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The lived experience of healthcare professionals working frontline during the 2003 SARS epidemic, 2009 H1N1 pandemic, 2012 MERS outbreak, and 2014 EVD epidemic: A qualitative systematic review



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ABSTRACT

Objective: To synthesize qualitative literature exploring the lived experience of healthcare workers (HCWs) who cared for patients during the following infectious disease outbreaks (IDOs): the 2003 SARS epidemic, 2009 H1N1 pandemic, 2012 MERS outbreak, and 2014 EVD epidemic. We aim to reveal the collective experience of HCWs during these four IDOs and to create a reference for comparison of current and future IDOs.

Methods: Three electronic databases were searched, yielding 823 results after duplicates were removed. Forty qualitative and mixed-methods studies met the criteria for full file review. Fourteen studies met the inclusion and exclusion criteria. The data from the *Results* or *Findings* sections were manually coded and themes were conceptualized using thematic analysis.

Results: Of the 14 studies, 28.6% focused on SARS, 21.4% on H1N1, 21.4% on MERS, and 28.6% on EVD. Studies occurred in six different countries and included physicians, nurses, paramedics, and emergency medical technicians as participants. Five themes were conceptualized: *Uncertainty*, *Adapting to Change*, *Commitment*, *Sacrifice*, and *Resilience*.

Conclusion: This review identified the collective experience of HCWs caring for patients during four 21st century IDOs. This qualitative systematic review offers a reference to compare similarities and differences of other IDOs, including the COVID-19 pandemic.

1. Introduction

Infectious disease outbreaks (IDOs) are not a new phenomenon. Within 2020 alone, the World Health Organization identified 74 IDOs from 18 different pathogens, while in 2019, 119 IDOs were identified from 21 different pathogens (World Health Organization, n.d.a). Healthcare workers (HCWs) play a crucial role working on the frontlines of these IDOs and the wellbeing of HCWs is essential for ensuring a functioning health system during global health crises (World Health Organization, 2020a, 2020b). During IDOs, HCWs are exposed to circumstances that result in unique experiences. There has perhaps never been more interest in HCWs' experiences during IDOs than now with the current climate of the COVID-19 pandemic. Over the course of the pandemic there has been an influx of research and media coverage about the impact of the COVID-19 pandemic on HCWs and their frontline

experiences. This has inspired some researchers to review literature of HCWs' experiences from past IDOs and draw comparisons to the COVID-19 pandemic. However, many of these reviews have focused specifically on the psychological impact on HCWs working during IDOs, rather than approaching it more broadly (Busch et al., 2021; Kisely et al., 2020; Preti et al., 2020). To our knowledge, there has not yet been a synthesis of qualitative research exploring the overall lived experience of HCWs working during IDOs that occurred in the 21st century. The term "lived experience" can be described as the subjective human experience, including the choices, perceptions, and responses of an individual, in order to understand a specific phenomenon of interest (Given, 2008). A qualitative synthesis of the lived experience of HCWs working during recent IDOs offers a reference to compare the findings of studies exploring novel IDOs, aiding in the recognition of similarities and differences amongst HCWs' experiences. Through identifying these patterns

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of experience, health systems can rapidly adapt existing protocols and support resources to ensure they are appropriately tailored to the needs of the HCWs working in each specific IDO. Ultimately, this will provide a more comprehensive picture of the subjective experiences of HCWs that are unique to each emerging IDO. For this reason, we sought to explore the lived experience of HCWs who cared for patients during IDOs that have occurred since the turn of the century. Unfortunately, exploring every IDO over the past 20 years was not a realistic endeavor for a qualitative review. Therefore, we selected the following notable IDOs: the 2003 Severe Acute Respiratory Syndrome (SARS) epidemic, the 2009 H1N1 Influenza A (H1N1) pandemic, the 2012 Middle East Respiratory Syndrome (MERS) outbreak, and the 2014 Ebola Virus Disease (EVD) epidemic (World Health Organization, 2015, September 1). Despite the unique characteristics of these four IDOs, including transmissibility, global case load, and mortality rates, we predict that there are common experiences amongst HCWs in different IDOs that can be synthesized into a collective experience.

1.1. Aim

Our primary aim is to synthesize qualitative literature exploring the lived experience of HCWs who cared for patients during the 2003 SARS epidemic, 2009 H1N1 pandemic, 2012 MERS outbreak, and 2014 EVD epidemic in order to determine a collective experience of HCWs during these 21st century IDOs. A secondary aim is to create a point of reference to compare future IDOs, including the COVID-19 pandemic.

2. Methods

2.1. Literature search strategy

OVID, CINAHL, and PsycINFO electronic databases were searched using the Population, Exposure, and Outcomes framework. For the

purposes of this search, the Population was HCWs, the Exposure was IDOs, and the Outcome was lived experience. Within these three categories, search terms included a combination of 32 keywords and 24 MeSH terms, as shown in the Appendix. To account for the diversity in terminology used to describe “lived experience”, we used a combination of 10 keywords and 15 MeSH terms. Additional limiters were applied in our search, including studies published in English between 2003 and 2020 in peer-reviewed journals with only human participants. COVID-19 search terms were included in our literature search, however, at the time of completing the search, there was limited qualitative literature exploring HCWs’ lived experience of the COVID-19 pandemic. We did not believe that the few existing COVID-19 studies would yet be comparable to our other included IDOs, as the true lived experience of HCWs has yet to be fully conceptualized in the literature as the pandemic is still ongoing. COVID-19 studies were, therefore, excluded from our final selection of studies.

2.2. Study selection and critical appraisal

We retrieved 708 results from OVID, 282 results from CINAHL, and 77 results from PsycINFO, as shown in Fig. 1. All retrieved papers were entered into a citation manager and duplicates were removed, leaving a total of 823 papers to be screened. Eligibility criteria included papers that were peer-reviewed, primary qualitative literature exploring HCWs’ lived experiences caring for suspected or confirmed cases of SARS, MERS, H1N1, or EVD. For the purposes of this review, HCW was defined as: physician, nurse, nurse practitioner, respiratory therapist, emergency medical technician (EMT), paramedic, or midwife. Studies with different methodological approaches were included as a form of second-tier triangulation in order to improve the validity and generalizability of the results (Finfgeld-Connett, 2010, 2014). Studies were not included if greater than 50% of participants did not work in acute care, were not considered HCWs as defined above, or had not cared for patients with

