REVIEW ARTICLE

Are nurses prepared to respond to next infectious disease outbreak: A narrative synthesis

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Abstract

Aim: The review aimed to present a synthesis of nurses' preparedness for infectious disease and the components of emergency preparedness.

Design: Narrative synthesis.

Methods: A systematic search and screening for relevant studies were conducted to locate the relevant articles. The included studies were examined for scientific quality using the Mixed Methods Appraisal Tool. The findings of included studies were synthesized by a narrative synthesis approach.

Results: Totally 15 studies were included, and 4 themes associated with nurses' preparedness for pandemic were identified: knowledge and skills, psychological preparation, external resources, and attitude and intention.

Conclusions: Most nurses express a positive willingness to respond to epidemics, although they do not believe they are adequately prepared. Some measures should be taken for improving nurses' emergency preparedness, including providing ongoing training, protective equipment, safe working environment and psychological intervention, improving nurses' resilience and accelerating the sharing of scientific information about epidemics.

KEYWORDS
communicable diseases, epidemic, infectious disease, narrative analysis, nurse, pandemic, preparedness

1 | INTRODUCTION

Over the past few decades, numerous communicable diseases have spread in human society, some of which have caused great threats, burdens and losses to human beings, such as the 2003 SARS epidemic (Stadler et al., 2003), the 2009 H1N1 influenza pandemic (Scalera & Mossad, 2009), the 2014 Ebola virus disease epidemic (Zawilińska & Kosz-Vnenchak, 2014), the 2015 MERS threat (Mackay & Arden, 2015) and the current outbreak of coronavirus disease (Valencia, 2020). These widespread infectious diseases represent one of the most imminent threats to the world. Moreover, outbreaks of infectious diseases have increased in frequency and intensity, posing much greater challenges and burdens on medical systems (Nii-Trebi, 2017).

The emerging and re-emerging infectious disease can be defined as a disease that has newly appeared in a population or has existed previously but is rapidly increasing in incidence (Morens et al., 2004). The abruption and rapid spread of infectious disease outbreaks have highlighted the capacity and speed of government and medical system to respond. In the fight against infectious

diseases, humankind has become increasingly aware of some infectious diseases. Accordingly, most governments and healthcare institutions have established systematic emergency plans to ensure the necessary supports are provided during the outbreaks so that healthcare personnel could give effective treatment and nursing for patients (Griffin et al., 2020; Imai et al., 2008). In reality, however, the first response to infectious disease outbreaks is usually not a government emergency service alert, but nurses or doctors working in the healthcare setting (Almutairi et al., 2016).

Nurses have always been the largest group in the healthcare system around the world, and have been at the frontline in responding to every infectious disease outbreak in history (Lam et al., 2020). During an emerging infectious disease outbreak, the demand for nurses is much greater than the demands for any other healthcare personnel, and more than usual (Baack & Alfred, 2013). Nurses have made a vital contribution to multiple aspects of implementing emergency preparedness plans, including disease diagnosis, prevention, screening, and symptom assessment, and they play an important role in nursing and treating the infected patients, and in the vaccination process (Jakeway et al., 2008). Simultaneously, nurses also participate in the development of infectious disease emergency plans and the evaluation of their application. Nurses are active at any stage of epidemic prevention and control, from outbreak to response to recovery (Adams et al., 2011). Given the nurses' role as the backbone of the healthcare system, nurses are required to make adequate emergency preparedness to deal with an outbreak of infectious disease at any time.

2 | BACKGROUND

Emergency preparedness has frequently been addressed in the field of health care and disaster nursing (Biddinger et al., 2018; McNeill et al., 2018). It has been used as the basis for individual, institute and government preparedness plans for enhancing readiness and increasing response capacity to public health emergencies. Slepski (2005) defined emergency preparedness of nurses as comprehensive skills, abilities, knowledge and actions that were needed to prepare and respond for a threatened, actual or suspected, chemical, radiological, nuclear, biological or other related events. In 2019, ICN further categorized core competencies in disaster nursing into eight domains, the first of which was emergency preparedness (International Council for Nurses, 2019). In this review, such an event or disaster nursing was an outbreak of an infectious disease.

