Middle East respiratory syndrome (MERS)
- tuberculosis (TB)
- influenza-like illness/respiratory infections

We defined IPC as (guided by, but not exclusive to, WHO 2014):

- early recognition and source control (triage, respiratory hygiene);
- administrative controls (isolation, spatial separation, patient cohorting);
- environmental and engineering controls (cleaning and disinfection, ventilation);
- PPE (donning (putting on) and doffing (taking off), gowns, gloves, masks, goggles); and
- hand hygiene.

Search methods for identification of studies

An information specialist (MS) designed and conducted all searches, which were informed by a topic expert and independently peer reviewed by an Information Specialist and Assistant Managing Editor at Cochrane. We conducted a scoping search to gain familiarity with the breadth and depth of the literature and to assist in identifying keywords and medical subject headings.

Electronic searches

Due to time constraints, we took the decision to search only one database. MS conducted a systematic search of Ovid MEDLINE (Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) < 1946 to March 26, 2020 >) in collaboration with the research team, which included a topic expert. The search was developed to include (Healthcare workers OR Healthcare professionals) AND (Respiratory diseases OR Coronavirus infections) AND (Personal protective equipment OR protective clothing OR Infection Control) AND (Guidance OR Guidelines OR adherence OR compliance). See Appendix 1.

Searching other resources

As we searched only Ovid MEDLINE, HD and LB undertook a search of the reference lists of key papers using citation chaining. This is a search method that starts with one paper, that creates a chain of references linked backwards and forwards from the original paper (Nyakang'o 2018). One member of the team (CH) also screened the results of the scoping search to identify potential references.

Selection of studies

Four review authors (CH, PM, HD, LB) independently assessed the titles and abstracts to evaluate eligibility. They then retrieved the full texts of all papers identified as potentially relevant and also assessed these papers independently. We double-screened all titles, abstracts and full texts. We resolved disagreements by discussion or, when required, by involving a third review author. These selection criteria were framed by an understanding of the needs of health workers during the COVID-19 pandemic.

We have included a table listing studies that we excluded from our review at full-text stage and the main reasons for exclusion (Characteristics of excluded studies). Where the same study, using the same sample and methods, was presented in different reports, we collated these reports so that each study (rather than each report) was the unit of interest in our review.

We have included a PRISMA flow diagram to show our search results and the process of screening and selecting studies for inclusion (Figure 1; Moher 2009).

Figure 1. Study flow diagram

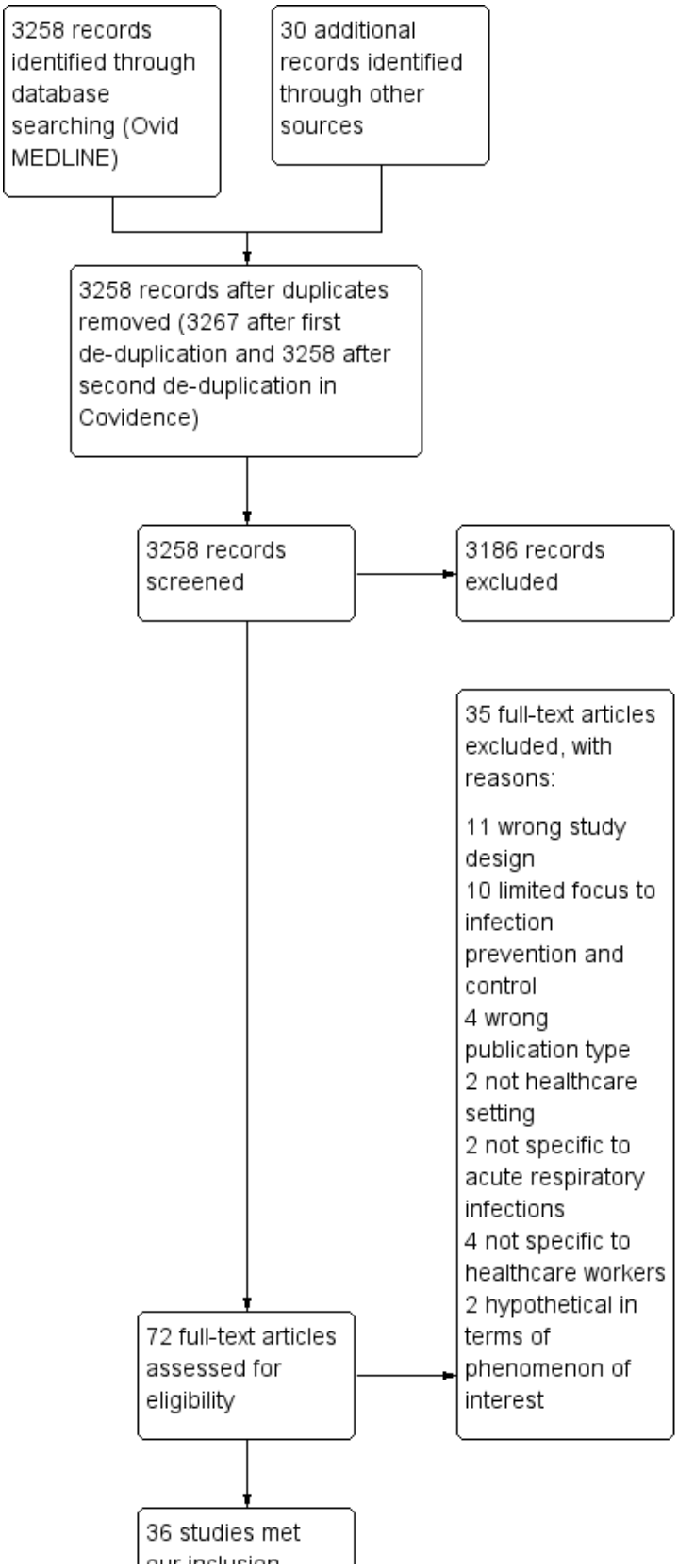

Figure 1. (Continued)

Language translation

For titles and abstracts that were published in a language that none of the review team is fluent in, we carried out an initial translation through open source software (Google Translate). We only identified one study, in Spanish, but later excluded it after a translation of the abstract and sections of the full text.

Sampling of studies

Qualitative evidence synthesis aims for variation in concepts rather than an exhaustive sample, and large amounts of study data can impair the quality of the analysis. We identified 36 studies that met our inclusion criteria. In order to decrease the number of included studies to a manageable amount to help ensure that the review could be completed rapidly, we chose the following three-step sampling frame (Ames 2017).

- First, in order to ensure that we captured a range of respiratory infectious disease types, we included all nine studies that looked at coronaviruses (MERS = 2 and SARS = 7), as, similarly to COVID-19, they have a mixture of contact, droplet, and airborne transmission.
- Second, we assessed the data richness of the 27 remaining studies focusing on TB, H1N1 and general respiratory virus outbreaks. To do this we used a simple 1 to 5 scale (Table 1), with permission from (EPOC 2017).
- From these 27 studies, we sampled the studies that scored a 3 or higher for data richness; but we also ensured a geographical spread across different continents with different income levels, we agreed to sample a further 11 studies (12 reports) to include in our review.

We therefore sampled a total of 20 studies (21 reports) for analysis.

Data extraction

Four review authors individually (CH, PM, HD, LB) performed data extraction using a data extraction form (Google Forms), designed specifically for this synthesis. We extracted the following information from each study.

- Year
- Aims and purpose of the study
- Study design
- Setting
- Type of respiratory disease
- Type of healthcare worker
- Type of IPC guideline or recommendation
- Sample size
- Data collection methods

We each extracted study data (qualitative themes/supporting quotations, and discussion) using the 'Theoretical Model to Explain Self-Protection Behaviour at Work' (Moore 2005a), as the framework, with supplementary sections for additional study data both within each of the three headings (organisational, environmental and individual factors) as well as data that did not fall within any of these. CH, PM, HD, LB individually extracted the data on all included studies with ongoing discussion and moderation to ensure consistency.

Assessing the methodological limitations of included studies

Two review authors (out of four: CH, PM, HD, LB) independently assessed each study for methodological limitations and we resolved disagreements through discussion between authors. We used an adapted version of the CASP tool (Critical Skills Appraisal Programme), and assessed methodological limitations based on the following domains: context, sampling strategy, data collection, data analysis, support of individual study findings in the underlying data, reflexivity, ethical considerations, and other concerns (Table 2).

Data management, analysis and synthesis

We used a ‘best fit framework approach’ (Booth 2015), in the analysis and synthesis of evidence. The best fit framework synthesis method provides an approach to build on an existing published model, devised for a potentially different but relevant population (Carroll 2013). We considered this approach useful for this review because it reduces the time taken to generate theory and is specifically geared to produce actionable messages by enriching existing theory (Booth 2015).

We used a theoretical model of workplace self-protective behaviour, the PRECEDE model of health promotion, initially developed by Greene 1991, modified by DeJoy 1996 and later remodified by Moore 2005a and titled the 'Theoretical Model to Explain Self-Protection Behaviour at Work'. It proposes predisposing, reinforcing and enabling factors related to self-protective behaviour at work. This model had been previously used to guide primary research on healthcare workers' perceptions of adhering to IPC guidelines (Moore 2005a), therefore we believed it to be apt for this review. Predisposing factors relate to individual characteristics (e.g. beliefs, attitudes, values), enabling factors relate to environmental factors (e.g. equipment availability and physical environmental factors) and the model also considers reinforcing organisational factors (e.g. safety climate, availability of training programmes and specific health and safety programmes) that facilitate self-protective behaviour. We used these factors as headings within which we categorised extracted data. One review author extracted data on three studies using a pilot form and a second review author checked the extracted data for correctness and completeness. Following team review, we carried out minor revisions to the form and then completed extraction on all included studies.

We used the five stages of 'best fit' a priori framework synthesis to analyse and synthesise findings (Booth 2015). Stages included familiarisation, identifying a thematic framework, indexing, charting, mapping and interpretation. Familiarisation involved immersion in the data and, subsequently, identifying the 'best fit' thematic framework. Indexing involved four review authors (CH, PM, HD, LB) rereading the studies and applying the framework, moving between the data and the developing themes. Charting involved rearranging data according to relationships and finally mapping and interpretation, where we mapped the range and nature of reviewed concepts and looked for how the themes addressed the review question and aim. We acknowledged that we would conduct thematic synthesis for additional findings. All data had a fit within the three broad domains of the framework. However, we added one additional subtheme called 'Discomfort of PPE', which was captured under the domain of individual factors. In the final review stage, we changed the descriptor of one subheading in the organisational factors domain from 'Specific health & safety programme' to 'Communication on IPC guidelines'. We made this change to enhance the applicability, clarity and readability for all, but particularly for clinicians. During all stages of data synthesis, regular meetings of the review team facilitated critical discussion and interrogation of the data. Peer review of synthesised findings facilitated trustworthiness, coherence and relevance of the findings. Across the three domains we identified 26 key findings, which represented our analysis.

Once the review findings were completed, one review author (CG) examined each finding, identified factors that could influence the implementation of the intervention, and developed prompts for future implementers. These prompts are presented in the implications for practice section. These prompts are not intended to be recommendations, but are phrased as questions to help implementers consider the implications of the review findings within their context. We sent this section to a selection of healthcare workers from different countries and working in different healthcare sectors to gather their feedback about the relevance of these prompts and the manner in which they were phrased and presented. We made minor revisions based on this feedback.

Assessing our confidence in the review findings

Four review authors (CH, PM, HD, LB) independently used the GRADE-CERQual (Confidence in the Evidence from Reviews of Qualitative research) approach to assess our confidence in each finding (Lewin 2018). GRADE-CERQual assesses confidence in the evidence, based on four key components.

1. Methodological limitations of included studies: the extent to which there are concerns about the design or conduct of the primary studies that contributed evidence to an individual review finding.
2. Coherence of the review finding: an assessment of how clear and cogent the fit is between the data from the primary studies and a review finding that synthesises those data. By cogent, we mean well supported or compelling.
3. Adequacy of the data contributing to a review finding: an overall determination of the degree of richness and quantity of data supporting a review finding.
4. Relevance of the included studies to the review question: the extent to which the body of evidence from the primary studies supporting a review finding is applicable to the context (perspective or population, phenomenon of interest, setting) specified in the review question.

After assessing each of the four components, we made a judgement about the overall confidence in the evidence supporting each review finding. We judged confidence as high, moderate, low, or very low. We based our final assessment on consensus among ourselves. All findings start as high confidence and are then graded down if there are important concerns regarding any of the GRADE-CERQual components.