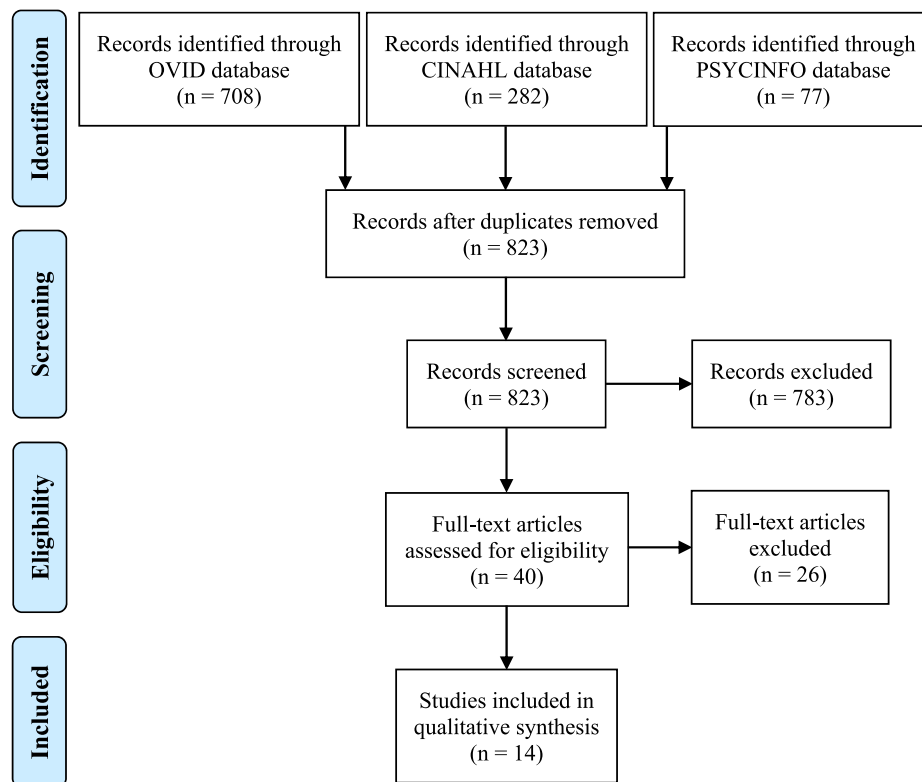


Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) study selection flow diagram. From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6 (6): e1000097. doi:10.1371/journal.pmed1000097.

suspected or confirmed SARS, MERS, H1N1, or EVD. Studies with a primary aim of exploring HCWs' experience of infection control logistics, vaccination, deployment, professionalism, or simulations of IDOs were excluded as these topics represent their own unique phenomena. This helped ensure all selected studies aligned with the aim of this review. The inclusion and exclusion criteria used to determine eligibility are outlined in Table 1.

After screening was complete, the full text of 40 papers were independently reviewed for eligibility by two authors. In cases of disagreement, the study was reviewed and discussed amongst the authors with reference to the inclusion and exclusion criteria until consensus was reached. A total of 14 studies were ultimately included in this review. Each paper was then critically analyzed by two authors independently using the Critical Appraisal Skills Programme (CASP) Qualitative Studies Checklist. The CASP score was used to appraise the relevancy, trustworthiness, and overall quality of the selected studies, however, critical appraisal was not included as a factor in study selection. A data extraction table, including study aim, themes, and CASP scores can be found in Table 2.

2.3. Analysis and synthesis

Thomas and Harden's (2008) approach was used to guide qualitative evidence synthesis. This method was selected because the 2018 update from the Cochrane Qualitative and Implementation Methods Group (Noyes et al., 2018) identifies Thomas and Harden's methodology as the most suitable option for thematic synthesis because it is both accessible and adaptable to varying breadths of qualitative data. The study data were defined as text within the *Results* or *Findings* sections and all verbatim quotes from participants, including those reported outside these two sections (Thomas & Harden, 2008). Some studies in our review combined the *Results/Findings* and *Discussion* sections. In these situations, all text in the combined section was considered data. Once extracted, data from the 14 studies were analyzed using Thomas and Harden's (2008) methods of thematic analysis for qualitative systematic reviews. Data were manually coded individually by two authors. Codes were developed inductively and included text ranging from a single phrase to multiple sentences, keeping in mind the importance of maintaining meaning and context when coding for systematic reviews (Noyes et al., 2018; Thomas & Harden, 2008). Authors met after coding each study to compare codes and further examine the data in order to reach a shared understanding. After the initial coding process was complete, codes that only included studies from one of the selected IDOs were excluded to ensure that final themes represented a collective experience of HCWs working in IDOs, rather than an experience that was unique to one specific IDO. The remaining codes were then organized into categories and

Table 1
Inclusion and exclusion criteria for study selection.

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> Peer-reviewed, primary qualitative literature exploring HCWs' lived experiences working during one of the following IDOs: SARS, MERS, H1N1, or EVD. "Healthcare worker" as defined by the following: physician, nurse, nurse practitioner, respiratory therapist, paramedic, emergency medical technician, or midwife. Papers must use qualitative methods. For studies using mixed methods, only the qualitative data will be considered. Published in English. Published between 2003 and 2020. 	<ul style="list-style-type: none"> >50% of HCW participants do not meet the "healthcare worker" definition stated in the inclusion criteria, or if the study does not report how many participants were in roles involving direct patient care. >50% of HCWs did not work in acute care or did not care for suspected or confirmed infectious disease cases. Studies focusing on HCWs' experience of infection control, logistics, vaccination, deployment, professionalism, or simulation of IDOs. Studies that are secondary research, or primary research that does not report themes. Full-text unavailable.

relevant verbatim quotes were collected. At this point, all original studies were reviewed by two authors to ensure the findings of each study were reflected in the codes and categories. Themes were then conceptualized, and original studies were again revisited to assess whether final themes were representative of the 14 studies and four IDOs.

3. Results

3.1. Study characteristics

Fourteen studies were selected to be included in the review. Of the final selected studies, four (28.6%) focused on SARS (Chiang et al., 2007; Chung et al., 2005; Liu & Liehr, 2009; Shih et al., 2007) three (21.4%) on H1N1 (Corley et al., 2010; Lam & Hung, 2013; Wong et al., 2012), three (21.4%) on MERS (Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018), and four (28.6%) on EVD (Alexander et al., 2020; Belfroid et al., 2018; Jennings et al., 2018; Smith et al., 2017). The studies occurred in six countries: the United States (US), the Netherlands, Taiwan, China, Australia, and South Korea. The year of publication ranged from 2005 to 2020. Thirteen studies included nurses as participants, five included physicians, and one included EMTs and paramedics. Six studies included more than one HCW discipline. There were no studies in the final selection that included nurse practitioners, respiratory therapists, or midwives. Ten of the 14 studies reported gender demographics. Of these studies, the proportion of participants was 87 percent women and 13 percent men. Six papers received high CASP scores, seven moderate, and one low. Five major themes were identified: *Uncertainty*, *Adapting to Change*, *Commitment*, *Sacrifice*, and *Resilience*.

3.2. Uncertainty

Uncertainty was a consistent experience amongst frontline HCWs due to the novelty as well as the unfamiliar and unpredictable nature of the IDOs. This made it difficult for HCWs and health systems to prepare (Alexander et al., 2020; Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Y.; Kim, 2018), with one author describing the experience as "a voyage of uncertainty" (Chung et al., 2005, p. 514). HCWs who had worked during previous IDOs, especially ones they considered more severe, reported less uncertainty, fear, and psychological stress (Corley et al., 2010; Y.; Kim, 2018; Lam & Hung, 2013; Wong et al., 2012). One paper reported that HCWs' uncertainty was most intense at the beginning of an IDO, but slowly diminished as time passed (Shih et al., 2007). In Corley et al.'s (2010) study reviewing the H1N1 pandemic, they commented that "as the pandemic wore on, the fear of the disease itself 'dropped off after a while when they realized it wasn't a SARS thing'" (p. 582).