The emergency preparedness for an epidemic of hospital nurses is the main issue of concern. Firstly, nurses are the first group to recognize the outbreak of an emerging infectious disease (Chen et al., 2016). Secondly, nurses are the important implementer of the emergency plans for an epidemic in hospitals (Adams et al., 2011). They need to maintain up-to-date knowledge of available emergency resources, plans, policies and procedures to ensure the emergency plans work correctly and timely, for protecting patients and hospital staff. Thirdly, nurses are the primary implementer of nursing

> **What does this paper contribute to the wider global clinical community?**
>
> - Most nurses feel unprepared, especially psychologically, to deal with the next infectious disease outbreak.
> - External support including ongoing training and frequent retraining, personal protective equipment, safe working environment, fast information access and psychological intervention should be provided for nurses to deal with epidemics.

and treatment for infected patients, so they need to know the approaches to accommodate the vulnerable population, to care for and treat the infected patients (Chen et al., 2016; Lam & Hung, 2013). As recommended by the Association of Community Health Nursing Educators (ACHNE) (Kuntz et al., 2008), all nurses working in hospitals and communities should possess basic emergency competencies to deal with future outbreaks of infectious disease. According to the competencies framework recommended by the ICN, emergency preparedness competencies among general professional nurses include four aspects, maintaining a preparedness plan, participating in emergency drills, maintaining up-to-date knowledge of emergency, familiarizing the approaches to accommodate vulnerable population (International Council for Nurses, 2019).

However, in the field of infectious disease prevention and control, studies tend to focus more on the organizational capacity of governments and medical institutions (Kim-Farley, 2017), while the importance of emergency preparedness of nurses for prevailing epidemic has been understood, but it is not sufficiently clear. To date, it has been unclear how well nurses are prepared for future infectious disease outbreaks. Some primary studies have assessed the experience and perception of nurses in epidemic response (Chen et al., 2016; Lam & Hung, 2013), some have assessed the knowledge of infectious disease prevention and treatment (Adebimpe & Ibirongbe, 2019; Fryk et al., 2020) and some have evaluated the belief about or attitude to the epidemic (Adongo et al., 2017; O'Boyle et al., 2006). But nurses' preparedness for responding to sudden and emerging health threats is considered to include knowledge, skills, abilities and value (Kuntz et al., 2008), but there is still a lack of exploration. Lam et al. (2018) conducted a literature review on nurses' preparedness in 2016, but only a few qualitative studies were included for analysis, limited by the relatively small number of articles included; the underlying components of nurses' preparedness were not well synthesized.

O'Sullivan et al. (2008) found that nurses felt unprepared to respond to infectious disease. Then, Baack and Alfred (2013) reported a similar finding that most nurses were not confident in their ability to deal with an emerging event. However, research (Fryk et al., 2020) found that 98% of nurses said that they were capable of undertaking their role in the management of infectious diseases. It is uncertain whether nurses' preparedness for infectious disease has improved

enough over time. Therefore, it is critical to determine whether nurses are prepared for future infectious disease outbreaks.

3 | OBJECTIVES

The literature review aimed to explore nurses' preparedness for infectious disease and the main components of emergency preparedness. It was hoped that identifying the constituent of emergency preparedness would address the concerns and needs of nurses who are currently involved or will be involved in the epidemic prevention and control. This review would give some information and suggestions for designing strategies and training programmes to effectively improve nurses' preparedness for future infectious disease outbreaks. The following questions were used to guide and conduct this narrative synthesis:

1. Do nurses feel fully prepared to respond to future infectious disease outbreaks?
2. What competencies or resources or support are essential for nurses to be able to deal with infectious diseases?

4 | METHODS

4.1 | Study design

A narrative synthesis is a textual approach that has been widely used in reviewing to synthesize evidence extracted from both qualitative and quantitative studies. It was adopted for this literature review. The development of this review was based on the guidance for narrative synthesis published in 2006 (Popay et al., 2006). Given the limited studies on the preparedness of nurses, qualitative, quantitative and mixed-method studies were included to enable an exploration of the preparedness for infectious disease outbreaks from a nursing perspective. The review methods were compliant with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (File S1).

