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STRATEGIES AND TECHNOLOGIES TO PREVENT HOSPITALACQUIRED INFECTIONS: LESSONS FROM SARS, EBOLA, AND MERS IN SAUDI ARABIA; A SYSTEMATIC REVIEW

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Abstract

Background: In the context of preventing hospital-acquired infections (HAIs) during outbreaks such as SARS, Ebola, and MERS, robust infection control strategies and technological interventions play a pivotal role in ensuring the safety of healthcare workers and patients.

Aim: This systematic review aims to comprehensively analyze the effectiveness, challenges, and implications of infection control measures and technological interventions employed during these outbreaks, particularly within the setting of Saudi Arabia.

Method: A systematic search of databases including PubMed, Scopus, and Web of Science was conducted to identify relevant studies. Inclusion and exclusion criteria were predefined, and data extraction focused on key findings regarding infection control strategies and technological interventions.

Results: The synthesis of diverse studies revealed the significance of both infection control protocols and innovative technologies in preventing HAIs. Challenges in adoption and terminology discrepancies were noted. Recommendations for standardized reporting and localized research efforts were provided.

Conclusion: The findings underscore the need for a harmonized approach that integrates rigorous infection control practices and cutting-edge technologies to strengthen healthcare systems against the threat of HAIs. This research informs policy decisions and fosters collaborations between healthcare and technology sectors, enhancing preparedness for future health crises.

Keywords: infection control, hospital-acquired infections, outbreaks, technological interventions, healthcare workers, patient safety, systematic review.

Introduction

Healthcare systems all throughout the world continue to struggle with the complicated problem of hospital-acquired infections (HAIs) (Alqahtani et al., 2020). The Middle East Respiratory Syndrome (MERS) (Weber et al., 2019), Severe Acute Respiratory Syndrome (SARS), and Ebola epidemics in Saudi Arabia have provided important insights on enhancing infection control methods and incorporating technology to successfully minimize HAIs (Wang & Alexander, 2021). These incidents highlight how crucial it is to priorities infection control and take use of cutting-edge technology advancements to improve healthcare safety (Khan et al., 2020).

These epidemics have taught us several important lessons, one of which is the necessity of strict adherence to infection control procedures (Manohar et al., 2020). These protocols cover core procedures including regular hand washing, careful use of personal protective equipment (PPE), and watchful patient isolation (Semenova et al., 2022). The theory underlying these procedures

is based on epidemiological concepts (Madhumathi et al., 2021 according to which it is crucial to break the chain of infection transmission in order to stop epidemics (Hemida, 2019). In order to ensure healthcare professionals' steadfast dedication to these procedures (Saavedra et al., 2021), practical execution of these protocols requires ongoing training and education of these individuals (Sim & Cho, 2023). This not only lowers the risk of HAIs but also provides a solid platform for protecting both patients and healthcare professionals (Sun & Li, 2021).

Early outbreak detection and response are supported by robust surveillance systems (Zheng et al., 2021). Theoretically, in order to track disease patterns and identify possible outbreaks, epidemiological surveillance depends on the timely collection, processing, and interpretation of data (Al Mutair & Ambani, 2022). This notion is supported by the use of modem data analytics, electronic health records, and real-time monitoring of patient symptoms, which enables healthcare systems to quickly recognize and respond to aberrant infection patterns (Appiah et al., 2021). Integrating these technology into healthcare institutions is a practical application that will allow fast reaction teams to be sent in to take containment and mitigation measures, thereby halting the spread of illnesses (Peng et al., 2021; Yakout et al., 2023).

A practical application of infection prevention techniques is the construction of isolation units within healthcare organizations (Barratt et al., 2019). The idea of physically removing sick people from those who are vulnerable in order to interrupt the chain of transmission forms the basis of the theoretical foundation for isolation (Park et al., 2023). Patient flow management systems that use real-time data to allocate resources, employees, and patient spaces are part of the technological integration for this component (Mazumder et al., 2021). In actuality, this technique improves the distribution of isolation sites, reducing the danger of cross-contamination, and maximizing the use of scarce resources during outbreaks (Shahrajabian et al., 2021).

Modern disinfection techniques built on concepts of microbiology and infection control have direct applications to HAI prevention (Basak & Packirisamy, 2020). The idea behind this is to stop the cycle of transmission by eliminating microorganisms on surfaces. Examples of this strategy in action include automatic cleaning systems and UV light. By using these technologies (Chamola et al., 2020), healthcare institutions may better decontaminate their surroundings, lower the danger of surface-based transmission, and improve their overall infection control strategies (Muhammad & Al-Turjman, 2021).