While uncertainty was a common theme amongst the reviewed studies, the degree to which uncertainty was discussed varied considerably. Factors that contributed to HCWs' experience of uncertainty included level of preparedness, amount of training, and the frequency of policy revisions (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). Many HCWs expressed concerns related to their training and knowledge about infection control procedures, personal protective measures, patient care, and the epidemiology of the IDO (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Liu & Liehr, 2009; Shih et al., 2007). One HCW in Shih et al.'s (2007) study stated, "We were significantly worried that the government had failed to build up a clear picture of the SARS virus transmission pathways or reliable protocols for health professionals to use" (p. 174). Some HCWs worried that the shortcomings of their training and knowledge compromised patient care (Corley et al., 2010; Liu & Liehr, 2009; Shih et al., 2007; Wong et al., 2012). However, other HCWs believed they were appropriately prepared to effectively do their job

Table 2
Data extraction table: Characteristics of the selected studies.

Author	Year	Location	IDO	Method	Participants	Study Aim	Themes	CASP Score
Alexander et al.	2020	US	EVD	Qualitative Grounded theory Inductive content analysis	16 Paramedics 6 Emergency Medical Technicians	“Examine the attitudes and behaviors of Emergency Medical Technicians and Paramedics when faced with the decision to care for patients with suspected Ebola Virus Disease and to illicit suggestions for improvement of infectious disease preparedness.”	1. Reactions to Scare 2. Decision-making 3. Suggestions for future response	Moderate
Belfroid et al.	2018	Netherlands	EVD	Qualitative Thematic analysis Iterative process	13 Nurses 6 Physicians 1 Person in charge of logistics	“To gain insight into how healthcare organizations can prepare to meet the needs of their HCWs by capturing the experiences of HCWs with patients with suspected EVD.”	1. The novelty of the threat 2. The risk of infection and fear of transmission 3. The excessive attention	Moderate
Chiang et al.	2007	Taiwan	SARS	Qualitative Hermeneutics Thematic analysis	15 Emergency Room Nurses 6 Intensive Care Unit Nurses	“Analyze nurses’ experiences of role strain when taking care of patients with SARS.”	1. Self-preservation 2. Self-mirroring 3. Self-transcendence	High
Chung et al.	2005	Hong Kong	SARS	Qualitative Phenomenology Colaizzi method	8 Nurses	“To explore in depth the experiences of nurses’ caring for SARS patients in Hong Kong.”	1. A myriad of emotions in caring for SARS patients 2. Concept of uncertainty 3. Revisiting the ‘taken for granted’ features of nursing	Moderate
Corley et al.	2010	Australia	H1N1	Qualitative Phenomenology Colaizzi method	34 Nurses and medical staff	“To document and describe the lived experiences of the nursing and medical staff caring for patients in the intensive care unit with confirmed or suspected H1N1 during the influenza pandemic; to validate the staffs’ experiences; and assist in informing future pandemic planning by highlighting the collective experiences of these frontline health care workers.”	1. The wearing of personal protective equipment 2. Infection control procedures 3. Fear of contracting and transmitting the disease 4. Adequate staffing levels within the ICU 5. New roles for staff 6. Morale levels 7. Education regarding ECMO 8. The challenges of patient care	High
Im et al.	2018	South Korea	MERS	Qualitative	8 Intensive Care Unit Nurses	“Explore the experiences of eight South Korean nurses during an outbreak of the Middle East Respiratory Syndrome (MERS).”	1. Feeling hopeless and cut off 2. Feeling shame and overworked 3. Feeling pride of fulfilling a duty	Low
Jennings et al.	2018	US	EVD	Qualitative Conventional Content analysis	10 Registered Nurses 2 Doctors 5 Support staff	“Describe the experience of members of the Emory University Hospital Serious Communicable Diseases Unit (SCDU) who worked with EVD patients in 2014.”	1. Meeting the challenge to make the SCU team 2. Principles of high reliability 3. Transferability	High
Kang et al.	2018	South Korea	MERS	Qualitative Descriptive Content analysis	27 Nurses	“Explore the working experiences of nurses during the Middle East Respiratory Syndrome outbreak.”	1. Experiencing burnout owing to the heavy workload 2. Relying on personal protective equipment 3. Being busy with catching up with the new guidelines for MERS 4. Caring for suspected or infected patients with caution	High
Y. Kim	2018	South Korea	MERS	Qualitative Phenomenology Colaizzi method	12 Nurses	“What were the nurses’ experiences of caring for MERS-CoV patients?”	1. Going into a dangerous field 2. Strong pressure because of MERS-CoV 3. The strength that makes me endure 4. Growth as a nurse 5. Remaining task	High
Lam & Hung	2013	Hong Kong	H1N1	Qualitative Exploratory Content analysis	10 Emergency Room Nurses	“Explore the perception of Hong Kong emergency nurses regarding their work during the human swine influenza pandemic outbreak.”	1. Concerns about health 2. Comments on the administration 3. Attitudes of professionalism	High
Liu & Liehr	2009	China	SARS	Qualitative Descriptive exploratory conventional content analysis	6 Nurses	“Document their [nurses’] thoughts and feelings about caring for SARS patients and to seek instructive messages to guide nursing in future epidemics.”	1. Personal challenge 2. Essence of care 3. Self-growth	Moderate
Shih et al.	2007	Taiwan	SARS	Qualitative Content analysis	200 Registered Nurses	“Identify the stage-specific difficulties encountered by Taiwan’s frontline nurses and reveal the background context framing this life-threatening phenomenon to better	1. Precaring stage—Terror of being infected and sacrificed 2. The tangible caring stage—Challenges of infection control and health care cooperation	Moderate

(continued on next page)

Table 2 (continued)

Author	Year	Location	IDO	Method	Participants	Study Aim	Themes	CASP Score
Smith et al.	2017	US	EVD	Qualitative	3 Physicians 8 Nurses 10 Support staff	understand the nurses' needs during the anti-SARS process in Taiwan." "Explore broad concepts of behavioral health in healthcare workers caring for highly infectious patients at a tertiary care center in the United States."	3. Postcaring stage—Life after surviving the SARS disaster 1. Positive experiences were emotional, while challenges were technical 2. A significant percentage of workers encountered interpersonal stressors 3. Physicians and nurses had stressors primarily related to patient care 4. Mental health was an important supportive service 5. Working in the biocontainment unit during activation was more stressful than everyday work for most but not all workers	Moderate
Wong et al.	2012	Hong Kong	H1N1	Qualitative Thematic analysis	4 Physicians 3 Nurses 3 Healthcare assistants	"Explore HCWs' attitudes towards and concern for working in the isolation ward during novel H1N1 flu pandemic."	1. Willingness to retain in the post 2. Duty concerns during novel H1N1 flu pandemic management	Moderate

(Belfroid et al., 2018; Corley et al., 2010; Jennings et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007; Wong et al., 2012).