4.2 | Search strategy

A systematic search was conducted based on the three-phase searching model developed by the Joanna Briggs Institute for Evidence-Based Health Care (Joanna Briggs Institute, 2008): primary identification of keywords; searching article titles and abstracts for keywords and hand-searching reference and contacting authors. The MEDLINE, BNI, CINAHL and EMBASE electronic databases were searched by using keywords and Medical Subject Headings to locate the potentially relevant articles published in the period 1996 to December 2020. The searching queries were as follows: (infectious disease OR communicable disease OR pandemic OR epidemic OR public health emergency OR COVID-19 OR H1N1
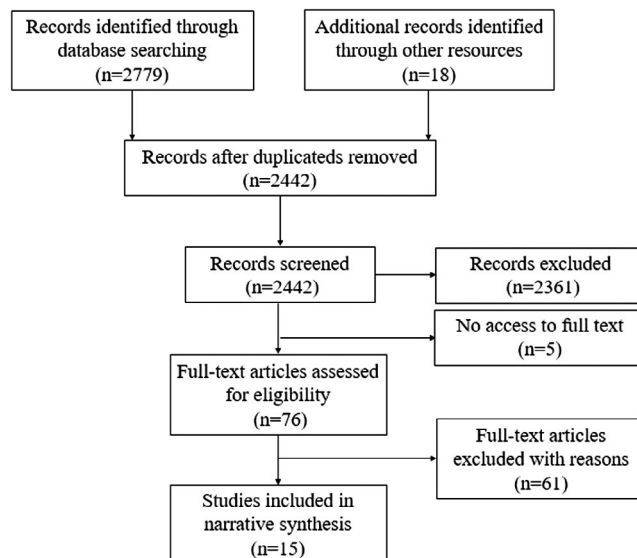

FIGURE 1 Study selection process

OR Ebola OR avian flu OR Middle East Respiratory Syndrome OR Severe Acute Respiratory Syndrome OR swine flu) AND (nurse OR nursing personnel OR nursing staff) AND (experience OR perception OR preparedness OR readiness OR response OR defense OR capacity). Google Scholar and Web of Science were used for citation tracking to identify references that were very probably relevant to the topic of this review.

To facilitate critical appraisal, inclusion and exclusion criteria were set to ensure the selected articles were relevant to the aim of this review. Papers were included if they met the following criteria: original research; the target population was nurses who work at a hospital; the phenomenon was associated with an emerging infectious disease (Morens et al., 2004); the papers were involved in a description of the preparedness/readiness of nurses. Papers not written in English or without full text were excluded from the review.

The PRISMA flow chart was used as a tool to document every step of the studies selection process, see Figure 1 for more details. The reading of the title, abstract and full text of included records was done by two independent reviewers. Only records that were excluded by two authors were finally excluded. The Endnote software was used for duplicated paper removal and paper screening and Microsoft Excel was used to document the extracted data from the included articles.

4.3 | Quality appraisal

This review included three types of studies: qualitative, quantitative and mixed-method studies. Therefore, a quality appraisal tool that included criteria covering all the three types of study design was needed. The 2018 version of the Mixed Methods Appraisal Tool (MMAT) developed at McGill University (Pluye & Hong, 2014) was used for study quality appraisal in this review. The tool consists of 25 methodological quality criteria items for appraising

studies of different designs; each criterion scores on a nominal scale (yes, no or can't tell). These criteria could be used for quality assessment of five types of studies: qualitative studies; quantitative randomized controlled trial; quantitative non-randomized studies; quantitative descriptive studies and mixed-methods studies. According to the suggested evaluation method of the MMAT, an overall score was not presented. After a detailed appraisal of 16 studies, 1 article was excluded because only 60% of the quality criteria were met. The results of the study quality appraisal are listed in Table 1.

4.4 | Data extraction and synthesis

Data extraction and synthesis were carried out using the framework of Guidance on the Conduct of Narrative Synthesis in a systematic review (Popay et al., 2006). After reading the full text, 15 studies were met the inclusion and exclusion criteria and identified as relevant to the topic. These 15 studies were summarized using the designed data extraction form by two researchers. Information extracted from the included studies included the first author and publication year, country, setting, study aim, study approach and design, participant type and number, study results and findings (see Table 2 for more details). The extracted data were critically scrutinized in a detailed and line-by-line manner and then thematically analysed by comparing results and findings from each included study. The text description of the result from the included studies was coded by an in-depth appraisal according to common findings. This process resulted in 18 codes related to the preparedness of nurses, and finally, 4 themes were developed (Table 3).

5 | RESULT

The initial search resulted in 2,779 articles by electronic data searching and 18 articles by citation tracking. Of these, 355 records were removed because of duplication, 2,361 records were removed by title and abstract screening, 5 records were deleted because the full text was not available; finally, 76 full-text papers were included for careful review. Of these, 21 records did not focus on nurses, 23 records were irrelevant to the topic of this review, 13 records were not primary articles, 3 were not in a hospital setting and 1 article did not meet the quality appraisal criteria. Finally, 15 full-text papers were included for review (Figure 1).