'Summary of qualitative findings' table(s) and evidence profile(s)

We have presented our summaries of the findings and our assessments of confidence in these findings in a 'Summary of qualitative findings' table (Table 3). We will present detailed descriptions of our confidence assessment in evidence profiles following initial publication of this rapid review.

Review author reflexivity

The review author team was assembled quickly in response to Cochrane's call for review authors to undertake rapid reviews in key areas related to the COVID-19 pandemic.

The team represents diverse professional backgrounds and varied methodological expertise; all skills were necessary to conduct this rapid qualitative evidence synthesis (QES) in the time frame required. Some of the team has healthcare backgrounds (CH and PM are nurses, LB and DD are midwives, XHC is a specialty registrar in infectious diseases) and provided important topic expertise. CH, PM, DD and LB are university lecturers in faculties of healthcare professionals. XHC has a clinical role in the area of infectious diseases and currently cares for patients. All the healthcare professionals have experience of IPC guidelines and incorporating them into their clinical work.

All the review authors are researchers within health care. Some members of the group are experienced qualitative (CH, PM, LB, CG) and mixed-methods researchers (PM, HD). AB, CG, CH, LB and PM are experienced in the methodology of QES and CH, PM, LB, DD previously conducted a QES together. AB and CG are leaders in advancing the methodology of QES. AB alongside MS brought information specialist expertise to the team. XHC brought her knowledge of the subject area and offered much appreciated guidance in relation to acute respiratory infections. DD and AB are currently involved in many teams that are involved in prioritising questions and conducting rapid reviews in relation to COVID-19. All members of the team have an interest in synthesising the evidence in relation to COVID-19 to support researchers and the healthcare community during this time when there is an urgent need to prevent the spread of the virus.

Some members of the review team felt that the culture within which guidelines are introduced has a major influence on how they are perceived and actioned by health professionals. Terms such as 'compliance' suggest a culture of enforcement whereas 'recommendations' conveys a sense of 'enlightened cooperation'. This context may influence levels of adherence but also how health professionals feel about being required/requested to adhere.

The methods section of this review outlines the rationale underpinning additional decisions we made. We acknowledge that we would have enjoyed and benefited from making these decisions and the associated thinking in a more leisurely time frame. However, a rapid response to a prioritised question was required, and this remained our guiding principle throughout. We took comfort from the words Dr Michael Ryan (Executive Director, WHO Health Emergencies Programme) used in a press conference focusing on the response needed to the COVID-19 pandemic:

"If you need to be right before you move, you will never win. Perfection is the enemy of the good when it comes to emergency management. Speed trumps perfection. The problem in society we have at the moment is that everyone is afraid of making a mistake. Everyone is afraid of the consequence of error. But the greatest error is not to move. The greatest error is to be paralysed by the fear of failure." (Ryan, 14 March 2020).

RESULTS

Results of the search

We found 36 studies that met our inclusion criteria. We sampled 20 of these studies (published in 21 papers) for inclusion in the analysis (Figure 1). As described in the Methods section, we used a sampling frame that aimed to capture a range of respiratory infectious disease types and geographical spread and to include data-rich studies. The sampled studies were published between 2005 and 2019.

Description of the studies

In this section, we describe the 20 studies that we sampled for analysis. For a description of all of the 36 eligible studies, see our Characteristics of included studies.

Study settings

Twelve of the sampled studies were from high-income countries: Australia (2), Canada (2), Hong Kong (1), Singapore (2), South Korea (2), Taiwan (2), and USA (1). Seven of the sampled studies were from middle-income countries: China, the Dominican Republic, India, Russia and South Africa (3). One study was from a low-income country, Uganda.

Ten of the sampled studies were from Asia (China, Hong Kong, India, Russia, Singapore, South Korea, Taiwan); four studies were from Africa (South Africa and Uganda); four were from North or Central America (Canada, the Dominican Republic, USA); and two were from Australia. None of the included studies were from South America or Europe.

Most of the sampled studies were from hospital settings (15 studies), at least 10 of which focused on acute hospital settings. Other healthcare facilities included in the studies were different levels of Veterans Affairs healthcare facilities, outpatient clinics, TB clinics, family practices, and primary care settings.

Study participants

Most of the studies included nurses (14 studies) or doctors (9 studies). Other types of healthcare workers included in the studies were allied healthcare workers such as occupational therapists, respiratory therapists and physiotherapists; ancillary staff with responsibility for patient care, such as porters and domestic workers; laboratory technicians; infection control practitioners; and managers.

Topic of interest

The sampled studies focused on healthcare workers' views and experiences with regards to infection prevention and control for TB (7 studies) SARS (7), H1N1 (3), MERS (2) or more generally respiratory virus outbreaks (1). Twelve studies explored healthcare workers' use of general PPE, and in some cases their use of facemasks or respirators. Thirteen studies explored healthcare worker practice in relationship to local, national or international guidelines or recommendations.

Methodological limitations of the studies

We assessed over half of the included studies as having no or minor methodological limitations, with six studies having major or moderate methodological limitations. Most studies gave some description of the context and data collection strategy, and in almost all studies we assessed the study findings as sufficiently supported by the underlying data. Across the majority of studies reporting of researcher reflexivity was poor. About half of the studies did not report, or did not report clearly, on sampling strategy, data analysis and ethical considerations. See Table 2 for full details of the assessment of methodological limitations for each study.

Confidence in the review findings

Out of 26 findings, we graded three as high confidence, 18 as moderate confidence, and five findings as low confidence using the GRADE-CERQual approach (Table 3). Our explanation of the GRADE-CERQual assessment for each review finding will be shown in the evidence profiles (to follow initial publication).

Review findings

Our 26 findings are presented within the three broad domains of our framework: organisational, environmental and individual factors.

Within each of these, we used further subthemes to present the review findings in a meaningful way.

- Organisational factors
  - Safety climate
  - Communication of IPC guidelines
  - Availability of training programmes
- Environmental factors
  - Physical environment
  - Availability of PPE
- Individual factors
  - Individual knowledge
  - Individual attitudes
  - Individual beliefs
  - Discomfort of PPE (additional to the original framework)

Organisational factors

Safety climate

Finding 1: Healthcare workers perceived their response to guideline protocols being influenced by the level of support that they received from their management team

When healthcare workers perceived that supportive behaviours were offered by hospital administration and managers this promoted their engagement with IPC (Chapman 2017a; Tseng 2005; Woith 2012; Zinatsa 2018): "The practice by administrators of making rounds on the units and offering words of encouragement was perceived as being supportive of staff"; 'the administrators come to see us and they offered encouragement to follow IC policies' " (Nurse, Hospital 2; Woith 2012: 1094).

As well as offering encouragement with guideline adherence (Woith 2012), participants in one study (Zinatsa 2018), suggested that managers could foster a safety culture by modelling appropriate infection control practices for all staff. Some of the nurses felt that the support they received from their organisation during the SARS crisis (e.g. the Director of Nursing bought them food; ointment for discomfort caused by facemasks was supplied; and they received phone calls about their well-being from the hospital's psychiatrists) fostered their courage to respond actively to the situation (Tseng 2005). Healthcare workers judged hospital management's commitment to a safety climate by the actions they took during a time of crisis (Chapman 2017a; Corley 2010; Moore 2005a). Feeling unsupported during this time was seen to impact on motivation to adhere to infection control measures: "HCWs [healthcare workers] who feel devalued or unimportant to the institution's mission may be psychologically affected in their completion of daily clinical responsibilities as well as their reflections on their selected vocation, including motivation to adhere to infection control measures" (Chapman 2017a: 2123).

We have moderate confidence in this evidence.

Finding 2: If healthcare workers considered that the IPC guidelines were long, ambiguous or did not reflect international guidance, they described feeling unsure as to which IPC guidance they should adhere to

Healthcare workers judged a guideline to be inappropriate if it was too long or too difficult to follow (Chau 2008); if it did not mirror broader national or international guidance (Kang 2018b; Locatelli 2012); and if they believed that it was unclear and not easy to follow (Chau 2008; Corley 2010; Shih 2007). Ambiguous guidelines were said to add to the healthcare workers' confusion in relation to which elements of IPC were required: "The discrepancy between the level of respiratory protection needed continued to thwart our efforts. What we have been taught, what we believed to be true, and what was recommended by federal agencies did not agree, which became problematic" (Locatelli 2012: 624). Healthcare workers working in an intensive care setting reported that the lack of firm, clear recommendations regarding PPE made them feel "unprotected" and "undervalued" at the height of a H1N1 pandemic.

We have moderate confidence in this evidence.

Finding 3: With guidelines changing so frequently, healthcare workers felt overwhelmed and often were not able to keep up with the most recent guidance

The speed at which some of the guidelines changed caused difficulties for some of the healthcare workers and made it problematic for them to implement the most recent protocols (Kang 2018a; Locatelli 2012; Moore 2005a; Wong 2012). One participant in a Veteran Affairs facility referred to the "information overload" (Locatelli 2012). With it came the inability to prioritise one item of information before new information superseded it (Wong 2012): "... there was so much information. The information changed on more than a daily basis, and even the managers, sometimes, I am sure they were confused. Which directives to take? Which ones not to take? And I don't think there was enough time for even the managers to relate all the information to the workers. We were just being bombarded with new directives, on how to do certain things and things changed so quickly... when you are so busy trying to actually do work; you don't have enough time to go sit at the computer and read word by word on what's being directed to you." (Moore 2005a: 261).

We have moderate confidence in this evidence.

Finding 4: If IPC guidelines were considered impractical, healthcare workers found them difficult to implement

Impractical guidance did not take into account how patient care is implemented: "Other challenges included the perception that some policies were not applicable to PHC [primary healthcare] settings … when you read the policy you see that it doesn't affect people at the primary care level … it's for hospital based – that's the problem" (Zinatsa 2018: 5).

Nurses in one study (Wong 2012), termed impractical guidance as "inflexible IPC". They suggested that the proposed guidance in their workplace was not possible and this actually increased their risk of contracting H1N1. Frontline healthcare workers "did not adapt well" (Shih 2007), or "were too busy" to engage (Adeleke 2012), when their own views on IPC practices differed from the policies and procedures or they believed that the policies did not relate to their work environment (Zinatsa 2018).

We have low confidence in this evidence.

Finding 5: The increased workload and healthcare worker fatigue associated with IPC guidelines, such as donning PPE and additional cleaning, were seen as a barrier to adherence

Adhering to IPC guidelines especially when using PPE in busy clinical situations impacted on the healthcare workers' productivity levels. Healthcare workers responsible for the efficiency of the

cleaning process in these wards were often under pressure to maintain adequate hygiene to meet the high patient turnover rates (Moore 2005a; Shih 2007; Tseng 2005; Wong 2012). Physical challenges from the PPE as well as the temperature in the ward environment added to the physical effort expended when caring for patients (Chapman 2017a; Seale 2014): "the increased worker fatigue, especially when using PPE in stressful situations, meant that productivity fell dramatically. Thus staffing levels on a per client basis needed to be increased to compensate and workers felt that this was not adequately addressed" (Moore 2005a: 263). Healthcare workers also referred to the additional workload that visitors to the hospital brought. If visiting was not restricted then healthcare workers bore the responsibility of having to monitor visitors' adherence to IPC practices such as distancing and hand sanitation (Corley 2010; Moore 2005a).

Not all organisations had taken fatigue into account and some nurses' workload was not adjusted accordingly. When unrealistic workloads remained, nurses stated that they would not be able to maintain the IPC guidelines of their hospital (Chapman 2017a; Chapman 2018): "… in any given time the [infection control] protocol will be disturbed because myself alone with 70 patients, how can I comply with the protocol?" (Chapman 2017a: 2122). One emergency physician suggested that organisations needed to explore increasing their healthcare workers and so reduce individual workloads: "another emergency physician proposed decreasing cumulative work hours per HCW [healthcare worker] as a way to cut the risk of workplace hazards" (Chapman 2018).

We have moderate confidence in the evidence.