Frequent revisions of personal protective equipment (PPE) guidelines, infectious disease policies, and patient care procedures were released in order to share new information as it became available. While some HCWs appreciated this (Belfroid et al., 2018; Jennings et al., 2018; Lam & Hung, 2013; Wong et al., 2012), others expressed difficulty keeping up with changing guidelines as it added more uncertainty to an already overwhelming situation (Alexander et al., 2020; Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007; Wong et al., 2012). One HCW described it as follows:

Because the disease was so new, information continued to change ... modification and updating of the infection control procedures and recommendations day by day, and even hour by hour, increased frustration and uncertainty. The perception of personal danger was exacerbated by this uncertainty. (Chung et al., 2005, p. 514, p. 514)

It was not uncommon for HCWs to question the level of the protection PPE offered and to fear it was inadequate (Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Kang et al., 2018; Y.; Kim, 2018; Liu & Liehr, 2009; Shih et al., 2007). This was compounded by the frequent infection control policy updates, which led to ambiguity and a lack of confidence in the overall effectiveness of PPE and infection control procedures (Alexander et al., 2020; Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Y.; Kim, 2018; Shih et al., 2007).

3.3. Adapting to change

HCWs were faced with new day-to-day responsibilities and experiences while working in IDOs and frequently reported difficulties with PPE, increased workload, and new challenges (Alexander et al., 2020; Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). PPE became a struggle for HCWs as they were not used to the burden of wearing PPE for prolonged periods (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Smith et al., 2017). A HCW interviewed in Kang et al.'s study (2018) stated, "It's so sweaty and hard to breathe with it. It is hard to work and see clearly while wearing it (protective measures) [sic] and I feel dizzy when wearing it for long hours" (p. 3). Despite this, PPE was

necessary to reduce risk of infection and some HCWs expressed that it helped them feel safe and protected (Corley et al., 2010; Im et al., 2018; Y.; Kim, 2018; Smith et al., 2017). Many HCWs were ambivalent about their experiences with PPE, acknowledging that while they were grateful for its protection, it was also a significant burden (Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Smith et al., 2017).

HCWs frequently discussed changes in workload from their regular day-to-day work before the IDOs began (Belfroid et al., 2018; Corley et al., 2010; Im et al., 2018; Kang et al., 2018; Lam & Hung, 2013; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). Many HCWs reported in the studies examining SARS, H1N1, and MERS IDOs experienced an increased workload and staffing concerns (Corley et al., 2010; Im et al., 2018; Kang et al., 2018; Lam & Hung, 2013; Shih et al., 2007; Wong et al., 2012), with one HCW stating:

The patient turnover rate is very high and therefore our workload is heavy ... sometimes, we are very hard [sic] to stick to infectious control principals because of the heavy workload ... we cannot even wash the hands thoroughly because of occupied [sic] by receiving calls and admitting cases. (Wong et al., 2012, p. 1471, p. 1471)

In contrast, when HCWs in Belfroid et al. (2018) and Smith et al.'s (2017) studies compared their regular roles to working during the EVD epidemic, they described a reduced workload, lower patient volumes, and staffing levels that were beyond what was needed. Additionally, two EVD studies reported that some experienced intensive care nurses and paramedics believed working during EVD was less stressful and less dangerous than their regular work due to the low number of cases in the US (Alexander et al., 2020; Smith et al., 2017). HCWs indicated that they believed working in an IDO was a new challenge that they were willing, and sometimes even eager, to take on (Alexander et al., 2020; Belfroid et al.; Chung et al., 2005; Corley et al., 2010; Jennings et al. Y.; Kim, 2018; Smith et al., 2017), which was highlighted in Belfroid et al.'s (2018) study when a HCW stated, "Well, we are well-trained. Bring it on!" (p. 215).

3.4. Commitment

The theme of *Commitment* emerged from HCWs' discussions of their professional and personal obligations in relation to their own moral values. All studies included in this review discussed HCWs' perspectives on their duty to care and their willingness to work during IDOs, which often was at odds with their personal obligations, such as protecting

themselves and their families (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). One HCW who worked during SARS asked, "Which action is more commendable [for a nurse]: to protect my own life or to display professionalism?" (Chiang et al., 2007, p. 22). Each HCW balanced these conflicting responsibilities in different ways depending on their personal values (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007). The majority of HCWs in the reviewed studies demonstrated professional commitment in working frontline during the IDOs (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012), although the degree of personal sacrifice that was considered acceptable differed amongst individuals (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007).

HCWs felt a strong moral commitment to their work (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Lam & Hung, 2013; Liu & Liehr, 2009; Wong et al., 2012) and described feeling a duty to care for patients (Alexander et al., 2020; Chiang et al., 2007; Im et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Wong et al., 2012) as this was "what they signed up for when they joined their professions" (Wong et al., 2012, p. 1469). However, some did not believe they should be required to risk their own lives or their families' lives to do so (Chiang et al., 2007; Corley et al., 2010; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007). This left one HCW wondering, "I have my own family and also professional nursing role requirements. Facing this fatal disease, do I need to sacrifice myself even at the cost of losing all my family?" (Shih et al., 2007, p. 174). Others believed their professional commitments were of paramount importance, and at times believed they should be prioritized over their own personal safety (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Im et al., 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Wong et al., 2012), as one HCW stated:

I will work even though [sic] the last minute of my life ... because I feel that I cannot stop my work due to being scared of the disease ... It is unethical to be health professionals like that ... I don't want to be an escape soldier; I must be responsible. (Wong et al., 2012, p. 1469, p. 1469)

Through our analysis, it was apparent that HCWs often considered whether they felt they had a choice in working frontline during the IDOs (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). Some HCWs did not necessarily want to care for infected patients but felt like they were not given a choice (Alexander et al., 2020; Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Y.; Kim, 2018; Shih et al., 2007), while others were offered the opportunity and chose to volunteer (Belfroid et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Smith et al., 2017; Wong et al., 2012). However, those who believed they didn't have a choice felt considerable emotional distress about being required to care for patients during IDOs (Alexander et al., 2020; Belfroid et al., 2018; Chung et al., 2005; Y.; Kim, 2018; Shih et al., 2007). At times the emotional distress reduced HCWs' willingness to work (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Jennings et al., 2018; Y.; Kim, 2018; Shih et al., 2007) and led some to consider refusing to care for infected patients or resigning from their position entirely (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010;

Jennings et al., 2018; Y.; Kim, 2018).

3.5. Sacrifice

HCWs were required to make profound personal sacrifices while caring for patients during the IDOs. They consistently described their concerns about being a frontline HCW and the potential risk to their safety and the safety of their families, friends, and colleagues (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). This contributed to feelings of fear and anxiety (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). In Jennings et al.'s (2018) study, a HCW sounded distressed about the possibility of contracting the virus when saying, "We feared for our lives. None of us wanted to die" (p. 1169). Some HCWs chose to update their wills and get their affairs in order in preparation for this possibility (Chiang et al., 2007; Wong et al., 2012).