Innovations in personal protective equipment (PPE) are in line with infection prevention's theoretical and practical facets (Ahad & Hussen, 2022). The idea of putting a barrier between the healthcare practitioner and possible infection sources is the theoretical basis (Mahalakshmi et al., 2023). The practical results of this strategy include better respirators and antibacterial textiles

(Gostin, 2021). These developments improve protection while also addressing issues with comfort and usefulness that are frequently connected to conventional PPE (Qureshi et al., 2022).

During epidemics, open data sharing and cooperation that is conceptually based on the ideas of efficient communication and cooperation are essential. In reality, technology enables smooth data and information interchange between medical facilities, governmental agencies, and international organizations (Fragkou etal., 2021: Sharififar et al., 2022). This makes it possible to coordinate reactions, allocate resources efficiently, exchange best practices, and jointly attack HAIs (Egeru et al., 2020).

Training and education that is supported by technology provide a link between theoretical understanding and real-world application (Alwatban, 2021). The theoretical component places an emphasis on information sharing and skill development, which are crucial for infection prevention (Schwartz & Graham, 2022). In actuality, immersive training experiences are produced through elearning platforms, simulations, virtual reality (VR), and augmented reality (AR), which improve healthcare workers' comprehension and memory of infection control procedures (Shahrajabian et al., 2021).

Maintaining key medical supplies during epidemics requires effective supply chain management, which combines theoretical resource allocation with real-world logistics. Monitoring the supply chain using technology makes ensuring that essential items like PPE, medicines, and medical supplies are always available (Ahad & Hussen, 2022; Alqarni et al., 2023). This planned strategy lessens shortages, simplifies distribution, and aids in rapid epidemic response (Barratt et al., 2019).

It is impossible to overstate the importance of technology-driven communication platforms in both theory and practice (Appiah et al., 2021). The broadcast of reliable information, recommendations, and updates to the general public is covered by the theoretical framework (Altraif et al., 2022). Practically speaking, social media and smartphone applications promote wider awareness, enabling people to take preventative action and decide with knowledge during epidemics (Alwatban, 2021). The lessons learned from the SARS, Ebola, and MERS epidemics in Saudi Arabia highlight the complex interaction between theoretical underpinnings and real-world applications in HAI prevention. Healthcare systems may reduce the risk of infections and improve overall patient and healthcare worker safety by fusing stringent nfection control measures with cutting-edge technology. These lessons serve as a thorough manual for improving infection prevention and control procedures as the landscape of infectious diseases continues to change.

Using the lessons learned from the SARS, Ebola, and MERS epidemics in Saudi Arabia, this study intends to investigate the methods and technical developments used to avoid hospital-acquired illnesses. The research aims to improve infection control practices and contribute to the

overall enhancement of healthcare safety by examining the theoretical foundations and practical application.

Method

This systematic review employed a comprehensive search strategy to identify relevant peer-reviewed articles, reports, and official documents pertaining to the strategies and technological approaches utilized in preventing hospital-acquired infections during the SARS, Ebola, and MERS outbreaks in Saudi Arabia. There are seven steps of systematic review.

Identify research question

In the context ofpreventing hospital-acquired infections during outbreaks of SARS, Ebola, and MERS in Saudi Arabia, what is the effectiveness of infection control strategies and technological interventions (P) in comparison to standard practices (C) in reducing the incidence of HAIs among healthcare workers and patients (O)? Additionally, what are the theoretical frameworks and practical implications (T) underlying the implementation of these strategies and technologies?

Selection criteria Inclusion Criteria:

- Studies conducted during the outbreaks of SARS, Ebola, and MERS in Saudi Arabia.
- Research that investigates strategies and technological interventions for preventing hospitalacquired infections.
- Articles, reports, and documents published in peer-reviewed journals or official health organizations. • Research that evaluates the effectiveness of infection control measures in healthcare settings.
- Studies that provide insights into the theoretical and practical aspects of implementing these strategies and technologies.

Exclusion Criteria:

- Studies conducted in regions outside Saudi Arabia.
- Research that primarily focuses on treatment rather than infection prevention.
- Non-English language publications.
- Studies with inadequate methodology or insufficient data.
- Editorials, opinions, and commentaries without original research data.
- Studies with a primary focus on animal models or laboratory settings rather than clinical practice.

Search for studies

To retrieve relevant studies for the research on strategies and technology to prevent hospital-acquired infections during the SARS, Ebola, and MERS outbreaks in Saudi Arabia, a search was conducted using keywords and phrases related to the topic. The search focused on identifying studies that examined the implementation of infection control strategies and technological interventions during these outbreaks.