5.1 | Research methods

Of the included 15 studies, 6 were qualitative design, 8 were quantitative design and 1 was mixed-method design. The data collection methods included questionnaire survey, observational study, individual interview and focus group.

5.2 | Research context

The selected studies focussed on several events, including the Ebola Virus Disease outbreak (Adongo et al., 2017; Almutairi et al., 2016; Piţigoi et al., 2018), the Viral Hemorrhagic Fever (Fryk et al., 2020), influenza (Imai et al., 2008), tuberculosis (Akande, 2020), the Severe Acute Respiratory Syndrome (O'Sullivan et al., 2008), the Middle East Respiratory Syndrome (Oh et al., 2017) and the H1N1 pandemic (Lam & Hung, 2013). Several studies focus on non-specified epidemics (Baack & Alfred, 2013; Chen et al., 2016; Considine & Mitchell, 2009; Koh et al., 2012; Lam et al., 2020; O'Boyle et al., 2006). For more details, see Table 2.

5.3 | Themes

A total of 18 codes were generated by comparing results and findings of the selected 15 studies (Table 3). The codes were synthesized into four themes related to nurses' preparedness, namely knowledge and skills, psychological preparation, external resources and attitude and intention. All 15 studies involved at least one of these 4 themes (Table 4).

The theme knowledge and skills involved five codes: knowledge, precautionary measures, previous experience, professionalism and risk appraisal. Ten of the 15 studies discussed the importance of knowledge and skills in nurses' preparedness for infectious disease prevention and control. This knowledge included the aetiology, mode of transmission, signs and symptoms, treatment, infection control measures (Akande, 2020; Almutairi et al., 2016; Lam & Hung, 2013). The clinical skills related to infectious diseases mentioned in the paper mainly include patient nursing and risk appraisal (Akande, 2020; Koh et al., 2012; Lam & Hung, 2013; Lam et al., 2020; Piţigoi et al., 2018). Previous experience was mentioned in several studies (Baack & Alfred, 2013; Considine & Mitchell, 2009; Fryk et al., 2020; Koh et al., 2012; Oh et al., 2017), and it was also integrated into the knowledge and skills theme since previous experience played an important role in improving the knowledge and skills of nurses in dealing with infectious disease.

Psychological preparation involved six codes that reflected nurses' psychological issues, including fear, anxiety, worry, stress, unconfident and concern for health. Eight studies (Adongo et al., 2017; Chen et al., 2016; Fryk et al., 2020; Imai et al., 2008; Lam & Hung, 2013; O'Boyle et al., 2006; Oh et al., 2017; O'Sullivan et al., 2008) have found a varying degree of psychological problem among nurses when dealing with an epidemic of infectious disease.

External resources involved 5 codes in 12 studies, including safe working environment (O'Boyle et al., 2006), training and retraining (Adongo et al., 2017; Akande, 2020; Almutairi et al., 2016; Chen et al., 2016; Considine & Mitchell, 2009; Fryk et al., 2020; Koh et al., 2012; O'Sullivan et al., 2008; Piţigoi et al., 2018), protective equipment (Chen et al., 2016; Considine & Mitchell, 2009; Imai et al., 2008; O'Boyle et al., 2006), information (Oh et al., 2017;

TABLE 1 Quality appraisal of the studies using the Mixed Methods Appraisal Tool (MMAT)

Studies	Criteria from the Mixed Methods Appraisal Tool																								
	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Adongo et al. (2017)	1	1	1	1	1																				
Almutairi et al. (2016)																1	1	0	1	1					
Baack and Alfred, (2013)																1	1	1	1	1					
Chen et al. (2016)	1	1	1	1	1																				
Considine and Mitchell, (2009)																1	0	1	1	1					
Fryk et al. (2020)	1	1	1	1	1											1	0	1	1	1	1	1	1	1	1
Imai et al. (2008)																1	1	1	1	1					
O'Sullivan et al. (2008)																1	1	1	1	1					
Oh et al. (2017)																1	1	1	1	1					
Akande, (2020)																1	1	1	1	1					
Koh et al. (2012)	1	1	1	0	1																				
Piţigoi et al. (2018)																0	1	1	1	1					
Lam and Hung, (2013)	1	1	1	1	1																				
O'Boyle et al. (2006)	1	1	1	1	1																				
Lam et al. (2020)	1	1	1	1	1																				

Note: Yes, 1; no or can't tell, 0.