Many HCWs expressed feelings of isolation as they chose to, or were required to, physically distance themselves from others, including their families (Belfroid et al., 2018; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007; Smith et al., 2017). HCWs often recognized that this isolation was necessary for the protection of patients, colleagues, and loved ones (Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007). In addition to being physically isolated, HCWs were also socially isolated as many were stigmatized by family, community members, and sometimes even coworkers who worried they might transmit the infection (Belfroid et al., 2018; Chiang et al., 2007; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Shih et al., 2007; Smith et al., 2017). Im et al. (2018) stated a HCW "recalled the gaze of other staff members; she said they made her feel like she was 'vermin.'" (p. 73). To avoid being ostracized by their communities, some HCWs avoided disclosing their profession outside of the hospital (Chiang et al., 2007).

HCWs reported many traumatic experiences while working frontline during IDOs (Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Y.; Kim, 2018; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017), with many incidents involving witnessing patient suffering (Chiang et al., 2007; Corley et al., 2010; Im et al., 2018; Y.; Kim, 2018; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017). Some HCWs felt powerless when they struggled to help patients or relieve their suffering due to lack of effective treatment (Chung et al., 2005; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017). In Liu and Liehr's (2009) study, a HCW said, "I really felt sad. I thought they [the patients] believed in us very much, they thought they could be cured by us but, in fact, from our respect, if they were really severe, we could do nothing" (p. 2884). This was echoed by a HCW interviewed in Smith et al.'s (2017) study who stated, "That will forever be the worst day of my career. He came to us and ... his kidneys weren't working, it was falling apart, and I couldn't do anything to stop it" (p. 107). From these quotes, it is clear how devastating it was for HCWs to witness their patients' suffering. Some of these experiences elicited feelings of vulnerability as HCWs considered their own mortality (Alexander et al., 2020; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007; Smith et al., 2017). This feeling of vulnerability was evident in Chung et al.'s (2005) study when HCWs were required to care for their own coworkers who had become infected with SARS, as one HCW stated, "I have seen my colleagues stricken with this disease ... Am I going to be next?" (p. 513). Ultimately, HCWs sacrificed the safety of themselves and their families in addition to facing isolation, stigma, and traumatic experiences in order to care for their patients. The consequences of these immense personal sacrifices were exhaustion and burnout (Corley et al., 2010; Im et al., 2018; Kang

et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007), which Kang et al. (2018) stated was because “they faced [a] deteriorating situation and worked without expecting when [it] would stop” (p. 4).

3.6. Resilience

HCWs demonstrated resilience while working in remarkably challenging circumstances. This was exemplified through their continued efforts to maintain camaraderie with colleagues and positive morale in the face of adversity (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). Support from family, colleagues, and those in leadership positions, along with open communication, were identified as factors that contributed to a more positive experience (Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). Effective teamwork and professional collaboration appeared to be associated with positive morale and a sense of togetherness (Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017). A number of HCWs were motivated to continue working during the IDOs and to learn more about infectious diseases to better prepare for the future (Alexander et al., 2020; Belfroid et al., 2018; Corley et al., 2010; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009). HCWs became more confident in themselves (Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007), with one HCW concluding, “I believed if you had the confidence you could do a lot of things and no matter what you did, it was worthy” (Liu & Liehr, 2009, p. 2886). Many HCWs described a change in their perspectives, a renewed commitment to their profession, and were proud of the work they accomplished (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017). Following the MERS outbreak in South Korea, a HCW reflected:

I've never been proud of being a nurse before ... I seriously worried about whether to resign because I didn't like my work. However, after caring for MERS-CoV patients, I felt proud of myself and began to take pride in being a nurse. (Y. Kim, 2018, p. 785, p. 785)

HCWs showed resilience through their demonstrations of personal and professional growth and feelings of fulfillment that emerged from caring for patients in adverse work environments (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017). HCWs often critically reflected on their experiences and used reflection as a tool to find meaning in their experience and to grow personally and professionally (Chiang et al., 2007; Im et al., 2018; Y.; Kim, 2018; Liu & Liehr, 2009; Shih et al., 2007). Although HCWs described difficult and sometimes traumatic experiences (Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017), all but one study revealed that HCWs had positive feelings and perspectives about their contributions (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017). Some HCWs referred to their work during the IDOs as deeply rewarding and worthwhile (Im et al., 2018; Kang et al., 2018; Smith et al., 2017), while others described it as a “treasurable” (Lam & Hung, 2013, p. 244) or “unforgettable” experience (Chung et al., 2005, p. 514). Their positive sentiments were enhanced through feeling appreciated by their colleagues, families, and

communities (Chung et al., 2005; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Liu & Liehr, 2009; Shih et al., 2007). Kang et al. (2018) revealed that when HCWs “returned to their work unit, they often heard ‘You did a good job’ from their peers, and that ‘It felt supportive and healing’” (p. 6). After working during the IDOs, some HCWs found new meaning in their lives (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Im et al., 2018, 2018; Kang et al., 2018; Y.; Kim, 2018; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017), with one HCW stating, “Being alive should not be taken for granted any more ... I do not want my life filled with regret and bad feelings before my death” (Chiang et al., 2007, p. 22) and another stating, “I will not waste time any longer” (Liu & Liehr, 2009, p. 2886). It is clear that, for many HCWs, working during these IDOs fostered a sense of purpose (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017); “Everyone had the feeling they were doing something good for this world” (Belfroid et al., 2018, p. 214).

4. Discussion

This review synthesized literature exploring the lived experience of HCWs who cared for patients during SARS, H1N1, MERS, and EVD to establish a collective experience of HCWs working in 21st century IDOs. Our results reveal that *Uncertainty*, *Adapting to Change*, *Commitment*, *Sacrifice*, and *Resilience* are consistent themes amongst the 14 studies in this review. Despite the unique characteristics of each IDO, our review suggests that it is still possible to identify a collective experience of frontline HCWs. Although we have described a collective experience within this review, each IDO has specific trends and variations. Within any IDO, there are likely to be aspects that are entirely unique or lie in the extremes of the spectrum of this collective experience. We will explore some of the variations we observed in our analysis within this discussion.

Our review found that fear and concerns regarding PPE efficacy were more frequently reported in SARS, MERS, and H1N1 studies compared to the EVD studies. One notable difference between EVD and the other three IDOs, is that EVD is transmitted via bodily fluids (Centers for Disease Control and Prevention, 2021), whereas the others are respiratory viruses spread via droplet transmission (Centers for Disease Control and Prevention, 2005; Centers for Disease Control and Prevention, n.d.; World Health Organization, 2015, June 21). It is feasible that HCWs' concerns regarding PPE effectiveness may be related to differences in mode of transmission and the PPE recommendations associated with each, however, this has yet to be evaluated in the literature. It is also necessary to consider that all four EVD studies included in our review occurred in high-income countries with comparatively low caseloads and sufficient access to PPE (Alexander et al., 2020; Belfroid et al., 2018; Jennings et al., 2018; Smith et al., 2017). Therefore, it is certainly possible that this discrepancy is due to the circumstances of the EVD studies included in this review, rather than the mode of transmission of the virus itself.