Communication of IPC guidelines

Finding 6: Clear communication strategies and sharing new information within organisations were seen as vital for the successful implementation of IPC guidelines

The constantly changing nature of information and guidelines was held as challenging for the healthcare workers to process and also for the organisations to disseminate. Having clear strategies to communicate any updates or changes in protocol was viewed as helpful by healthcare workers (Corley 2010; Kang 2018a; Locatelli 2012; Moore 2005a; Seale 2014). Communication that was focused (Kang 2018a; Locatelli 2012); summarised the main points and summarised new information (Kang 2018a); and was co-ordinated by one department/source (Locatelli 2012; Tseng 2005), meant that clear messages were shared in a timely manner: "We had our public affairs officer as our only spokesperson to keep message concise, simple, and consistent. No one else had any questions asked of them; they always deferred back to the Chief of Medicine or the public affairs officer." (Locatelli 2012:625)

Healthcare workers in organisations with poor communication strategies described a piecemeal approach to obtaining information, from a variety of sources (including the media), which added to the confusion experienced by frontline staff (Corley 2010).

We have high confidence in this evidence.

Finding 7: Using multiple platforms or methods of communication was considered to be a useful way of ensuring that all staff received accessible information and updates in relation to IPC guidelines

Healthcare workers emphasised the importance of receiving information in a timely manner (Kang 2018a; Locatelli 2012; Moore 2005a; Seale 2014) although bombarding healthcare workers with information when they are trying to work could also impact on their adherence to the new information (Moore 2005a). healthcare workers suggested that because they are so busy, organisations should consider a multi-faceted approach to communication (Locatelli 2012; Moore 2005a; Seale 2014): "staff responsible for internal communication should select channels most likely to reach their target audience and find ways to utilize multiple dissemination methods" (Locatelli 2012: 625).

Routes for the dissemination of information included the use of posters (Locatelli 2012), "town hall" meetings (Moore 2005a; Yassi 2005), a daily case conference (Shih 2007), a free mobile phone messaging application (Kang 2018a), and a summary notice communicated at the changeover of working shifts (Kang 2018a). For some healthcare workers these were more useful routes of communication than email as they were not able to access and read email while caring for patients (Moore 2005a): "It would have been nice to have been informed of the changes right off. Sometimes that didn't always happen... " [Another speaker] "And I can add to that. I personally think the reason that was, is because it was all done by e-mail and a lot of direct people house-keeping, nursing, anybody that does direct care - don't sit down at a computer before they start their day. I think that it was not the ideal method" (Moore 2005a; 263).

We have low confidence in this evidence.

Availability of training programmes

Finding 8: Lack of training about the specific infection and how to use PPE was seen to contribute to poor implementation of IPC guidelines

Training and education was viewed as necessary if full adherence to guidelines is to be achieved (Chau 2008). Some of the participants acknowledged that, aside from their initial professional education, they had no training in relation to IPC (Adeleke 2012; Akshaya 2017; Tan 2006); others highlighted little or limited training (Rowlands 2007). Some of the healthcare workers stated that training was only available for managers, not frontline care providers (Chapman 2017a; Zinatsa 2018). Those who had experienced training noted that it was insufficient and that they required additional education (Chapman 2018; Chau 2008; Corley 2010; Locatelli 2012; Moore 2005a; Yassi 2005): "Other common barriers identified by the 3 groups [study participants] were the workload and poor practices by colleagues highlighting the need for further training and education for all grades of staff" (Chau 2008: 46).

Poor knowledge of risk factors associated with specific infections (SARS, TB) impacted on the healthcare workers' understanding of policies and subsequently their adherence to IPC guidance (Adeleke 2012; Akshaya 2017; Chau 2008; Zinatsa 2018). Lack of training in relation to the specifics of PPE was also raised and how this limited the healthcare workers' ability to use PPE correctly (Chapman 2017a; Corley 2010; Moore 2005a; Tan 2006).

We have high confidence in this evidence.

Finding 9: Where training was not mandatory and performance was not assessed in practice, healthcare workers felt this contributed to lack of adherence to IPC guidelines

In spite of the availability of some level of education for healthcare workers, it was noted that this did not automatically lead to the implementation of IPC guidelines in practice (Woith 2012).

Some healthcare workers suggested that the voluntary nature of the training for themselves and their colleagues contributed to this, and that mandatory attendance was warranted (Chapman 2018; Chau 2008; Matakanye 2019; Moore 2005a; Woith 2012; Yassi 2005). Healthcare workers in a hospital proposed that, "mandatory workshops should be offered for every employee [in the health institution]" across all professional groupings (Chapman 2017a).

The benefits of follow-up audit and the assessment of healthcare workers' adherence to IPC guidelines in the clinical area were also raised as ways of organisations continuously monitoring the "infection control knowledge" of their staff (Chau 2008; Zinatsa 2018). As highlighted by Yassi 2005, "focus groups members expressed their views that repeated training was needed and that better tracking methods to monitor who had been trained and who requires training should be developed" (p 47).

We have moderate confidence in this evidence.

Finding 10: Frontline healthcare workers described how they could not balance the role of IPC trainer with their existing clinical responsibilities

While healthcare workers described a need for ongoing training, the models of training employed in some areas were held as not being suitable or sustainable (Chau 2008; Moore 2005a; Yassi 2005; Zinatsa 2018). It was noted that frontline healthcare workers with a commitment to providing patient care were not in a position to meet the training requirements of their colleagues (a model that was employed in many of the hospital sites). A frontline healthcare worker working during the SARS crisis stated, "you cannot educate in a crisis" (Moore 2005a: 47). A similar point was raised by a healthcare worker who noted that the "train-the-trainer model needs to be evaluated with respect to time commitments on frontline workers" (Yassi 2005: 47). It was deemed impossible to assume the dual role of teacher and healthcare provider at a time when patients had considerable needs: "the problem is with primary instructor, it's also primary caregiver and so they have to determine what their priorities are going to be teaching all staff as they are doing bedside care, or are they going to be taking their focus away from their patient and worrying about all the staff" (Moore 2005a: 263).

We have low confidence in this evidence.

Environmental factors

Physical environment

Finding 11: A healthcare facility environment with sufficient space to isolate patients was regarded as a key facilitator for healthcare workers' ability to adhere to infection control methods

Healthcare workers generally considered that the space available in the physical environment was important in facilitating the management and control of cross contamination (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Kang 2018b; Matakanye 2019; Tseng 2005; Zinatsa 2018). Space (sufficient or lack of) was an important factor to adherence, with wide variation of facilities across studies. Some healthcare workers reported spacious well-equipped protective facilities (Moore 2005a; Tseng 2005), while others (Kang 2018b; Wong 2012) reported adequate facilities but with some limitations, such as two-patient isolation rooms (Wong 2012). Inadequate space in the facilities was commonly reported particularly in the studies from low- to middle-income countries (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Matakanye 2019; Woith 2012; Zinatsa 2018). Many healthcare workers in these countries reported working in completely unsuitable buildings and were concerned at deteriorating hospital infrastructure (Matakanye 2019; Zinatsa 2018). Space for isolation facilities was unavailable, or not fit for purpose, in many sites. This impacted healthcare workers' ability to adhere to recommended infection control guidelines (Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Matakanye 2019; Woith 2012). As one female physician participant said: "We are aware that we should not have placed the [TB] patient with other [non- TB] patients, but with limited space, we have no other option. We are aware that what we are doing is wrong" (Chapman 2017a: 2120).

The lack of appropriate physical space was perceived as a barrier to the implementation of the patient separation measures necessary to reduce cross-contamination (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2018; Matakanye 2019). Physical space was also impacted by high patient turnover rates at times of crisis, and healthcare workers reported that this hampered their ability to adhere to infection control measures despite their knowledge to the contrary (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2018; Matakanye 2019; Woith 2012; Zinatsa 2018).

We have moderate confidence in this evidence.

Finding 12: Lack of provision of adequate ventilation, isolation rooms, anterooms and shower facilities within the healthcare setting was viewed as a barrier to achieving IPC measures

Healthcare workers considered the provision of adequate engineering infrastructure within the healthcare facility as a vital component in helping them maintain IPC methods (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Kang 2018a; Matakanye 2019; Tseng 2005; Zinatsa 2018). This included the provision of good ventilation, isolation rooms or negative pressure rooms; and appropriate fit testing of equipment. Three studies of SARS and one of H1N1 reported good facilities to manage a respiratory disease epidemic, with well-equipped ventilated rooms with anterooms and alarm systems (Shih 2007; Tseng 2005; Wong 2012). However, the lack of shower facilities for staff was considered problematic. Inadequate ventilation was a common issue cited by healthcare workers in several studies as impacting the environmental control of the disease process (Adeleke 2012; Buregyeya 2013; Chapman 2018; Matakanye 2019; Zinatsa 2018). Studies reported poorly ventilated wards, clinics and waiting rooms that put patients at a risk of contracting disease from others (Buregyeya 2013; Chapman 2017a; Chapman 2018; Matakanye 2019; Zinatsa 2018). Healthcare workers in some facilities reported requesting improved ventilation but in many instances a lack of funding was cited as the reason for the lack of provision (Adeleke 2012; Buregyeya 2013). The provision of isolation rooms was considered the best approach to minimise cross-contamination, but many studies reported a lack of this facility (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2018; Matakanye 2019; Woith 2012; Wong 2012; Zinatsa 2018). One study reported the availability of isolation rooms as inadequate in that they housed two patients (Wong 2012). High patient turnover was a greater consideration among those hospitals dealing with respiratory infections. Although these hospitals may have had isolation rooms the need to find beds for patients during surges of disease sometimes necessitated patients being accommodated in

general wards that lacked isolation facilities (Shih 2007; Tseng 2005; Wong 2012). Some healthcare workers reported feeling frustrated and powerless to address the engineering aspects of their facilities (Buregyeya 2013). Healthcare workers perceived institutional-level barriers that reflected limited availability of institutional funding for appropriate and effective protection for healthcare workers (Buregyeya 2013; Chapman 2017a). As one focus group participant said; "…but they didn't carry it out; we put in our action plan to put some aeration to allow air flow through some of the corridors but it wasn't done because of the funds" (Buregyeya 2013: 7).

We have moderate confidence in this evidence.

Finding 13: Practical measures such as route control, minimising overcrowding, fast-tracking infected patients and visitor restrictions, to reduce the risk of contamination, were viewed as important tools for the protection of the patient and staff

A significant concern among healthcare workers was the potential for contact with people who may already have become sources of infection (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Matakanye 2019; Woith 2012; Zinatsa 2018). For this reason, controlling people's movement in the hospital was key to minimising risk of contamination. Healthcare workers welcomed the implementation of measures such as route control or the designation of elevators and routes as exclusive for patients, staff and supplies (Tseng 2005). "Everybody including patients' family members, visitors, nurse aides, clerks, janitors and maintenance personnel, needed protection. The most serious concern was that some of these people might have already become sources of infection; so controlling everyone's movement in the hospital was vital" (Tseng 2005: 61). Other reported strategies included fast-tracking patients to clinic appointments (Akshaya 2017; Buregyeya 2013), minimising hospital overcrowding (Chapman 2017a), managing patients outside (Matakanye 2019), and providing separate wards for contaminated patients (Chapman 2017a; Zinatsa 2018). Visitor restrictions were described in other studies (Akshaya 2017; Rowlands 2007).

We have moderate confidence in this evidence.

Finding 14: Healthcare workers' access to handwashing facilities and surface decontamination supplies was viewed as a key factor in adhering to infection control methods

Healthcare workers acknowledged that environmental decontamination was an important mechanism in the fight against the spread of the disease (Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Kang 2018a; Wong 2012; Zinatsa 2018). In some studies, healthcare workers reported difficulty in adhering to environmental and worker decontamination because of a lack of supplies as well as poor handwashing practices because of lack of adjacent sinks (Adeleke 2012; Akshaya 2017), no handwashing soaps (Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018), and a lack of running water (Akshaya 2017). As one nurse described: "When it comes to washing, there are no soaps provided for hand washing. Sinks are put up but no water is available. Running water is required; however, it is not there" (Akshaya 2017: 6). Healthcare workers in other studies felt that most of their facilities had adequate hand-cleansing gel stations, which could compensate for the areas where there might be a lack of hand-washing sinks (Moore 2005a; Shih 2007; Tseng 2005; Wong 2012). Some healthcare workers described becoming emotionally distressed at being unable to apply appropriate infection control measures (Chapman 2017a; Chapman 2018). Some healthcare workers welcomed the directive to keep disinfectant readily available in order to decontaminate all surfaces such as phones, desks, doorknobs and elevator buttons after use (Moore 2005a; Tseng 2005). Strategies reported to assist in decontamination of the environment included wet mopping (Akshaya 2017), and equipment disinfection (Moore 2005a; Tseng 2005).

We have moderate confidence in this evidence.