TABLE 2 Summary of included studies

Study	Country	Emergency event	Design/method	Aim	Sample size	Main finding
Adongo et al. (2017)	Ghana	EVD	Interview	To explore the perceptions and attitude about Ghana's preparedness towards EVD.	44 nurses	Nurses did not get enough training on EVD management and had inadequate Personal Protective Equipment. Most nurses expressed fear and unwillingness to work in Ebola treatment centre.
Almutairi et al. (2016)	Saudi Arabia	EVD	Cross-sectional survey	To identify the awareness, attitudes and practices to precautionary measures to EVD.	545 nurses	The majority were knowledgeable about the aetiology, mode of transmission, signs and symptoms, and treatment of EVD. All participants had high levels of concern about EVD and the implementation of infection control precautionary measures. Healthcare providers must be trained in infection control and precaution.
Baack and Alfred (2013)	USA	No particular	Cross-sectional study	To describe nurses' perceived readiness to manage disaster situations.	620 nurses	Most nurses are not confident in their abilities to deal with a major disaster event. The nurses who have had actual prior experience in disasters or shelters tend to show more confidence.
Chen et al. (2016)	China	No particular	Interview	To explore Taiwanese nurses' experiences and concerns about working in negative pressure isolation wards.	10 nurses	Themes identified: complexity of patient care; dissatisfaction with the quantity and quality of protective equipment; shortage of nursing staff; continued worries about being infected; and sensitivity to self-protection. Improving working environment, giving good quality protective equipment and psychological support and ongoing education are needed.
Considine and Mitchell (2009)	Australia	No particular	Cross-sectional survey	To explore disaster preparedness among emergency nurses.	64 nurses	Limitations to using personal protective equipment; lack of experience with chemical, biological and radiological (CBR) disaster; the average time to last training was 19.2 months. The majority gave positive responses about their willingness to participate in CBR incident. Fewer than half the nurses felt adequately prepared.
Fryk et al. (2020)	Australia	VHF	Observation and interview	To explore how prepared and supported frontline healthcare workers felt about managing VHF.	23 nurses	Themes were identified: concerns about training frequency, miscommunication, difficulty with uncertainty, feeling underprepared, and fear of transmitting infection to others. The majority feel supported and confident to care for VHF patients, but also have moderately-high degree of anxiety. Insufficient personal experience and lack of adequately trained staff on the ward to care for VHF patients.
Imai et al. (2008)	Japan	Influenza	Cross-sectional survey	To assess the preparedness at the individual level and institutional level.	3,681 nurses	Healthcare workers assigned low importance to personal protective equipment and showed mixed attitudes (anxious but accepting) to the potential risk. Institutional preparedness was an important predictor of individual preparedness
O'Sullivan et al. (2008)	Canada	SARS	Cross-sectional survey	To assess perceptions of preparedness for disasters and access to support mechanisms in emergency and critical care units nurses.	1,543 nurses	Nurses feel unprepared (for individual and institution) to respond to large scale disasters and reported inadequate access to resources to support disaster response capacity. More training and information are required for enhancing preparedness for frontline healthcare workers.

TABLE 2 (Continued)

Study	Country	Emergency event	Design/method	Aim	Sample size	Main finding
Oh et al. (2017)	South Korea	MERS	Cross-sectional survey	To examine levels of stress and professionalism, and intention to respond to possible future outbreaks.	313 nurses	Prior outbreak nursing experience was importantly associated with intention to give care for patients with a newly emerging infectious disease in the future considering stress and professionalism. Gathering information about nurses' experience of epidemics and regular assessment of job stress and professionalism are required.
Akande (2020)	Nigerias	Tuberculosis	Cross-sectional survey	To determine the levels of Tuberculosis related knowledge and practices of nurses.	390 nurses	Small proportions of the nurses had good knowledge and practice level. Training was necessary for nurses to improve their knowledge and skills.
Koh et al. (2012)	Singapore	Respiratory infectious diseases	Interview	To investigate the risks perception about infectious diseases and the associated factors.	10 nurses	Themes were identified: living with risk; the experience of SARS; and acceptance of risk.
Piţigoi et al. (2018)	Romania	EVD	Cross-sectional survey	To survey the Ebola knowledge, attitudes and perceptions among the institute's healthcare workers.	100 nurses	Nurses could correctly identify Ebola's aetiological agent. Nurses perceived high personal and family risk. Most nurses had been trained about Ebola-specific management, but frequent retraining was also required. File S1 (prevention method, treatment options, preparedness plan) about Ebola infection were requested.
Lam and Hung (2013)	China	Human swine influenza	Interview	To explore the perception of emergency nurses about during the human swine influenza.	10 nurses	Themes were identified: concerns about health, comments on the administration, attitudes of professionalism. The emergency nurses demonstrated a sense of commitment and professional morale in promoting a high quality of nursing care.
O'Boyle et al. (2006)	USA	No particular	Focus group	To identify beliefs and concerns of nurses working in designated hospitals during public health emergencies.	33 nurses	Limited access to personal protective equipment, risk of infection, unmanageable numbers of patients, and unsafe clinical environments. Loss of freedom to leave the hospital and fear that hospitals would not give treatment to nurses.
Lam et al. (2020)	China	Emerging infectious disease	Interview	To explore emergency nurses' perceptions on the risks appraisal of the emerging infectious disease.	24 nurses	Themes were identified: the novelty of an emerging infectious disease, the severity of an emerging infectious disease, the proximity to an emerging infectious disease, the complexity of an emerging infectious disease situation, and the response levels towards an emerging infectious disease situation.