PPE is critical for reducing transmission and keeping HCWs safe during IDOs, however, wearing PPE for prolonged periods carries its own risks. Many studies in our review discussed the burden of PPE (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Smith et al., 2017), with one study reporting difficulty breathing, dizziness, and presyncopal episodes (Im et al., 2018). Multiple studies have explored the adverse effects that result from wearing PPE for extended periods of time, including headaches, dizziness, extreme exhaustion, and profuse sweating (Davey et al., 2021; Tabah et al., 2020). Beyond the physical effects associated with PPE, Davey et al. (2021) reported that cognitive tasks may be negatively impacted, such as reduced attention as well as impaired decision-making and problem-solving abilities. Based on our review, PPE appears to be a double-edged sword for HCWs in IDOs; while PPE offers life-saving protection, it can also bear a significant burden (Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Kang et al., 2018;

Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Smith et al., 2017). The considerable difficulties experienced while wearing PPE further emphasizes the sacrifice HCWs made to care for their patients.

In this review, HCWs more frequently reported feeling uncertain in situations with minimal resources, limited preparedness, and no experience working in previous IDOs (Chiang et al., 2007; Chung et al., 2005; Shih et al., 2007; Wong et al., 2012). This inverse relationship between uncertainty and resources, preparedness, and previous IDO experience may provide an explanation for why studies exploring the EVD epidemic reported less feelings of uncertainty (Alexander et al., 2020; Belfroid et al., 2018; Jennings et al., 2018; Smith et al., 2017). These studies were in areas outside the epicenter of the EVD epidemic, such as the US and the Netherlands, which presumably resulted in greater preparation time, significantly lower caseloads, and less reported concerns of resource scarcity. All of which could have ultimately led to reduced levels of uncertainty. Additionally, while there were frequent reports of increased workload for HCWs working in SARS, H1N1, and MERS IDOs (Corley et al., 2010; Im et al., 2018; Kang et al., 2018; Lam & Hung, 2013; Shih et al., 2007; Wong et al., 2012), some HCWs working during the EVD epidemic described the workload as reduced or comparable to their day-to-day work (Belfroid et al., 2018; Smith et al., 2017). This may again be because the EVD studies were in areas with relatively low caseloads, but also may have been related to the staffing concerns mentioned by HCWs in SARS, H1N1, and MERS IDOs (Corley et al., 2010; Kang et al., 2018; Lam & Hung, 2013; Shih et al., 2007; Wong et al., 2012).

Our review identified the importance of HCWs considering the balance between their professional and personal commitments when faced with working during an IDO. Some HCWs did not want to risk the lives of themselves or their families in order to care for patients (Chiang et al., 2007; Corley et al., 2010; Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007), while others did not hesitate to prioritize their professional duties over their own safety (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Im et al., 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Wong et al., 2012). However, it is important to note that there was considerable variation in HCWs' perspectives, even within a single study. HCWs' final conclusions and rationale appeared to have less to do with the characteristics of the IDO, and more to do with the values and obligations of the individual HCW. Additionally, there appeared to be a connection between HCWs' control over their decision to care for infected patients and their willingness to work (Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Jennings et al., 2018; Y.; Kim, 2018; Smith et al., 2017). Therefore, it is likely that these variations will continue to exist within other future IDOs depending on the values of the individual and the policies of the health systems they work in.

One topic that was consistent across all reviewed papers was fear of contracting the virus or spreading it to loved ones (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). HCWs were often acutely aware that they were risking their safety because their duties and responsibilities involved close contact with infected patients. During the SARS epidemic, HCWs accounted for over 21% of confirmed global SARS cases, many of whom were exposed in the workplace (World Health Organization, n.d.c), while HCWs working during the EVD epidemic were estimated to be between 21 and 32 times more likely to be infected than the general public (World Health Organization, 2016). Similarly, in the MERS outbreak, hospital-acquired cases outnumbered community-acquired cases, with an associated spike in HCW infections (World Health Organization, n.d.b). It is undeniable that HCWs are placed at significant risk when caring for patients with infectious diseases. However, the level of risk varies depending on the profession as well as the area of practice. HCWs who are involved in direct patient care and high-risk interventions, such as aerosol-generating medical procedures in the context of respiratory infections, are considered to be at significantly higher risk

during IDOs (Simonds & Sokol, 2009).

Our review identified stigma as a common experience amongst HCWs working in SARS, MERS, and EVD (Belfroid et al., 2018; Chiang et al., 2007; Im et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Shih et al., 2007; Smith et al., 2017), however, stigma was not discussed in the H1N1 studies. This finding has been corroborated in Kisely et al.'s (2020) review examining the psychological impact of IDOs on HCWs. Stigma towards HCWs was identified during other IDOs in their review but was not reported in studies exploring the H1N1 pandemic (Kisely et al., 2020). Goulia et al. (2010) speculates that the contrast in stigma directed towards HCWs between the H1N1 pandemic and the SARS epidemic, was due to the public's perception of H1N1 as a community-acquired infection, whereas SARS was considered a hospital-acquired infection. As a result, HCWs in the H1N1 pandemic were considered to be no more likely to spread the infection than other community members (Goulia et al., 2010), which may explain why stigma was not directed towards HCWs specifically, despite being an issue in the community setting (Earnshaw & Quinn, 2013). In comparison, during the SARS epidemic, those who worked in healthcare facilities were considered much more likely to become infected with SARS than those in the general population, which led to considerable stigmatization of HCWs (Goulia et al., 2010; Hsin & Macer, 2004; Styra et al., 2008). Another factor that could have led to limited stigmatization of HCWs during the H1N1 pandemic, may have been the relatively low mortality rate associated with the virus in comparison to the other reviewed IDOs (Petersen et al., 2020; Shultz et al., 2016), leading some to perceive H1N1 as a less severe illness (Corley et al., 2010; Petersen et al., 2020). Interestingly, the estimated upper limit of the global death toll from H1N1 far exceeded that of SARS, MERS, and EVD combined (Petersen et al., 2020; Shultz et al., 2016), suggesting that the stigmatization of HCWs may be more correlated with the mortality rate of a specific IDO than the total number of deaths.

The theory of the social construction of reality (Berger & Luckmann, 1966) may explain some of the differences in society's perceptions of HCWs working during various IDOs. Stigma towards HCWs was related to community members' assumptions of HCWs' risk of transmitting the infection. Unfortunately, collective perceptions such as this create a shared reality that can lead to stigma that has devastating impacts on those subjected to acts of discrimination. At the outset of the COVID-19 pandemic, the WHO recognized the potential harm of this and encouraged governments, organizations, media, and various companies to develop Healthcare Hero Campaigns to combat the negative perceptions of HCWs (World Health Organization, February 2020). Language is a powerful tool for constructing our reality (Pfadenhauer & Knoblauch, 2019) and by altering the language used in relation to HCWs, the WHO was able to promote a reality in which HCWs are regarded and publicized as champions who should be celebrated for their role during the COVID-19 pandemic. This strategy remedies past negative societal perceptions of HCWs involvement in IDOs, replacing negative connotations with positive sentiments to establish a reality in which HCWs are seen as public heroes instead of threats to public safety. Evidence for the relative success of these campaigns include the regular cheering for healthcare workers that occurred at 7:00 p.m. every night in many cities around the world, which has not been seen in past IDOs (Booth et al., 2020). Therefore, such efforts may contribute to a reduction in overall stigma and discrimination in the COVID-19 pandemic in comparison to previous IDOs in the 21st century.