Availability of PPE

Finding 15: Inadequate supplies of appropriate PPE, of a required standard, to ensure patient and staff safety was perceived by healthcare workers and managers as a serious concern

Healthcare workers across the majority of studies were concerned about the adequacy of PPE provision (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Corley 2010; Kang 2018a; Kang 2018b; Locatelli 2012; Matakanye 2019; Moore 2005a; Rowlands 2007; Seale 2014; Shih 2007; Tan 2006; Tseng 2005; Woith 2012; Wong 2012; Yassi 2005; Zinatsa 2018). Staff needed reassurance that the PPE available was of a high standard and suitable for the task (Corley 2010; Kang 2018b; Moore 2005a; Shih 2007; Tan 2006). Nursing management saw it as a high priority to ensure adequate supplies of PPE and to reassure staff that these were available (Corley 2010). The available hospital budget impacted the quality of the available PPE (Chapman 2017a; Chapman 2018; Kang 2018b; Woith 2012). Some hospitals were well funded and had ordered supplies from several different suppliers to ensure a constant supply (Tseng 2005). The duration of the epidemic, and length of time PPE was required, impacted on availability (Corley 2010; Tan 2006; Tseng 2005; Zinatsa 2018). As one bedside nursing staff member outlined, "as supplies ran out the 'rules' changed and surgical masks and plastic aprons were [considered] effective. It made me worried that the only reason it was changed was due to stock shortage and that perhaps we weren't as protected" (Corley 2010: 580). Many healthcare workers identified supply problems, particularly with N95 masks during the SARS outbreaks (Moore 2005a; Shih 2007; Tan 2006; Tseng 2005). Other studies related to TB also identified non-availability of N95 masks (Akshaya 2017; Buregyeya 2013; Chapman 2018; Matakanye 2019; Woith 2012, Zinatsa 2018), while one (Akshaya 2017), highlighted that if they were available, they were not provided to nursing or housekeeping staff. Some healthcare workers were particularly concerned at the lack of supply of N95 masks and felt exposed to higher risk of contamination as a result (Akshaya 2017). In the event of poor supply, healthcare workers resorted to other measures to protect themselves. For example, some used surgical gowns and disposable raincoat shoe covers (Shih 2007). Healthcare workers from private healthcare facilities resorted to prolonged use or recycled the PPE as a desperate means to conserve these items (Tan 2006).

We have moderate confidence in this evidence.

Finding 16: Healthcare workers identified that the need for PPE increases as disease outbreaks intensify, therefore PPE supply lines should be adjusted to anticipate and meet increasing needs as outbreaks continue

Requirements of PPE supply were mediated by the stage of the epidemic (Kang 2018a; Woith 2012). Lower levels of PPE usage were common at the early stage of outbreaks, due to reduced instruction from health authorities in relation to requirements for

IPC (Matakanye 2019; Tan 2006; Woith 2012; Zinatsa 2018). As one physician described during a SARS outbreak: "The rest did not use the gown due to inadequate dissemination of information and instruction from the health authority in the early stage of outbreak, complacency or they had no gown, which were also in acute shortage during the SARS outbreak" (Tan 2006: 52). Before outbreaks became a concern, levels of PPE worn reflected a perceived low level risk of exposure. For example, healthcare workers only used gloves during patient interactions. However, as outbreaks intensified, an increased amount of PPE was used to provide protection, increasing the supply need (Kang 2018b). Some studies reported some healthcare workers only using PPE with known infected patients (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Matakanye 2019; Woith 2012; Zinatsa 2018). A lack of adequate instructions from health authorities increased the potential inappropriate PPE use in situations where it was not required, thereby increasing the need for additional supplies (Kang 2018a; Woith 2012).

We have moderate confidence in this evidence.

Individual factors

Individual knowledge

Finding 17: Healthcare workers' knowledge that a colleague or patient has contracted the infection was seen as facilitating adherence to IPC guidance

Healthcare workers believed that their adherence to wearing facemasks and to room ventilation increased after they learned that a colleague had contracted the infection (Tan 2006; Zinatsa 2018). It also discouraged them from believing that healthcare workers are immune to contracting infections. For instance, one healthcare worker in a primary healthcare setting described that, "…after that nurse was infected with TB we had to move to the smaller room but at least it has two doors and then we decided that our patient[s] must wait outside in the line then it improved. No one got infected after that. (BbO1)" (Zinatsa 2018: 6). Other healthcare workers reported increased adherence to the use of PPE only when they were treating diagnosed TB patients (Adeleke 2012; Zinatsa 2018).

We have low confidence in this evidence.

Finding 18: When knowledge of IPC was limited to specific healthcare workers in the team, this was identified as a barrier to the teams' overall ability to adhere to IPC guidelines

Some healthcare workers observed that, due to a lack of knowledge amongst the wider team (such as support staff and non-specialist nurses), IPC measures such as waste disposal and generally managing the chain of infection were not adhered to (Chau 2008; Shih 2007). One nurse participant explained; "Most of the housecleaning staff [were] less well educated. They were not brave enough to stay in patients' rooms or careful enough when following the provided detailed cleaning procedures. Therefore, the bin was often too full of used clothes and garbage. The infection risk was thus further increased" (Shih 2007: 175). It was suggested that monitoring and training of the wider team (not only nurse specialists) may address this (Chau 2008).

We have low confidence in this evidence.

Finding 19: While healthcare workers appreciated that they had an individual responsibility to increase their knowledge, they need the evidence, rationale and support to do so

Both information on, and rationale for IPC guidance, was seen as important, but healthcare workers reported that they needed support to source appropriate evidence (Moore 2005a; Yassi 2005). For example, "participants also wanted valid evidence on effective hours for PPE items" (Kang 2018b: 236). It was also suggested that support from the infection control team would be helpful (Corley 2010).

We have moderate confidence in this evidence.

Individual attitudes

Finding 20: The use of PPE, particularly masks, was not always recognised as important for healthcare workers, thus hindering adherence to IPC guidelines

Some healthcare workers, particularly in the context of TB, believed adherence to IPC guidance was unnecessary as risks of transmission were low (Adeleke 2012; Akshaya 2017; Seale 2014; Tan 2006; Zinatsa 2018). Healthcare workers were reported as having inaccurate opinions about infection transmission, cause and containment (Adeleke 2012; Chapman 2017a; Woith 2012). Other healthcare workers questioned the effectiveness of IPC guidance in protecting them from diseases such as SARS and TB (Kang 2018b; Seale 2014; Tan 2006). "One healthcare worker noted that 'there's a lot of gaps around the surgical mask' and that the 'lack of tight seal prevents adequate protection'. Some even went on to say 'surgical (face) masks are useless.' " (Seale 2014). This was primarily in relation to N95 masks in the absence of mask-fitting (Tan 2006). PPE was sometimes perceived as "just for show" (Seale 2014).

We have moderate confidence in this evidence.

Finding 21: When healthcare workers felt they placed a high value on the importance of IPC; they had increased adherence, and incorporated IPC more intuitively in to routine practice

This was particularly evident in the context of SARS and MERS (Kang 2018a; Moore 2005a; Tan 2006; Yassi 2005). Valuing IPC came from awareness, training and previous experience (Chau 2008; Kang 2018a; Tan 2006; Seale 2014; Yassi 2005). "All the participants had worn masks during their contact with the suspected SARS patients. They singled out the mask as the key equipment that protected them from the corona virus. FP6: 'I am just relieved that at the time of contact, we were already having an increased awareness about SARS and we were already wearing the N95 mask' " (Tan 2006: 52).

We have moderate confidence in this evidence.

Individual beliefs

Finding 22: healthcare workers' fear of infecting themselves or others was seen as facilitating their adherence to IPC guidelines

Healthcare workers' fear of contracting SARS or MERS made them more vigilant in adhering to IPC guidance (Kang 2018a; Moore 2005a; Tan 2006). They also worried about transmitting the disease to their families and co-workers (Kang 2018a; Moore 2005a; Tan 2006; Woith 2012). "Fear of infecting loved ones was the main motivator across all categories of workers in all settings: 'We fear spreading the disease to our families, children and grandchildren' (physician, Hospital 2)" (Woith 2012: 1094).

We have moderate confidence in this evidence.

Finding 23: Patient isolation and use of face masks could be perceived as frightening and stigmatising for patients, thus reducing their use

Healthcare workers were hesitant to isolate patients until a diagnosis was confirmed because of the stigma of being infectious (Buregyeya 2013; Seale 2014; Zinatsa 2018). Also wearing facemasks could be seen as creating a barrier between the healthcare worker and patients, which could make patients feel uncomfortable (Tan 2006), particularly children who may become frightened (Seale 2014) "participants coupled facemask/respirator use with putting 'barriers up' between themselves and their patients and associated their use with having a negative impact on their relationships with patients and ability to provide care. They perceived that children were less tolerant of facemask/respirator-wearing HCWs [healthcare workers] and that some staff members were willing to expose themselves to infection rather than potentially scaring children by wearing a facemask" (Seale 2014).

We have moderate confidence in this evidence.

Finding 24: The workplace culture, and influence of colleagues, was seen to act as either a barrier or a facilitator to adherence to IPC guidelines

In a workplace culture of complacency, healthcare workers were less likely to adhere to IPC guidelines (Woith 2012; Zinatsa 2018). Alternatively, peer pressure in the workplace could facilitate adherence, and healthcare workers would remind each other to wear masks/respirators (Adeleke 2012; Moore 2005a; Woith 2012). "HCWs [healthcare workers] tend to be influenced by the social norm when colleagues wear PPE. One HCW declared: In this particular clinic, I see that everybody wears a mask more than in other clinic, which is encouraging….I think when you are working with people who are conscious of IC [infection control], it makes you more conscious of IC. (Key informant four – Professional HCW)" (Adeleke 2012: 199). Workplaces where all staff adhered to IPC guidelines, created a culture whereby healthcare workers had a sense of "pulling together" (Corley 2010).

We have moderate confidence in this evidence.

Finding 25: healthcare workers felt a duty of care to their patients and this was believed to supersede or enhance their adherence to IPC guidelines, in the context of their sense of professional obligation

Some healthcare workers, particularly in busy settings, felt their duty of care to the patient was the most important thing and as a result, compromised their adherence to IPC guidance (Chapman 2017a; Matakanye 2019): "One female physician, however, appeared to disregard the role of infection control practices in healthcare service delivery: 'Many times we do not even think about the disease [and] we do not protect ourselves because we want to help another person' " (Chapman 2017a: 2121). Other healthcare workers, on the other hand, felt they should take professional responsibility for effective control practices (Adeleke 2012; Chapman 2017a; Moore 2005a; Woith 2012).

We have moderate confidence in this evidence.

Discomfort of PPE

Finding 26: The discomfort of wearing PPE was believed to reduce healthcare workers' adherence to their use, and it was suggested that ensuring proper fit could help to overcome this barrier

Healthcare workers identified substantial physical discomfort when wearing PPE and this was believed to act as a barrier to adherence. These discomforts included difficulty in donning multiple PPE (Kang 2018b), difficulty in breathing and feelings of suffocation (Adeleke 2012; Kang 2018a; Tan 2006); exhaustion and fatigue (Moore 2005a); sweating, dizziness, dehydration and irritation (Kang 2018a; Moore 2005a; Woith 2012); backache (Kang 2018a); and glasses fogging up (Woith 2012). "All I know is by the time I got out of the room, I could squeeze my clothes. I was so dehydrated. You can't just go back and get a drink. It's too time consuming... Because just coming out you have to strip and then you have to re-gown, double of everything and you have to go back in. And the time that it takes to put all these layers on is just so much that you can't be bothered" (Moore 2005a: 265).

Appropriate size, fit and quality of PPE were seen as key considerations in facilitating staff to wear PPE to protect against contamination (Chapman 2017a; Kang 2018b; Moore 2005a). Problems were reported by healthcare workers regarding the sizing of PPE and use of inappropriate materials (Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Corley 2010; Kang 2018b; Matakanye 2019). Some healthcare workers identified that the poor quality of the PPE available at their facilities was a barrier to adhering to their use (Akshaya 2017; Kang 2018b; Woith 2012). If N95 respirators were not fitted correctly there were concerns that they would be ineffective (Corley 2010). Woith 2012 suggested that many healthcare workers did not follow manufacturer's instructions for use and storage of the PPE, thereby negatively impacting the quality and effectiveness. Healthcare workers in one study suggested that organising fit tests could minimise discomfort by identifying the most suitable respirators (Adeleke 2012).

We have high confidence in this evidence.