Abbreviations: EVD, Ebola virus disease; MERS, middle east respiratory syndrome; SARS, severe acute respiratory syndrome; VHF, viral haemorrhagic fever.

TABLE 3　Summary of codes and themes

Themes	Codes
1. Knowledge and skills	• Knowledge • Precautionary measures • Previous experience • Risk appraisal • Professionalism
2. Psychological preparation	• Fear • Unconfident • Anxiety • Stress • Worry • Concern about health
3. External resources	• Training and retraining • Protective equipment • Psychological support • Information availability • Safe environment
4. Attitude and Intention	• Willingness • Commitment

O'Sullivan et al., 2008; Piţigoi et al., 2018) and psychological support (Chen et al., 2016).

Attitude and intention contained two codes (willingness and commitment), which were discussed in four articles. Adongo et al. (2017) reported that the majority (86.4%) of nurses were unwilling to treat Ebola-infected patients, while two other studies (Considine & Mitchell, 2009; Imai et al., 2008) reported that nurses showed positive responses about their willingness to work during epidemics with potential risk. Another study (Lam & Hung, 2013) discussed the professional commitments of nurses during an influenza outbreak.

6 | DISCUSSION

From the synthesis of findings, it was clear that most nurses were willing to respond to infectious disease outbreaks. However, the majority of nurses were not fully prepared to deal with a pandemic. Nurses said that they received inadequate training and support, and lack experience and have psychological barriers. Four themes associated with nurses' preparedness for epidemic events were identified: knowledge and skills, psychological preparation, external resources, attitude and intention. These themes provided a framework for improving nurses' readiness to respond to an epidemic of infectious disease.

6.1 | Knowledge and skills

Knowledge and skills are considered as core competencies for nurses to respond to a pandemic of infectious disease in each research (Akande, 2020; Fryk et al., 2020; Piţigoi et al., 2018). Previous studies (Considine & Mitchell, 2009; Grimes & Mendias, 2010) have reported a positive relationship between nurses' knowledge of infectious disease and the willingness to respond to a pandemic. During an epidemic, nurses play an important role in epidemic investigation, disease screening, infected patients nursing and treating, disease prevention and immune vaccination (Jakeway et al., 2008). Additionally, it is also crucial for nurses to have adequate knowledge and skills of risk appraisal and self-protection. If nurses are infected, they may spread the virus to colleagues, patients and the general public, and worsen the situation of pandemic control (Baack &Alfred, 2013). However, infection among health workers remains a serious problem today.

TABLE 4　The distribution of the themes in studies

Study	Themes: Knowledge and skills	Themes: Psychological preparation	Themes: External resources	Themes: Attitude and intention
Adongo et al. (2017)		√	√	√
Almutairi et al. (2016)	√		√	
Baack and Alfred, (2013)	√			
Chen et al. (2016)		√	√	
Considine and Mitchell, (2009)	√		√	√
Fryk et al. (2020)	√	√	√	
Imai et al. (2008)		√	√	√
O'Sullivan et al. (2008)		√	√	
Oh et al. (2017)	√	√	√	
Akande, (2020)	√		√	
Koh et al. (2012)	√		√	
Piţigoi et al. (2018)	√		√	
Lam and Hung, (2013)	√	√		√
O'Boyle et al. (2006)		√	√	
Lam et al. (2020)	√			
Total: 14	10	8	12	4

It is reported thousands of healthcare workers have been confirmed infected in the current COVID-19 pandemic (Barranco & Ventura, 2020; Wang et al., 2020; Wang et al., 2020).