The emotional impact of caring for patients during IDOs was a dominant topic in the studies included in this review (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). Witnessing the death or suffering of a critically ill patient is immensely distressing and traumatic for HCWs, regardless of whether it is in the context of an IDO (Nia et al., 2016). Unsurprisingly, many HCWs in our study expressed feelings of exhaustion and burnout (Corley et al., 2010; Im et al., 2018; Kang et al., 2018;

Y.; Kim, 2018; Lam & Hung, 2013; Shih et al., 2007). A systematic review and meta-analysis reviewing SARS, H1N1, MERS, EVD, and COVID-19 found 31.8% of HCWs working frontline exhibited symptoms of burnout (Busch et al., 2021). Working during these IDOs has also been correlated with increased depression, anxiety, insomnia, and symptoms of post-traumatic stress disorder (Busch et al., 2021). During the SARS epidemic, Marjanovic et al. (2007) found burnout in HCWs was exacerbated by frequent interactions with infected patients and reduced confidence in infection control measures, while J. S. Kim and Choi (2016) found that during the MERS outbreak, reduced resources for treatment and limited support from family and friends were associated with increased burnout. HCW burnout does not appear to be a short-term experience as Maunder et al. (2006) found that HCWs who worked during the SARS epidemic still had high rates of burnout and psychological distress two years after the epidemic ended. Fortunately, awareness of HCW burnout has increased and research has shown that, at the institutional level, improved training of infection control measures, greater leadership support, and psychiatric resource availability contribute to a reduction in emotional exhaustion (Magnavita et al., 2021).

Despite the hardships that HCWs experienced during the IDOs, our review found evidence of resilience in all reviewed studies (Alexander et al., 2020; Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). Robertson et al. (2016) describes resilience in HCWs as multifaceted and “is represented by continuing to perform well, adapting to changing circumstances, and maintaining a sense of professional and personal fulfillment” (p. e430). HCWs in the reviewed studies adopted coping strategies, such as open communication, team collaboration, and self-reflection, which may have contributed to HCWs’ resilience, personal growth, and fulfillment (Belfroid et al., 2018; Chiang et al., 2007; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017). Positive personal outcomes after challenging experiences is often referred to as posttraumatic growth (Tedeschi & Calhoun, 2004). This term describes the “positive, transformative power of suffering; that is, psychological changes that occur as a result of undergoing some stressful event” (Asmundson et al., 2021, p. 2). This may be an explanation of why some HCWs report positive change after working frontline during IDOs, as has been demonstrated in previous literature (Heung et al., 2005).

Magnavita et al. (2021) and Krasner (2009) found personal coping strategies, such as engaging in mindfulness and seeking social support, were associated with reduced burnout in HCWs. In our review, support appeared to play a vital role in contributing to a more positive experience, with support from family, colleagues, and leaders being most commonly referenced (Belfroid et al., 2018; Chung et al., 2005; Corley et al., 2010; Im et al., 2018; Jennings et al., 2018; Kang et al., 2018; Y.; Kim, 2018; Lam & Hung, 2013; Liu & Liehr, 2009; Shih et al., 2007; Smith et al., 2017; Wong et al., 2012). Although frequently discussed, feeling supported was not a universal experience for HCWs in the reviewed studies. Nevertheless, seeking social support is crucial during stressful events and is proposed to strengthen resilience and improve effective coping (Hallen et al., 2020; Heath et al., 2020; Taku, 2014). It is important to note that in order to have an effect on resilience, the type of social support must be individualized and adaptable as the needs of each individual may evolve over time (Southwick et al., 2016). This may be critical for health systems to consider when offering supportive resources to HCWs during IDOs. Other considerations include employing peer support strategies, like the Battle Buddy system (Ramsberger et al., 2002; as cited in Albott et al., 2020), which may have greater utility in IDO scenarios and requires limited organizational effort (Albott et al., 2020). Such systems pair similar individuals to help cope during challenging events and promote resilience by creating a culture in which individuals

feel validated and supported (Albott et al., 2020). Fostering resilience is crucial as burnout not only has implications on the functioning of a healthcare system (Noseworthy et al., 2017), but has ramifications on the personal safety of HCWs, having been associated with HCW suicide (Kuhn & Flanagan, 2017; Stehman et al., 2019).

The secondary aim of our review was to create a reference of comparison for future IDOs, including the COVID-19 pandemic. Literature exploring the lived experience of HCWs working frontline during the COVID-19 pandemic has already begun to be published and will likely continue to be published for many years to come. The findings from our systematic review can be compared to currently available literature in order to explore the ways in which the current pandemic may be unique to other previous IDOs. Unsurprisingly, many studies exploring COVID-19 have identified similar findings as our review, such as uncertainty, fear of infection, fear of transmission to friends and family, challenges with PPE, concerns about frequent policy revisions, increased workload, stigma, witnessing patient suffering, comradery and social support, resilience, as well as evidence of burnout and emotional exhaustion. (Gunawan et al., 2021; Karimi et al., 2020; LoGiudice & Bartos, 2021; McGlinchey et al., 2021; Villar et al., 2021). This suggests that many experiences discussed in this review have been similar to HCWs’ experiences during the COVID-19 pandemic. That being said, the COVID-19 pandemic has frequently been referred to as “unprecedented” and, therefore, it is not unexpected that there are certain differences in HCWs’ reported experiences (LoGiudice & Bartos, 2021; McGlinchey et al., 2021). For example, some HCWs working during the COVID-19 pandemic have described overwhelmed healthcare systems, including situations in which morgues were full and grocery store trucks were used for extra space. These extreme circumstances were not reported in the studies from previous IDOs. Additionally, McGlinchey et al. (2021) and Gunawan et al. (2021) reported considerable frustration amongst HCWs in regard to the public’s responses to COVID-19 guidelines, leading some HCWs to plead to the public to abide by government restrictions. Additionally, HCWs during COVID-19 described major changes in their daily lives outside of work that were not described in the studies included in our review, such as cancellations of weddings and graduation celebrations. HCWs working during COVID-19 also reported greater community support, such as local restaurants donating food, ‘thank you’ signs placed in front yards, and support from other essential workers, including firefighters and police officers (LoGiudice & Bartos, 2021). We also noted technology was discussed more frequently in the COVID-19 studies in comparison to those included in our review. These discussions include reference to telemedicine accessibility and limitations, as well as tablets and videoconferencing apps used to connect hospitalized patients with their families (LoGiudice & Bartos, 2021; McGlinchey et al., 2021). The difference in HCWs’ experiences during the COVID-19 pandemic in comparison to the IDOs included in our review is likely multifactorial. While many explanations can be hypothesized, further research is required to conclusively determine the reasons for these unique experiences and how they may evolve over the course of the pandemic.