Limitations of the review

We conducted and report this QES as a rapid review. In order to present this research to the healthcare community in a timely manner, we made some compromises. We will address these compromises when we update this review.

As noted previously, we searched only Ovid MEDLINE for this review. We acknowledge that this is a potential weakness that may have limited the breadth of potential studies available for inclusion. In light of this, we screened more than 1500 references as part of our scoping exercise and additional citation chaining, retrieving a further 30 references for screening, and contributing nine studies that we deemed eligible for inclusion.

We did not synthesise all the studies that met our inclusion criteria. While we provide a rationale for the sampling framework, we remain mindful that the studies we included may not reflect the diversity of healthcare workers' behaviours and experiences. For instance, our sampling approach focused on geographical spread, whereas it may have been equally or more relevant to focus on income setting, and level of health care (i.e. primary, secondary, tertiary).

Within the time available for this review, we did not conduct any subgroup analysis or interrogate the data to explore the impact on healthcare workers of different respiratory infections, settings or geographical areas on the barriers and facilitators to adherence with IPC guidelines.

While this review was carried out in response to the COVID-19 pandemic, we decided to include studies of any respiratory infectious disease in the review. Most of the included diseases, such as SARS and MERS, are similar to COVID-19 in their mode of transmission. One exception is TB, which is transmitted by air. This has some implications for the type of IPC strategies that are chosen. The review author team therefore discussed whether or not studies of TB should be included in the review. Two factors led us to include studies of TB. First of all, the data in the studies of SARS and MERS were relatively thin and limited to Hong Kong, Singapore, Canada, Taiwan and South Korea, whereas several of the TB studies included rich data and added to the range of study settings. Secondly, the review team agreed that potential barriers and facilitators to adhering to IPC guidelines had many similar implications for healthcare workers in TB environments as for the other diseases. Our sampling strategy was therefore designed to ensure that there was a balance of studies representing different respiratory infectious diseases. We also took the type of disease into account when assessing our level of confidence in the review findings. For example, where findings were supported by studies focusing on TB and influenza but not SARS or MERS, we would have downgraded them for lack of relevancy to all settings.

We believe that our analysis and assessment of confidence was rigorous given the time frame but recognise that we have not provided a detailed insight into the contexts in which the data were collected. Furthermore we have not included the full evidence profile for each finding in this version, but these will be included in the update.

DISCUSSION

As this is a rapid review, we have not included a discussion section. However, we plan to include a full discussion in a later version of this review.

AUTHORS' CONCLUSIONS

Implications for practice

Below is a set of questions that are drawn from the findings in this review, and that may help ministries of health, healthcare facilities, and other stakeholders to plan, implement, or manage infection prevention and control strategies for respiratory infectious diseases.

Deciding on and communicating about IPC guidance

- Have you made sure that the guidance your staff are expected to adhere to follows national or international guidelines?
- Have you tailored your IPC guidance so that it is practical and possible to implement in your specific workplace? Have you gathered input from different members of staff, including support staff, to help you adapt the guidance to your workplace?
- Have you ensured that all members of staff, including cleaning staff, porters, kitchen staff and other support staff, have easy access to information regarding current IPC guidance?
- Have you made sure that IPC guidance is presented in a format that is clear, unambiguous, brief and easy to follow for all members of staff?
- IPC guidelines and strategies may change quickly and often. Have you considered how changes will be communicated to all members of staff?
- Have you considered using a variety of information channels to communicate about IPC guidance, for instance through phone apps or staff meetings at the beginning of shifts?

Workload

- Have you assessed the extent to which new IPC strategies, including an increased use of PPE and more time-consuming cleaning routines, will add to staff members' workloads and perhaps slow them down? Have you considered if and how you can increase the number of healthcare workers and support staff to address these issues?

Physical environment

- Does your facility have the space and infrastructure to implement the IPC guidance? Are there enough isolation rooms and anterooms? Do you have shower rooms for healthcare workers? If patient turnover is high, do you have enough rooms for new patients while cleaning and preparing the rooms of discharged patients?
- Are practical measures in place to control people's movement in your facilities? Have you ensured that patients with and without infections, visitors and suppliers take different routes, stay in different areas, use different elevators etc?

Personal protective equipment (PPE) and other supplies

- Do staff members have good access to running water, sinks and soap, or to hand sanitisers in spaces where water is not available?
- Is sanitiser easily available so staff members can decontaminate all surfaces such as phones, desks, doorknobs and elevator buttons before and after use?
- Do your facilities have adequate supplies of PPE for all members of staff, including support staff?
- Where you do have adequate supplies of PPE, has this been made clear to members of staff to avoid re-use or misuse?
- Can you reassure staff about the quality of PPE?
- PPE can be difficult to put on or remove, and be very uncomfortable to wear. Can you help ensure that this equipment is of an appropriate fit and size, including arranging fit testing of equipment such as masks and eye protection?

Training and education

- Have you ensured that all members of staff, including support staff, receive training and education in IPC strategies?
- Does this training and education include how to implement the IPC guidance in practice (including how to use PPE correctly, waste disposal, etc)?
- Does this training and education include the underlying rationale of IPC (i.e. how the infection is caused and transmitted and how the different elements of your IPC strategy are meant to contain it)?

- Have you considered making IPC training and education mandatory for all members of staff?
- Do you have on-site trainers with sufficient time and skills? Trainers need to be able to provide ongoing training to new or part-time staff and to keep up-to-date with regard to changes in guidance. Healthcare workers who are providing patient care are not likely to have enough time to train others in IPC, particularly in outbreak situations. Consider using staff who do not have patient care duties to provide training to other staff.
- Is your training model sustainable, given the availability and responsibilities of different healthcare workers?

Encouraging and ensuring IPC adherence

- Does your workplace encourage and support staff members' adherence with IPC guidance? Is it clear that staff members' safety needs are valued by managers? Do managers and colleagues actively acknowledge others' efforts to adhere and do managers lead by example?
- Do you have monitoring and evaluation strategies in place to assess staff adherence with the IPC guidance? Are all members of staff, including support staff, included in IPC monitoring and evaluation?

Relationships with patients and patients' family members

- Have you considered restricting access to visitors, at least in outbreak situations?
- Where visitors are not allowed into your facility, do you have systems in place to allow patients and staff to communicate with family members and to reduce loneliness?
- In some situations, healthcare workers may feel that masks and other PPE get in the way of their duty of care, for instance where patients are particularly frightened or feel stigmatised. Do healthcare workers have strategies for dealing with these situations? And is it clear to them when they must use PPE and when they can avoid it?

Implications for future research

This rapid review was undertaken in response to the COVID-19 pandemic. We were therefore interested in studies on other coronaviruses. However many of these studies reported relatively thin data and lacked the depth for more meaningful synthesis. For this reason, we included studies on broader respiratory infections, including influenza and TB, which offered additional rich insights into the barriers and facilitators to IPC guideline adherence. Future qualitative and mixed-methods studies should consider the transferability of their findings by providing thick descriptions that allow practitioners and other researchers to determine the relevancy and applicability of their conclusions.

Most of the included studies were from hospital settings. Future qualitative research in this area, including research carried out during the COVID-19 pandemic,should also explore healthcare workers' use of and adherence to IPC guidance in other settings, including primary care facilities and community-based facilities such as care homes.

In geographical terms, there was a lack of research from Europe and South America in particular.

We urgently need comparable research in the context of COVID-19 that further looks at the barriers that we identified in our review. There is also a need to focus on developing and evaluating interventions that aim to create a climate of safety and with clear IPC guidance consistent with international guidelines. Future research also needs to look at training and education interventions to ensure a knowledgeable workforce who value the importance of IPC guidance. Research needs also to examine how to make best use of the available physical environment to reduce contamination risk while managing patient care adequately.

Better reporting is needed in qualitative research on this topic, particularly around sampling methods, researcher reflexivity, and data analysis. Rigour and transparency in the reporting of qualitative research is imperative in order to increase our confidence in their findings.

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CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Adeleke 2012

Sampling status	Sampled for inclusion in the analysis
Country	South Africa
Setting	TB clinic
Type of respiratory condition	TB
Study participants	13 professional and lay HCWs (not further specified) and facility managers
Type of infection prevention and control (IPC) strategy or guideline	International IPC guidelines
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Interviews and focus groups
Notes	

Akshaya 2017

Sampling status	Sampled for inclusion in the analysis
Country	India
Setting	TB centre
Type of respiratory condition	TB
Study participants	20 nurses, doctors, ancillary staff with responsibility for patient care (porters, domestic workers)
Type of infection prevention and control (IPC) strategy or guideline	National IPC guideline
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Interviews
Notes	

Brouwer 2014

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Mozambique
Setting	Hospitals

Brouwer 2014 *(Continued)*

Type of respiratory condition	TB
Study participants	86 nurses, doctors, ancillary staff with responsibility for patient care (porters, domestics), TB programme staff, 11 focus groups
Type of infection prevention and control (IPC) strategy or guideline	International IPC guideline
Study design	Qualitative descriptive
Methods of data collection	Focus groups
Notes	

Buregyeya 2013

Sampling status	Sampled for inclusion in the analysis
Country	Uganda
Setting	Acute hospital
Type of respiratory condition	TB
Study participants	HCWs (type not further specified), 8 focus groups
Type of infection prevention and control (IPC) strategy or guideline	The study was conducted prior to release of the Ugandan National Policy on TB infection control.
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Focus groups
Notes	

Chapman 2017a

Sampling status	Sampled for inclusion in the analysis
Country	Dominican Republic
Setting	Acute hospital
Type of respiratory condition	TB
Study participants	40 nurses and doctors

Chapman 2017a *(Continued)*

Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks, local guideline, local recommendation
Study design	Grounded theory
Methods of data collection	Focus groups
Notes	

Chapman 2017b

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Dominican Republic
Setting	Acute hospital
Type of respiratory condition	TB
Study participants	9 nurses and doctors
Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks
Study design	Qualitative descriptive
Methods of data collection	Interviews
Notes	Second publication Chapman 2018

Chapman 2018

Sampling status	Sampled for inclusion in the analysis
Country	Dominican Republic
Setting	Acute hospital
Type of respiratory condition	TB
Study participants	40 nurses and doctors
Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks, local guideline, local recommendation
Study design	Grounded theory

Chapman 2018 *(Continued)*

Methods of data collection	Focus groups
Notes	Second publication from Chapman 2017a

Chau 2008

Sampling status	Sampled for inclusion in the analysis
Country	Hong Kong
Setting	Acute and rehabilitation hospitals
Type of respiratory condition	SARS
Study participants	109 nurses, doctors, allied healthcare (physiotherapists), allied healthcare (OT), healthcare assistants, ancillary staff with responsibility for patient care (porters, domestics), managers
Type of infection prevention and control (IPC) strategy or guideline	Local guideline
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Interviews
Notes	

Chughtai 2015

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Vietnam
Setting	Acute hospital
Type of respiratory condition	Unspecified respiratory disease
Study participants	Nurses and doctors, 20 focus groups with 10-12 participants in each
Type of infection prevention and control (IPC) strategy or guideline	Facemasks
Study design	Qualitative descriptive
Methods of data collection	Interviews
Notes	

Chughtai 2020

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Australia
Setting	Acute hospital
Type of respiratory condition	Unspecified respiratory disease
Study participants	20 nurses and midwives
Type of infection prevention and control (IPC) strategy or guideline	Facemasks
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Interviews
Notes	

Corley 2010

Sampling status	Sampled for inclusion in the analysis
Country	Australia
Setting	Acute hospital
Type of respiratory condition	H1N1
Study participants	34 nurses and doctors
Type of infection prevention and control (IPC) strategy or guideline	General PPE
Study design	Phenomenology
Methods of data collection	Focus groups, textual data from questionnaire
Notes	

Cowan 2013

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Ethiopia
Setting	Acute hospital

Cowan 2013 *(Continued)*

Type of respiratory condition	TB
Study participants	Nurses, doctors, health officers, pharmacists, lab technicians; 18 interviews and 25 focus groups
Type of infection prevention and control (IPC) strategy or guideline	Broader study aims: general TB management and prevention strategies
Study design	Qualitative descriptive
Methods of data collection	Interviews and focus groups
Notes	

Daftary 2016

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	South Africa
Setting	Acute hospital
Type of respiratory condition	TB
Study participants	17 nurses, doctors and "allied healthcare workers" (professional identity withheld for anonymity)
Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks, local guideline, local recommendation
Study design	Grounded theory
Methods of data collection	Interviews, focus groups
Notes	