Prior outbreak working experience was considered as an important way to acquire knowledge and skills related to patients' treatment, risk appraisal and self-protection (Chen et al., 2016). Another way to acquire knowledge and skill in risk appraisal and self-protection is through ongoing education and training. Every study on nurses' readiness has highlighted the importance of training to improve nurses' preparedness for dealing with pandemics, but most nurses feel that they have not received enough training (Adongo et al., 2017; Akande, 2020; Almutairi et al., 2016; Chen et al., 2016). The acquisition of knowledge and skills about infectious disease does not happen overnight; it requires constant training and frequent retraining (Olson et al., 2014). Some approaches have been proposed and proved to be effective, such as instruction from teachers with previous experience (Rastegarfar et al., 2019), scenarios presented by computers (Uden-Holman et al., 2014), simulation (Olson et al., 2014) and drills (Jakeway et al., 2008). As the virus mutates and the epidemic evolves, training should be conducted frequently and carried out in multiple ways, such as lectures, practical sessions, simulated drills or a combination of them.

6.2 | Psychological preparation

Studies on nurses' psychological health (Nie et al., 2020; Park et al., 2018) during the outbreak of infectious diseases have found that nurses have experienced varying degrees of psychological health problems, such as anxiety, stigma and stress. More seriously, continued stress would result in posttraumatic stress symptoms, poor service delivery, suicide ideation and suicide (Chidiebere Okechukwu et al., 2020). Therefore, providing psychological interventions for nurses engaged in infectious disease prevention and control is necessary and important. In addition, it may be more effective to make sufficient psychological preparedness before an outbreak than psychological intervention during an outbreak. However, the importance of psychological preparation has rarely been realized before the outbreak of infectious disease. Good psychological health is really important for nurses to perform more efficiently and effectively during an epidemic (Said & Chiang, 2020). Therefore, nurses who are unqualified in psychological assessment are not suggested to participate in epidemic prevention and control work.

The nurses' psychological preparation includes the individual psychological adjustment ability and the ability to give psychological care for infected patients (Said & Chiang, 2020). Nurses considered that it was their responsibility to give psychological care for victims in a public health emergency, and expressed learning need for emergency preparedness in terms of providing psychological care and intervention (Alzahrani & Kyratsis, 2017). However, education and training programmes mainly focus on the knowledge and skills for delivering care and treatment, with little focus on building the psychological capacity for pandemic preparedness. The question is raised of what intervention could be used to enhance nurses' psychological preparedness for a pandemic. According to the resilience framework developed by Kumpfer (Kumpfer & Summerhays, 2006), an individual's adaptation to stress and challenge depends on the environmental context, internal resilience factors and their transactional process. Before the outbreak, it is a good way to improve nurses' internal resilience for helping them better adapt to the challenge during epidemics. Previous studies (Li et al., 2015; Lorente et al., 2020) have proved that a good resilience level is positive for nurses to deal with negative emotions such as nervousness, fear and worry. Thus, developing and enhancing resilience among nurses is an effective way to enhance their psychological preparedness. Previous programmes (Magtibay et al., 2017; Mealer et al., 2017) designed to improve the resilience of nurses could be referred to or used.

6.3 | External resources

Even when nurses are adequately trained and equipped with sufficient knowledge and skills, external support is still essential in the fight against epidemic. During a pandemic, nurses may confront difficulties that they cannot solve individually, such as shortage of personal protective equipment and insufficient healthcare personnel (Chen et al., 2016; Wang, Zhou, et al., 2020; Wang, Zhang, et al., 2020). In this review, we concluded the external support that nurses needed to receive in combating the epidemic, including safe working environment, enough protective equipment, timely information, ongoing training and psychological support. Of these, information and psychological support have often been neglected by superiors in the previous outbreak.

Psychological support is mainly provided by family members, colleagues or organizations in the event of an outbreak (Labrague & De Los Santos, 2020). It would help nurses adjust their psychological status, relieve psychological stress and improve their adaptability (Song & Karako, 2020). Not only do nurses face increased physical and psychological stress, but they also face a high risk of infection. Hence, psychological supports are necessary for nurses. At present, psychological support teams are established in many hospitals to give psychological intervention for healthcare workers with psychological problems.