A noteworthy topic that was not discussed in any of the studies in our review is the difference in the experience of different genders working during IDOs. Of the studies in our review that reported gender demographics, 87% of participants were women. Therefore, it is important to consider how this may have impacted our results. We will be using the terms “men” and “women” to include anyone who identifies and has been socialized as these genders regardless of biological sex (i.e. male vs. female). We were unable to find any studies from these previous IDOs that compared the experiences of men and women HCWs. Fortunately, this appears to be a topic that has gained traction more recently as there are a number of studies that have explored the challenges of working as a HCW during the COVID-19 pandemic that may differ between genders. While the COVID-19 pandemic has placed a toll on the mental health of HCWs, women HCWs appear to be disproportionately affected. Young et al. (2021) found that women HCWs during the COVID-19 pandemic had higher PHQ-9 depression scores than their colleagues who identify as

men. Other studies have reported greater incidence of stress, anxiety, and post-traumatic stress disorder amongst women HCWs (Kang et al., 2020; Liu et al., 2020). This discrepancy is understandable as research from the COVID-19 pandemic demonstrates higher rates of infection in women HCWs compared to their male counterparts (El-Boghdady et al., 2020). While it is unclear exactly why this is, some researchers hypothesize this may be due to the gendered design of PPE to fit larger body types, which are less likely to fit women HCWs. A 2021 study noted that women HCWs also face the challenge of managing multiple roles, such as HCW, partner, parent, and academic while working during the pandemic (Austin et al., 2021). While many of the traditional household responsibilities often fell on women before the pandemic, Austin et al. (2021) found that this imbalance of gender roles has increased significantly during the COVID-19 pandemic. This gender divide may also lead to long term implications for future career potential as this HCW described the negative impact on her role as an academic during COVID-19:

There was also an academic push, you have to publish ... like I didn't write anything. You know why? Because I was cooking dinner and taking care of kids and trying to teach my daughter how to read ... Meanwhile, my husband has ... over 30 publications during this time ... so there's a huge discrepancy (Austin et al., 2021, p. 10).

There are many shared experiences amongst HCWs during the COVID-19 pandemic, however, it is also important to consider how experiences may vary based on gender. We recognize our discussion on this topic is a gross simplification of gender, which reflects the limitations of the current literature available. We hope there will be further research exploring the differences in experiences working during the pandemic for those in various gender roles, particularly for those who don't necessarily relate to traditional, binary gender identities.

5. Limitations

The data analysis and synthesis in this review was completed by only two authors, which may increase the risk of bias. This was mitigated by the authors analyzing the data individually and then meeting to compare codes and further examine the data to reach consensus as recommended by Noyes et al. (2018). In addition, the original studies were frequently revisited to ensure the original findings were accurately represented in this qualitative synthesis (Noyes et al., 2018). However, this review could have been strengthened by having an additional reviewer independently verify codes and themes in relation to the original studies.

Another limitation of our study is the low number of papers that met the inclusion and exclusion criteria in our search strategy. This may have been due to the absence of a universal definition and term for "lived experience." We accounted for this by using a combination of 10 keywords and 15 MeSH terms for "lived experience." However, we recognize it is possible that some studies may have used different terminology and, as a result, may not have been included in this review. Therefore, it is more difficult to be confident that our findings accurately represent the complexity of the phenomenon being explored.

A literature review is only as strong as the research that's included. The methodology of this review involved re-coding the findings published in qualitative studies. This is an inherent limitation of qualitative evidence synthesis because the analysis is based on what the authors of the selected studies chose to report. In order to reduce the impact of this limitation on our results, we only included topics that were discussed in more than one IDO to ensure the themes we identified represented a collective experience.

While our goal was to understand the lived experience of HCWs from multiple disciplines caring for infected patients during the IDOs, the majority of the papers only interviewed nurses. Of the 14 papers reviewed, eight exclusively interviewed nurses, one interviewed EMTs and paramedics, and the remaining five interviewed a combination of physicians, nurses, and support staff. This limits the ability to generalize the results to other HCWs as some of the experiences and challenges may have been unique to those working in a nursing role. Although four of the

studies included in this review didn't report gender demographics, of those that did, 87 percent were women. Therefore, it is possible that the themes described in this review were more greatly influenced by the perspective of women and are not representative of all genders. However, women are estimated to make up 70 percent of the global healthcare workforce (Lotta et al., 2021), and thus it is not entirely unreasonable for this review to reflect the experience of female healthcare workers more heavily.

The exclusion criteria for this review omitted papers that focused on infection control, logistics, vaccination, deployment, professionalism, and simulation of IDOs as these appeared to be their own unique topics. We were left with studies primarily from the US and Asian countries, with only two studies occurring outside these regions. As a result, the themes identified in this review may not represent the full breadth of experience of HCWs working during IDOs in other countries. Future literature reviews exploring this topic should consider using search criteria that incorporates studies in multiple languages, which may lead to more geographic diversity. It is also crucial to include countries with various GDPs, as the wealth of a country may impact the resources available in a healthcare system, which has the potential to alter the experiences of HCWs in these regions. In addition, we selected four specific IDOs to ensure the research team could feasibly analyze the qualitative data, however, it is important to note that this also narrows the scope of our review and may not adequately represent HCWs' experiences from all IDOs of the 21st century. Therefore, further research is needed to synthesize studies from other notable IDOs to more thoroughly conceptualize this topic.

In addition, it is important to consider the theory of social construction of reality when exploring a phenomenon occurring in multiple areas of the world. It is challenging to compare the lived experiences of HCWs and hypothesize the possible reasons for differences in their experiences when discussing IDOs that occurred in different times and locations. Therefore, we made cautious generalizations that do not completely encompass the complexities of the realities that existed in each specific society during the IDOs explored in this review. We acknowledge that we used a more objective approach to synthesize the lived experience of HCWs in IDOs. Future reviews may benefit from incorporating a more humanistic or sociological lens or other alternative method to qualitative research that have recently begun to gain popularity, such as citizen science or autoethnographies. These approaches would likely offer a more subjective discourse and may provide an alternative interpretation to the lived experience of HCWs working in IDOs.

6. Conclusion

This review highlights the lived experiences of HCWs caring for patients during the SARS epidemic, H1N1 pandemic, MERS outbreak, and EVD epidemic. We identified five central themes to HCWs' experiences: Uncertainty, Adapting to Change, Commitment, Sacrifice, and Resilience. It is clear that although there were major differences in these IDOs' total caseloads, deaths, and the populations affected, we were able to identify a collective experience of HCWs working in all four IDOs. While it is impossible to predict HCWs' experience during future IDOs, this systematic review offers a reference that can be used to compare other IDOs, including the COVID-19 pandemic. Understanding such experiences presents an opportunity for governing bodies and healthcare administrations to learn from the past and ultimately better prepare and support HCWs in current and future IDOs.

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CRedit authorship contribution statement

Erin R. Chahley: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. **Riley M. Reel:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. **Steven Taylor:** Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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