Emerson 2016

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Zambia and Botswana
Setting	Community healthcare setting
Type of respiratory condition	TB
Study participants	69 HCWs including TB co-ordinators, medical officers, nurses, health education specialists, as well as implementing partners

Emerson 2016 *(Continued)*

Type of infection prevention and control (IPC) strategy or guideline	Local guideline, local recommendation, national TB infection control guidelines
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Interviews
Notes	

Kang 2018a

Sampling status	Sampled for inclusion in the analysis
Country	South Korea
Setting	Acute hospital
Type of respiratory condition	MERS
Study participants	27 nurses
Type of infection prevention and control (IPC) strategy or guideline	General PPE
Study design	Qualitative descriptive
Methods of data collection	Interviews, focus groups
Notes	

Kang 2018b

Sampling status	Sampled for inclusion in the analysis
Country	South Korea
Setting	Acute hospital
Type of respiratory condition	MERS
Study participants	7 nurses, infection control nurse leaders
Type of infection prevention and control (IPC) strategy or guideline	General PPE
Study design	Not labelled

Kang 2018b *(Continued)*

Methods of data collection	Focus groups
Notes	

Kuyinu 2016

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Nigeria
Setting	Community healthcare setting
Type of respiratory condition	TB
Study participants	40 HCWs (not further specified), 4 focus groups
Type of infection prevention and control (IPC) strategy or guideline	Local guideline, local recommendation, national IPC guidelines
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Focus groups
Notes	

Kuyinu 2019

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Nigeria
Setting	Primary care
Type of respiratory condition	TB
Study participants	50 HCWs (not further specified), 5 focus groups
Type of infection prevention and control (IPC) strategy or guideline	Local guideline, local recommendation, national guidelines
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Focus groups
Notes	

Lam 2013

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Hong Kong
Setting	Acute hospital
Type of respiratory condition	H1N1
Study participants	10 nurses
Type of infection prevention and control (IPC) strategy or guideline	Local guideline, local recommendation
Study design	Qualitative descriptive
Methods of data collection	Interviews
Notes	

Locatelli 2012

Sampling status	Sampled for inclusion in the analysis
Country	USA
Setting	Veterans Affairs healthcare facilities (22 high, 7 medium, and 4 low complexity-level facilities)
Type of respiratory condition	H1N1
Study participants	33 infection control officers/liaisons
Type of infection prevention and control (IPC) strategy or guideline	Local guideline, local recommendation
Study design	Qualitative methods
Methods of data collection	Interviews
Notes	

Matakanye 2019

Sampling status	Sampled for inclusion in the analysis
Country	South Africa
Setting	Acute hospital

Matakanye 2019 *(Continued)*

Type of respiratory condition	TB
Study participants	10 nurses
Type of infection prevention and control (IPC) strategy or guideline	General PPE, local guideline, local recommendation
Study design	Qualitative descriptive
Methods of data collection	Interviews
Notes	

McPherson 2018

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Canada
Setting	Residential and acute care settings
Type of respiratory condition	Influenza
Study participants	48 nurses, doctors, allied HCWs, policy implementation team members - participants representing 10 different categories of professions across health system roles (e.g. registered nurses, doctors, and pharmacists in managerial, occupational health and safety officer and public health officer roles)
Type of infection prevention and control (IPC) strategy or guideline	Facemasks, local guideline, a province-wide Influenza Prevention Policy requiring all HCWs in residential and acute care facilities to either be immunised against influenza, or wear masks in patient care areas during the influenza season.
Study design	Qualitative case study
Methods of data collection	Focus groups
Notes	

Moore 2005a

Sampling status	Sampled for inclusion in the analysis
Country	Canada
Setting	Acute hospital
Type of respiratory condition	SARS

Moore 2005a *(Continued)*

Study participants	105 HCWs: occupational health staff, infection control practitioners, doctors, clinical nursing staff, allied health professionals (respiratory therapists, laboratory technicians, physiotherapists), support staff, hospital managers
Type of infection prevention and control (IPC) strategy or guideline	General personal protective equipment (PPE)
Study design	Qualitative
Methods of data collection	Focus groups
Notes	

Nhan 2012

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Canada
Setting	A variety of healthcare settings
Type of respiratory condition	H1N1
Study participants	129 doctors, infectious disease microbiologists and public health/preventative medicine specialists
Type of infection prevention and control (IPC) strategy or guideline	International IPC guideline, resources, workload and patient management related to disease management
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Textual data from questionnaire
Notes	

Probandari 2019

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Indonesia
Setting	Primary care
Type of respiratory condition	TB
Study participants	22 nurses, doctors, laboratory staff, TB programme staff

Probandari 2019 *(Continued)*

Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks, national infection control guidelines
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Interviews, observation
Notes	

Rowlands 2007

Sampling status	Sampled for inclusion in the analysis
Country	Singapore
Setting	Acute hospital
Type of respiratory condition	SARS
Study participants	28 medical social workers
Type of infection prevention and control (IPC) strategy or guideline	Infection control practices
Study design	Qualitative descriptive
Methods of data collection	Interviews
Notes	

Seale 2014

Sampling status	Sampled for inclusion in the analysis
Country	Australia
Setting	Acute hospital
Type of respiratory condition	Respiratory virus outbreaks or a pandemic
Study participants	18 HCWs (not further specified)
Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks, respirators
Study design	Qualitative descriptive

Seale 2014 *(Continued)*

Methods of data collection	Interviews
Notes	

Shih 2007

Sampling status	Sampled for inclusion in the analysis
Country	Taiwan
Setting	Medical centres/teaching hospitals
Type of respiratory condition	SARS
Study participants	266 nurses, 25 focus groups, 6-10 per group
Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks, local guideline
Study design	Qualitative research triangulation
Methods of data collection	Focus groups
Notes	

Sissolak 2011

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	South Africa
Setting	Acute hospital
Type of respiratory condition	TB
Study participants	6 auxiliary nurses, 5 staff nurses and 9 professional nurses
Type of infection prevention and control (IPC) strategy or guideline	General PPE, local guideline, local recommendation
Study design	Phenomenology
Methods of data collection	Interviews
Notes	

Tamir 2016

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	Ethiopia
Setting	Health centres
Type of respiratory condition	TB
Study participants	15 HCWs (not further specified)
Type of infection prevention and control (IPC) strategy or guideline	General PPE, local guideline
Study design	Mixed methods (qualitative aspect)
Methods of data collection	Interviews, observation
Notes	

Tan 2006

Sampling status	Sampled for inclusion in the analysis
Country	Singapore
Setting	Family practices
Type of respiratory condition	SARS
Study participants	8 family physicians
Type of infection prevention and control (IPC) strategy or guideline	General PPE
Study design	Qualitative descriptive
Methods of data collection	Interviews
Notes	

Tseng 2005

Sampling status	Sampled for inclusion in the analysis
Country	Taiwan
Setting	Hospital

Tseng 2005 *(Continued)*

Type of respiratory condition	SARS
Study participants	Nurses and the director of the nursing department (6)
Type of infection prevention and control (IPC) strategy or guideline	General PPE, local guideline
Study design	Qualitative descriptive
Methods of data collection	Interviews
Notes	

Woith 2012

Sampling status	Sampled for inclusion in the analysis
Country	Russia
Setting	Hospitals and outpatient clinics
Type of respiratory condition	TB
Study participants	96 nurses, doctors, laboratory staff and support staff
Type of infection prevention and control (IPC) strategy or guideline	General TB infection control
Study design	Qualitative descriptive
Methods of data collection	Focus groups
Notes	

Wong 2012

Sampling status	Sampled for inclusion in the analysis
Country	China
Setting	Hospital
Type of respiratory condition	H1N1
Study participants	10 nurses, doctors and healthcare assistants

Wong 2012 *(Continued)*

Type of infection prevention and control (IPC) strategy or guideline	General PPE
Study design	Qualitative descriptive
Methods of data collection	Interviews
Notes	

Yassi 2005

Sampling status	Sampled for inclusion in the analysis
Country	Canada
Setting	Hospitals
Type of respiratory condition	SARS
Study participants	100+ nurses, doctors, allied HCWs (physiotherapists), infection control practitioners, occupational health staff, respiratory therapists
Type of infection prevention and control (IPC) strategy or guideline	Infection control guidance (level not specified)
Study design	Qualitative descriptive
Methods of data collection	Focus groups
Notes	

Zelnick 2014

Sampling status	Eligible but not sampled for inclusion in the analysis
Country	South Africa
Setting	Hospital
Type of respiratory condition	TB
Study participants	62 HCWs, hospital managers and infection control personnel
Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks, international IPC guideline, local guideline
Study design	Qualitative descriptive

Zelnick 2014 *(Continued)*

Methods of data collection	Interviews, focus groups
Notes	

Zinatsa 2018

Sampling status	Sampled for inclusion in the analysis
Country	South Africa
Setting	Primary care
Type of respiratory condition	TB
Study participants	53 nurses and facility managers
Type of infection prevention and control (IPC) strategy or guideline	General PPE, facemasks, international IPC
Study design	Qualitative case study
Methods of data collection	Focus groups, nominal group technique after focus groups
Notes	

HCW: healthcare worker; **IPC:** infection prevention and control; **MERS:** Middle East respiratory syndrome; **OT:** occupational therapist; **PPE:** personal protective equipment; **SARS:** severe acute respiratory syndrome; **TB:** tuberculosis

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Adu 2020	Not HCW
Aghaizu 2011	Limited focus on IPC
Bergeron 2006	Limited focus on IPC
Bernard 2017	Limited focus on IPC
Bernard 2018	Wrong study design
Bulage 2014	Wrong study design
Chan 2006	Hypothetical
Charania 2013	Not healthcare setting
Choi 2016	Wrong publication type

Study	Reason for exclusion
Devi 2010	Wrong publication type
Di Castri 2020	Limited focus on IPC
Garrett 2009	Hypothetical
Haeusler 2019	Wrong study design
Hines 2014	Wrong study design
Hines 2017	Limited focus on IPC
Honey 2013	Limited focus on IPC
Joseph 2004	Limited focus on IPC
Kantele 2010	Not healthcare setting
Kawatsu 2018	Limited focus on IPC
Khandaker 2010	Wrong publication type
Krein 2018	Not specific to ARI
Labarca 2011	Wrong publication type
Lau 2005	Wrong study design
Marme 2018	Not all HCWs
Maroldi 2017	Not specific to ARI
Mekebeb 2019	Wrong study design
Neil 2006	Not HCW
Phillips 2011	Limited focus on IPC
Phin 2009	Wrong study design
Pires 2010	Wrong study design
Ratnapalan 2013	Limited focus on IPC
Raymond 2012	Wrong study design
Rebman 2009	Not all HCWs
Rebmann 2010	Wrong study design
Tambyah 2004	Wrong study design

ARI: acute respiratory infection; **HCW:** healthcare worker; **IPC:** infection prevention and control

ADDITIONAL TABLES

Table 1. Purposeful sampling frame

	Measure	Example
1	Very little qualitative data presented that relate to the synthesis objective. Those findings that are presented are fairly descriptive.	For example, a mixed-methods study using open-ended survey questions or a more detailed qualitative study where only part of the data relate to the synthesis objective
2	Some qualitative data presented that relate to the synthesis objective	For example, a limited number of qualitative findings from a mixed-methods or qualitative study
3	A reasonable amount of qualitative data that relate to the synthesis objective	For example, a typical qualitative research article in a health services journal
4	A good amount and depth of qualitative data that relate to the synthesis objective	For example, a qualitative research article in a social sciences journal with more context and setting descriptions
5	A large amount and depth of qualitative data that relate in depth to the synthesis objective	For example, from a detailed ethnography or a published qualitative article with the same objectives as the synthesis

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Table 2. Assessment of methodological limitations