The COVID-19 epidemic tells us that virus may mutate very rapidly, and as a result, prevention and control measures should be constantly revised accordingly to play a good role in controlling the epidemic. Nurses should be aware of any change in the emergency preparedness plans. Besides, it is important to give nurses with File S1 on infectious disease infection, including prevention methods, treatment options and institution preparedness plans (Piţigoi et al., 2018). The rapid sharing of scientific information is an effective way to alleviate nurses' panic and fear, and can also give

timely guidance for nurses to manage patients, and take effective protective measures (Song & Karako, 2020). Indeed, many international journals have taken on the task of rapidly sharing scientific information. But this is not enough. The government and hospitals should improve the programme on the circulation of information to promote the faster dissemination of information between hospitals and healthcare workers.

6.4 | Attitude and intention

The attitude and intention are the direct factors affecting nurses' behaviour during the epidemic. During every epidemic outbreak, nurses have to endure a lot of hardship, but most nurses showed a positive attitude about responding to epidemic, as they regarded this as mission calling and their responsibility (Imai et al., 2008; Lam & Hung, 2013). However, some nurses have expressed reluctance to work in infectious disease treatment centres for fear of being infected and neglected (Adongo et al., 2017). This fear arises from nurses' belief that protective equipment does not give adequate protection against the virus and that the government is not paying enough attention to them (Adongo et al., 2017).

Nurses' attitude and intention to respond to pandemics are mainly related to risk appraisal, perceived duty and sense of self-value (Grimes & Mendias, 2010; Lam et al., 2020; Said & Chiang, 2020). The researchers (Considine & Mitchell, 2009) found that nurses' willingness to respond to epidemics might be related to perceived risk. Lam et al. (2020) also confirmed that nurses' perception to the threat of epidemic would influence their attitude and behaviour during the outbreak. However, nurses' attitude and intention were not related to training adequacy or previous experience and were less related to incentives (Adongo et al., 2017; Considine & Mitchell, 2009). This review proposed two approaches that might be useful for improving nurses' willingness to respond to epidemic. The first is to give a safe working environment for nurses, and sufficient protective equipment and appropriate incentives. The second is to help nurses to have a full understanding of career responsibilities during infectious disease outbreaks, and establish a correct professional value and self-value.

6.5 | Limitation

Firstly, this review included only English language articles and excluded evidence from non-English publications, which might not fully reflect nurses' preparedness for infectious disease outbreaks in countries around the world. Secondly, all the infectious diseases discussed in the included studies were respiratory infectious diseases, so the findings of this study might not be applicable to infectious diseases transmitted by other routes. Further study could explore how well nurses are prepared for infectious diseases from other routes of transmission, such as human immunodeficiency syndrome and hepatitis B.

7 | CONCLUSION

Nurses have made a vital contribution to the prevention and control of infectious diseases and continue to play important roles. This review concludes that most nurses express positive willingness to respond to pandemic, although they said they are inadequately prepared. In addition to knowledge, skills, values and external support, psychological readiness is also very important for nurses' preparedness to respond to an infectious disease outbreak. For improving the emergency preparedness, here are some suggestions:

- Provide ongoing training and frequent retraining on infectious disease knowledge and skills.
- Provide training in a multiple way, such as courses, scenarios, simulated drills or a combination of them, and it would be better to do it with student nurses as well.
- Improve nurses' resilience and the skills to deliver psychological support for patients.
- Provide adequate external support, including protective equipment, safe working environment and psychological intervention.
- Accelerate the sharing of scientific information about the epidemic so that nurses can take more effective measures to protect themselves and treat patients.

8 | RELEVANCE TO CLINICAL PRACTICE

The review highlights the inadequate preparedness of nurses to deal with pandemic and enriches the component of emergency preparedness, that is, adding psychological preparation. The identifying of the four themes of emergency preparedness would address the concerns and needs of nurse who are currently involved or will be involved in the epidemic prevention and control. This review also could give some information and suggestions for hospital managers or teachers at nursing colleges to design strategies and training programmes to effectively improve nurses or nurse students' preparedness for the future infectious disease outbreak.

CONFLICT OF INTEREST
All authors report no actual or potential conflicts of interest.

AUTHOR CONTRIBUTIONS
Anliu Nie, Xiangfen Su and Mengyuan Dong: Study design, analysis and manuscript preparation. Anliu Nie, Mengyuan Dong and Wenjie Guan: literature retrieval and literature review.

DATA AVAILABILITY STATEMENT
All data, models and code generated or used during the study appear in the submitted article.

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