Study ID	Was the context described?	Was the sampling strategy appropriate and described?	Was the data collection strategy appropriate and described?	Was the data analysis appropriate and described?	Were the findings supported by evidence?	Is there evidence of researcher reflexivity?	Have ethical issues been taken into consideration?	Overall assessment of methodological limitations
Adeleke 2012	Yes	No	No	No	Yes	No	No	**Major**
Akshaya 2017	Yes	Yes	Yes	No	Yes	No	Unclear	**Minor**
Buregyeya 2013	Yes	Unclear	Yes	Yes	Yes	No	Yes	**Minor**
Chapman 2018, Chapman 2017a	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	**Minor**
Chau 2008	Yes	No	No	No	Yes	No	No	**Major**
Corley 2010	Yes	Yes	No	Yes	Yes	No	Yes	**Minor**
Kang 2018a	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	**None**
Kang 2018b	Unclear	No	No	No	No	No	No	**Major**
Locatelli 2012	Yes	Unclear	Yes	Unclear	Yes	Yes	No	**Minor**
Matakanye 2019	Yes	Yes	Yes	Yes	Yes	No	Yes	**Minor**
Moore 2005a	Yes	Yes	Yes	Unclear	Yes	No	No	**Minor**
Rowlands 2007	Yes	Yes	Yes	Unclear	Yes	No	Unclear	Moderate
Seale 2014	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	**None**
Shih 2007	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	**None**
Tan 2006	Yes	Unclear	Yes	Unclear	Yes	No	No	**Minor**
Tseng 2005	Yes	Unclear	Yes	Unclear	Yes	No	No	Moderate
Woith 2012	Yes	Yes	Yes	No	Yes	No	Yes	**Minor**
Wong 2012	Yes	Yes	Yes	Yes	Yes	No	Unclear	**None**

Table 2. Assessment of methodological limitations *(Continued)*

Yassi 2005	Yes	Yes	Yes	No	Unclear	No	No	Moderate
Zinatsa 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Minor**

Table 3. Summary of qualitative findings

Summary of review finding	Studies contributing to the review finding	GRADE-CERQual assessment of confidence in the evidence	Explanation of GRADE-CERQual assessment
Organisation factors			
Safety climate			
Finding 1: HCWs perceived their response to guideline protocols being influenced by the level of support that they received from their management team	Buregyeya 2013; Chapman 2017a; Corley 2010; Moore 2005a; Tseng 2005; Woith 2012; Zinatsa 2018	**Moderate confidence**	Minor concerns regarding coherence, relevance, adequacy and methodological limitations
Finding 2: If HCWs considered that the IPC guidelines were long, ambiguous or did not reflect international guidance, they described feeling unsure as to which IPC recommendation they should adhere to	Chau 2008; Corley 2010; Kang 2018b; Locatelli 2012; Seale 2014; Shih 2007; Yassi 2005	**Moderate confidence**	Minor concerns regarding relevance and adequacy Moderate concerns regarding methodological limitations
Finding 3: With guidelines changing so frequently, HCWs felt overwhelmed and often were not able to keep up with the most recent guidance	Kang 2018a; Locatelli 2012; Moore 2005a; Shih 2007; Wong 2012; Yassi 2005	**Moderate confidence**	Minor concerns regarding methodological limitations Moderate concerns regarding relevance and adequacy
Finding 4: If IPC guidelines were considered impractical, HCWs found them difficult to implement	Adeleke 2012; Shih 2007; Wong 2012; Zinatsa 2018	**Low confidence**	Minor concerns regarding methodological limitations Moderate concerns regarding relevance Serious concerns regarding adequacy
Finding 5: The increased workload and HCW fatigue associated with IPC guidelines, such as donning PPE and additional cleaning, were seen as a barrier to adherence	Chapman 2017a; Chapman 2018; Chau 2008; Corley 2010; Moore 2005a; Seale 2014; Shih 2007; Tseng 2005; Wong 2012	**Moderate confidence**	Minor concerns regarding methodological limitations and relevance Moderate concerns regarding adequacy
Communication of IPC guidelines			
Finding 6: Clear communication strategies and sharing new information within organisations were seen as vital for the successful implementation of IPC guidelines	Corley 2010; Kang 2018a; Locatelli 2012; Moore 2005a; Seale 2014; Tseng 2005	**High confidence**	Minor concerns regarding relevance and adequacy Moderate concerns regarding methodological limitations
Finding 7: Using multiple platforms or methods of communication was considered to be a useful way of ensuring that all staff received accessible information and updates in relation to IPC guidelines	Kang 2018a; Locatelli 2012; Moore 2005a; Seale 2014; Shih 2007; Yassi 2005	**Low confidence**	Minor concerns regarding coherence and methodological limitations Moderate concerns regarding relevance and adequacy

Table 3. Summary of qualitative findings *(Continued)*

Availability of training programmes			
Finding 8: Lack of training about the specific infection and how to use PPE was seen to contribute to poor implementation of IPC guidelines	Adeleke 2012; Akshaya 2017; Chapman 2017a; Chapman 2018; Chau 2008; Corley 2010; Locatelli 2012; Matakanye 2019; Moore 2005a; Rowlands 2007; Tan 2006; Tseng 2005; Yassi 2005; Zinatsa 2018	**High confidence**	Minor concerns regarding relevance, adequacy and methodological limitations
Finding 9: Where training was not mandatory and performance was not assessed in practice, HCWs felt this contributed to lack of adherence to IPC guidelines	Chapman 2018; Chau 2008; Matakanye 2019; Moore 2005a; Woith 2012; Yassi 2005; Zinatsa 2018	**Moderate confidence**	Minor concerns regarding coherence, relevance, adequacy and methodological limitations
Finding 10: Frontline healthcare workers described how they could not balance the role of IPC trainer with their existing clinical responsibilities	Chau 2008; Moore 2005a; Yassi 2005; Zinatsa 2018	**Low confidence**	Minor concerns regarding coherence and relevance Moderate concerns regarding methodological limitations Serious concerns regarding adequacy
Environmental factors			
Physical environment			
Finding 11: A healthcare facility environment with sufficient space to isolate patients was regarded as a key facilitator for HCWs' ability to adhere to infection control methods	Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Kang 2018b; Matakanye 2019; Moore 2005a; Tseng 2005; Woith 2012; Wong 2012; Zinatsa 2018	**Moderate confidence**	Minor concerns regarding adequacy Moderate concerns regarding methodological limitations and relevance
Finding 12: Lack of provision of adequate ventilation, isolation rooms, anterooms and shower facilities within the healthcare setting was viewed as a barrier to achieving IPC measures	Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Kang 2018a; Matakanye 2019; Shih 2007; Tseng 2005; Wong 2012; Zinatsa 2018	**Moderate confidence**	No to minor concerns regarding coherence Minor concerns regarding adequacy Moderate concerns regarding methodological limitations and relevance
Finding 13: Practical measures such as route control, minimising overcrowding, fast-tracking infected patients and visitor restrictions, to reduce the risk of contamination, were viewed as important tools for the protection of the patient and staff	Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Matakanye 2019; Tseng 2005; Woith 2012; Zinatsa 2018	**Moderate confidence**	No to minor concerns regarding coherence Minor concerns regarding adequacy Moderate concerns regarding methodological limitations and relevance
Finding 14: HCWs' access to handwashing facilities and surface decontamination supplies was viewed as a key factor in adhering to infection control methods	Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Kang 2018a; Moore 2005a; Shih 2007; Tseng 2005; Wong 2012; Zinatsa 2018	**Moderate confidence**	Minor concerns regarding adequacy and relevance Moderate concerns regarding methodological limitations
Availability of PPE			

Table 3. Summary of qualitative findings *(Continued)*

Finding 15: Inadequate supplies of appropriate PPE, of a required standard, to ensure patient and staff safety was perceived by HCWs and managers as a serious concern	Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Corley 2010; Kang 2018a; Kang 2018b; Locatelli 2012; Matakanye 2019; Moore 2005a; Rowlands 2007; Seale 2014; Shih 2007; Tan 2006; Tseng 2005; Woith 2012; Wong 2012; Yassi 2005; Zinatsa 2018	**Moderate confidence**	Minor concerns regarding adequacy and relevance Moderate concerns regarding methodological limitations
Finding 16: HCWs identified that the need for PPE increases as disease outbreaks intensify, therefore PPE supply lines should be adjusted to anticipate and meet increasing needs as outbreaks continue	Adeleke 2012; Akshaya 2017; Buregyeya 2013; Kang 2018a; Kang 2018b; Matakanye 2019; Tan 2006; Woith 2012; Zinatsa 2018	**Moderate confidence**	Minor concerns regarding adequacy and relevance Moderate concerns regarding methodological limitations
Individual factors			
Individual knowledge			
Finding 17: HCWs' knowledge that a colleague or patient has contracted the infection was seen as facilitating adherence with IPC guidance	Adeleke 2012; Tan 2006; Zinatsa 2018	**Low confidence**	Minor concerns regarding relevance Moderate concerns regarding methodological limitations and adequacy
Finding 18: When knowledge of IPC was limited to specific HCWs in the team, this was identified as a barrier to the teams' overall ability to adhere to IPC guidelines	Chau 2008; Shih 2007	**Low confidence**	Moderate concerns regarding methodological limitations and relevance Serious concerns regarding adequacy
Finding 19: While HCWs appreciated that they had an individual responsibility to increase their knowledge, they need the evidence, rationale and support to do so	Corley 2010; Kang 2018b; Moore 2005a; Yassi 2005	**Moderate confidence**	Minor concerns regarding adequacy and relevance Serious concerns regarding methodological limitations
Individual attitudes			
Finding 20: The use of PPE, particularly masks, was not always recognised as important for HCWs, thus hindering adherence to IPC guidelines	Adeleke 2012; Akshaya 2017; Chapman 2017a; Kang 2018b; Seale 2014; Tan 2006; Woith 2012; Zinatsa 2018	**Moderate confidence**	Minor concerns regarding adequacy Minor to moderate concerns regarding methodological limitations
Finding 21: When HCWs felt they placed a high value on the importance of IPC; they had increased adherence, and incorporated IPC more intuitively into routine practice	Chau 2008; Kang 2018a; Moore 2005a; Seale 2014; Tan 2006; Yassi 2005	**Moderate confidence**	Minor concerns regarding adequacy and relevance Moderate concerns regarding methodological limitations
Individual beliefs			

Table 3. Summary of qualitative findings *(Continued)*

Finding 22: HCWs' fear of infecting themselves or others was seen as facilitating their adherence with IPC guidelines	Kang 2018a; Moore 2005a; Tan 2006; Woith 2012; Yassi 2005	**Moderate confidence**	Minor concerns regarding methodological limitations, adequacy and relevance
Finding 23: Patient isolation and use of face masks could be perceived as frightening and stigmatising for patients, thus reducing their use	Buregyeya 2013; Seale 2014; Tan 2006, Woith 2012; Zinatsa 2018	**Moderate confidence**	Minor concerns regarding relevance Minor concerns regarding methodological limitations Moderate concerns regarding adequacy
Finding 24: The workplace culture, and influence of colleagues, was seen to act as either a barrier or a facilitator to adherence to IPC guidelines	Adeleke 2012; Corley 2010; Moore 2005a; Woith 2012; Zinatsa 2018	**Moderate confidence**	Moderate concerns regarding methodological limitations and adequacy
Finding 25: HCWs felt a duty of care to their patients; and this was believed to supersede or enhance their adherence to IPC guidelines; in the context of their sense of professional obligation	Adeleke 2012; Chapman 2017a; Matakanye 2019; Moore 2005a; Woith 2012	**Moderate confidence**	Minor concerns regarding coherence and relevance Moderate concerns regarding methodological limitations and adequacy
Discomfort of PPE			
Finding 26: The discomfort of wearing PPE was believed to reduce HCWs' adherence to their use, and it was suggested that ensuring proper fit could help to overcome this barrier	Adeleke 2012; Akshaya 2017; Buregyeya 2013; Chapman 2017a; Chapman 2018; Corley 2010; Kang 2018a; Kang 2018b; Matakanye 2019; Moore 2005a; Tan 2006; Woith 2012; Yassi 2005	**High confidence**	Minor concerns regarding methodological limitations

CERQual: Confidence in the Evidence from Reviews of Qualitative research; **HCW:** healthcare worker; **IPC:** infection prevention and control; **PPE:** personal protective equipment

APPENDICES

Appendix 1. MEDLINE search strategy

Database(s): **Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R)** 1946 to 26 March 2020
Search strategy

#	Searches	Results
1	exp health personnel/	505492
2	(clinician* or consultant* or dentist* or doctor* or family practition* or general practition* or gyn?ecologist* or h?ematologist* or internist* or nurs* or obstetrician* or occupational therapist* or p?ediatrician* or pharmacist* or physician* or physiotherapist* or psychiatrist* or psychologist* or radiologist* or surgeon* or surgery or therapist* or coun-	2723419

(Continued)

	sel?or* or neurologist* or optometrist* or paramedic* or social worker* or health professional* or healthcare professional* or health care professional* or health personnel or healthcare personnel or health care personnel or health worker* or healthcare worker* or health care worker* or health provider* or healthcare provider* or health care provider or porter* or orderlies or orderly).tw,kf.	
3	exp health facilities/	772374
4	(hospital or hospitals or clinic or clinics or (primary adj2 care) or (health adj2 care)).tw,kf.	1727952
5	or/1-4	4368985
6	exp Respiratory Tract Infections/	352674
7	exp Coronavirus/	11503
8	exp Coronavirus Infections/	9823
9	(coronavirus* or 2019-nCoV or 2019 ncov or nCov or Covid-19 or Covid19 or SARS-CoV-2 or novel coronavirus or novel corona virus or covid* or pneumonia or severe acute respiratory syndrome or coronavirus 2 or coronavirus infection* or coronavirus disease or corona virus disease or new coronavirus or new corona virus or new coronaviruses or novel coronaviruses or sars or sars corona virus or respiratory infectious disease* or acute respiratory disease* or middle-east respiratory syndrome or MERS or tuberculosis or influenza or influenza like illness or pandemic*).tw,kf.	440154
10	or/6-9	626975
11	exp Infection Control/	62545
12	(aerosol or surface or environment or contaminat* or spatial or aerodynamic or disinfectant or cross infection or infection prevent* or infection control or viability or inactivation or indirect transmission or indirect virus transmission or indirect viral transmission or hand rub or hand rubbing or hand rubs or alcohol or hand hygiene or ethanol or hand disinfection).tw,kf.	2517591
13	Cross Infection/ep, pc, tm	38082
14	Occupational Exposure/pc	6602
15	exp Disease Transmission, Infectious/pc	13785
16	exp Protective Devices/	40288
17	(protective clothing or gown* or coverall* or protective layer* or surgical toga or apron or smock or hazmat or glove* or respiratory protective devices or mask* or face mask* or facemask* or respiratory protection or eye protection or personal protective equipment or goggles or safety spectacles or glasses or donning or doffing or respiratory hygiene or clean* or disinfect* or waste management or respiratory hygiene or environmental control*).tw,kf.	223962
18	((Droplet* or contact or isolation) adj3 precaution*).mp.	1325
19	(control adj3 measure*).tw,kf.	38498
20	((infectio* adj3 battl*) or (infectio* adj3 control*) or (infectio* adj3 fight*)).tw,kf.	49688
21	or/11-20	2823772

(Continued)

22	exp Guideline Adherence/	31479
23	(guideline* or protocol* or guidance).tw,kf.	850794
24	IPC guideline*.tw,kf.	27
25	("adhere to" or adherence or barrier* or challeng* or compliance or comply$ or facilitat*).tw,kf.	1734640
26	or/22-25	2462782
27	5 and 10 and 21 and 26	3284
28	animals/ not (humans/ and animals/)	4650113
29	27 not 28	3258

Appendix 2. Review protocol. The barriers and facilitators to health care workers' compliance with IPC recommendations for respiratory infectious diseases: a qualitative evidence synthesis

Protocol information

Team

Catherine Houghton, Pauline Meskell, Hannah Delaney, Michael Smalle, Andrew Booth, Xin-Hui Chan, Declan Devane, Linda Biesty

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Date protocol completed

27 March 2020

Background

Brief description of the condition/issue under consideration

The novel coronavirus (COVID-19), caused by SARS-CoV-2 (severe acute respiratory syndrome coronavirus), was first isolated in December 2019 in Wuhan, China. COVID-19 ranges in symptoms from asymptomatic to severe pneumonia with acute respiratory distress syndrome (ECDC 2020). It is spread mainly through droplet infection and contact with contaminated surfaces (Official Guidance 2020).

Description of the phenomenon of interest

Following the severe acute respiratory syndrome (SARS) outbreak in 2003, a study was undertaken in three Canadian cities affected by SARS to identify which organisational, environmental, and individual factors healthcare workers felt were most crucial in protecting themselves from respiratory tract infections while at work (Moore 2005b). These factors were seen to impact on the ability of healthcare workers to comply with issued guidelines.

In 2014, the World Health Organization (WHO) published guidelines for infection prevention and control (IPC) of epidemic- and pandemic-prone acute respiratory infections in health care. IPC strategies in healthcare facilities are commonly based on early recognition and source control, administrative controls, environmental and engineering controls, and personal protective equipment (PPE; WHO 2014).

Why it is important to do this review

The recent COVID-19 Pandemic has prompted concern about the ability of health care workers to strictly adhere to recommended IPC guidance. By identifying barriers and facilitators to IPC guideline compliance, we can more easily identify strategies that will support healthcare workers to undertake the IPC measures needed at such a critical time in health care internationally.

Objectives of the review

To identify the barriers and facilitators to healthcare workers' compliance with IPC recommendations for respiratory infectious diseases.

Methods

Criteria for considering studies for this review

Study and source eligibility	
Study design	☐ Randomised controlled trials (RCTs) ☐ Quasi-RCTs ☐ Non-RCTs ☐ Prospective cohort studies ☐ Retrospective cohort studies ☐ Case-control studies ☐ Cross-sectional studies ☐ Controlled before-and-after studies ☐ Modelling studies ☒ Other (qualitative studies and mixed-methods studies. Mixed-methods studies that include qualitative component utilising qualitative methods of data collection and analysis)
Minimum duration	
'SPICE' eligibility (setting, population, phenomenon of interest, comparison, evaluation)	
Setting	**Healthcare facilities** (Primary care settings, acute hospital settings, long-term care or community settings)
Population	**Health care workers working with respiratory infectious diseases** (alternate terms: healthcare professionals, health service providers) To include any healthcare worker including professionals (e.g. doctors, nurses, midwives, allied health professionals, pharmacists) or other workers (e.g. radiology porter, healthcare assistant) with responsibility for patient care in any hospital, long-term care or community setting (adapted from Moralejo 2018). **Respiratory infectious diseases** (alternate term: acute respiratory infections (ARIs) To include: CoVID-19, severe acute respiratory syndrome (SARS), severe acute respiratory syndrome coronavirus (SARS-CoV), Middle East respiratory syndrome (MERS), tuberculosis (TB), influenza-like illness
Phenomenon of interest	**Compliance/adherence to infection prevention and control (IPC) guidelines/recommendations** ? early recognition and source control (triage, respiratory hygiene) ? administrative controls (isolation, spatial separation, patient cohorting) ? environmental and engineering controls (cleaning and disinfection, ventilation) ? PPE (donning and doffing, gowns, gloves, masks, goggles, hand washing) (guided by but not exclusive to WHO 2014)

(Continued)

Comparison	**Potential comparison between subgroups: different settings, geographical areas, healthcare workers, types of diseases**
Evaluation	**Barriers and facilitators** (to include experiences and perceptions and factor that impact on adherence and compliance)

Search methods for identification of studies

Search methods			
Expertise	The searches will be informed by a content expert, conducted by an information specialist Mike Smalle, and independently peer reviewed.		
Electronic databases	Database [minimum checked – please specify one other] ☒ MEDLINE ☐ CENTRAL ☐ Embase ☐ Other ☐ Clinical trials registry (please specify)	From: 2002	To: 2020
Other searches	☒ Systematic review references ☒ Reference lists of included studies ☐ Grey literature (please specify) ☐ Citation tracking ☐ Data from the pharmaceutical industry ☐ Contact experts for references ☐ Other (please specify)	We will examine reference lists of included studies for relevance.	
Approach to ongoing and unpublished studies	☐ Include ongoing studies ☐ Unpublished studies ☒ Studies in press ☐ Exclude all studies that are ongoing, unpublished, or in press		

Methods for screening search results			
Expertise	Screening will be performed by methodologists (CH, LB, PM, HD) in Covidence		
Screening methods	Dual; second review author checks all excluded records	Abstract	Full text
	Dual; second author checks 30% of excluded records	☐	☒
	Dual; independent screen and cross-check	☒	☐

(Continued)

		☐	☐
Discrepancy resolution	☒ Consensus and/or third review author ☐ Other (please specify)		
Excluded studies	All decisions taken during screening will be documented and outlined in the final report with a list of excluded studies		
Inclusion of abstracts and conference proceedings	☒ Exclude all ☐ Include if clearly eligible and have usable data ☐ Include if clearly eligible regardless of usable data ☐ Include if eligibility is unclear and add to section in report		
Inclusion of non-English-language studies	☒ Include abstracts and full texts in any language ☐ Include full texts only ☐ Exclude		
	☐ All potentially relevant abstracts will progress to full-text screen ☐ [Single/dual] title/abstract screen by foreign-language speaker(s) ☐ [Abstract/methods/full text] will be translated for abstract/full text screen ☒ Listed as non-English language and not assessed further		

Data collection and analysis

Data extraction	
Expertise	Data extraction will be performed by methodologists (CH, LB, PM, HD)
Software	Data will be extracted using pilot-tested data extraction forms in Google Forms
Data to be extracted	Study design (including methods, location, sites, groups) Setting (type of healthcare setting) Participant characteristics (healthcare worker type) Type of infection prevention control (IPC) guideline/recommendation [specify details] Respiratory infectious disease type Qualitative findings (author descriptions and direct quotations)
Data extraction methods	☐ Single, no second review author ☒ Dual; second review author checks all data ☐ Dual; second review author checks [add proportion] ☐ Dual; independent screen and cross-check

(Continued)

Risk of bias tool	[Specify for each study design] ☐ No 'Risk of bias' assessment ☐ Cochrane RCT 'Risk of bias' tool ☐ ROBINS-I tool for non-randomised studies ☐ Adapted-hybrid of the RCT-ROBINS-I tools ☐ Newcastle-Ottawa Scale ☒ Another tool: Critical appraisal skills programme (CASP) quality assessment tool for qualitative studies	
Method of risk of bias assessment	☐ Single, no second review author ☒ Dual; second review author checks all judgements ☐ Dual; second review author checks [add proportion] ☐ Dual; independent screen and cross-check Critical appraisal skills programme (CASP) quality assessment tool for qualitative studies	☒ All outcomes ☐ Primary only
Discrepancy resolution	☒ Consensus and/or third review author ☐ Other (please specify)	
Contacting study authors	☐ Study authors will be contacted for missing information and data ☐ Study authors will be contacted for missing outcome data only ☒ Study authors will not be contacted	
Data management		
Software	Google Forms	
Standardisation	Best Fit Framework approach using the 'theoretical model explaining self-protective behavior at work' (Moore 2005a)	
Resolving conflicts between sources	Non applicable	

Data synthesis	
Measures of treatment effect	Not applicable for qualitative evidence synthesis
Unit of analysis issues	Not applicable for qualitative evidence synthesis
Assessment of heterogeneity	Not applicable for qualitative evidence synthesis
Assessment of reporting biases	Not applicable for qualitative evidence synthesis
Data synthesis	☐ Forest plots

(Continued)

	☒ Qualitative synthesis ☐ Synthesis without meta-analysis Best Fit Framework approach using the 'Theoretical Model to Explain Self-Protection Behavior at Work' (Moore 2005a)
Model	Not applicable for qualitative evidence synthesis
Subgroup analyses	The following subgroups will be explored: different settings, geographical areas, health care workers, types of diseases
Sensitivity analysis	Any post hoc sensitivity analyses that arise during the review process will be justified in the final report.
GRADE approach	☒ GRADE CERQual (Confidence in the Evidence from Reviews of Qualitative research) will be used for each summary of review finding and results presented in a 'Summary of findings' table

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Declarations of interest

Catherine Houghton: none known
Pauline Meskell: none known
Hannah Delaney: none known
Michael Smalle: none known
Andrew Booth: none known
Xin-Hui Chan: none known
Declan Devane: none known
Linda Biesty: none known

CONTRIBUTIONS OF AUTHORS

All authors designed the protocol.

MS designed (with AB) and performed the electronic searches.

CH, PM, HD, and LB conducted study selection and data extraction, with input from AB and XHC.

CH, PM, HD, and LB conducted sampling, analysis, assessment of methodological limitations and the GRADE-CERQual assessment of confidence in the review findings

CG developed the implications for practice section and Plain Language Summary

CH, PM, HD, MS, CG and LB drafted the manuscript.

All authors read and approved the final manuscript.

DECLARATIONS OF INTEREST

Catherine Houghton: none known
Pauline Meskell: none known
Hannah Delaney: none known
Michael Smalle: none known
Claire Glenton: none known
Andrew Booth: none known
Xin Hui Chan: none known
Declan Devane: none known

Linda Biesty: none known