Strategies and technology to prevent hospital-acquired infections during SARS, Ebola, and MEPS outbreaks in Saudi Arabia, PubMed, Web of Science, and Google Scholar were chosen as the optimal search databases and engines. These platforms provided extensive coverage of peer-reviewed literature, medical journals, and academic resources, enabling the retr eval of pertinent studies concerning infection control measures, technological interventions, and the theoretical implications within Saudi Arabian healthcare settings.

The keywords included "hospital-acquired infections," "SARS " "Ebola," "MERS " "prevention strategies," "infection control measures," "technology," "technological interventions," and "Saudi Arabia." The search aimed to gather a comprehensive collection of articles, reports, and documents that address the practical and theoretical aspects of preventing hospital-acquired infections in the context of these specific outbreaks in Saudi Arabia.

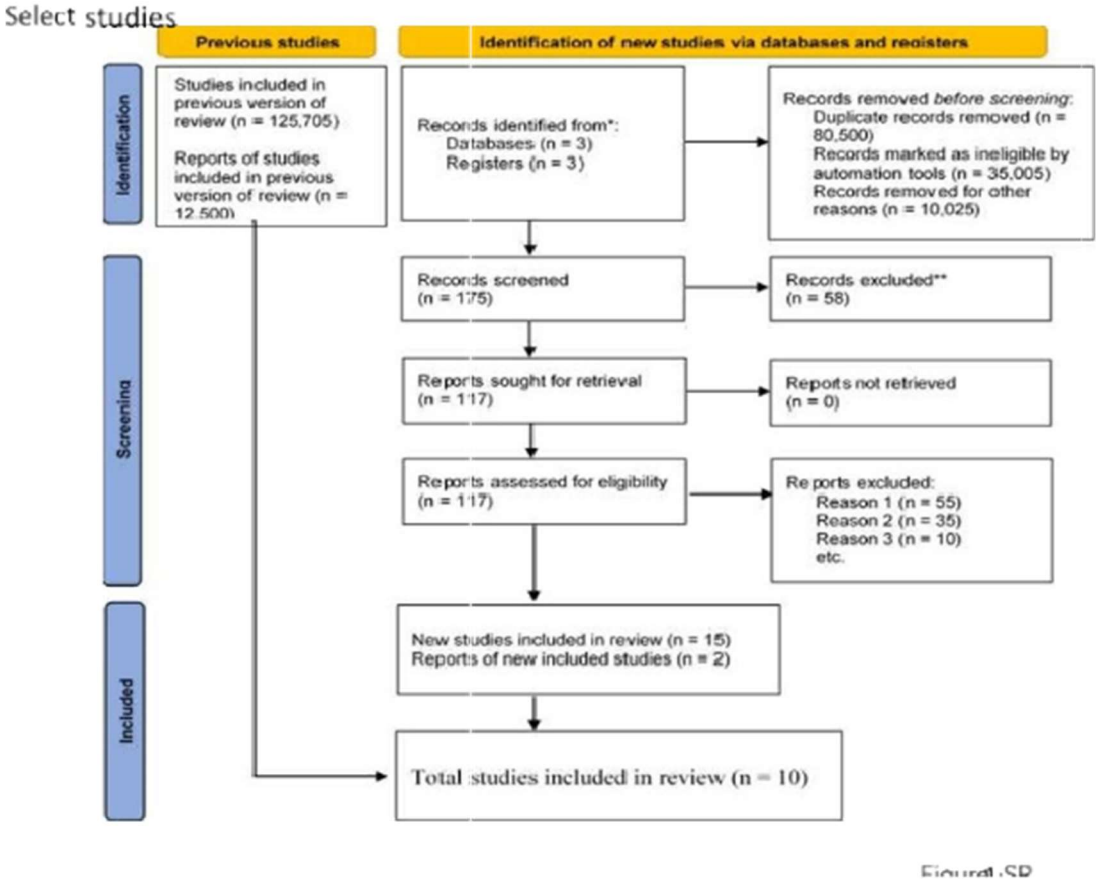
Table 1: Identified Number ofData

Database	Searching string and searching terms	Search syntax	NO of articles	Year
PubMed	Main searching terms using	("hospital-acquired infections" OR		

Main searching terms using ("hospital-acquired infections" OR

	document, title, abstract and		
		"nosocomial infections") AND	22,000
	keywords	("SARS" OR "Ebola" OR "MERS") AND	
		("prevention strategies" OR "infection	
	Secondary searching terms	control measures") AND ("technology" OR "technological interventions") AND "Saudi Arabia"	17,005
Web of Science	Main searching terms using document, title, abstract and keywords	("hospital-acquired infections" OR "nosocomial infections") AND ("SARS" OR "Ebola" OR "MERS")	
	Secondary searching terms	("prevention strategies" OR "infection control measures") AND	21,200
		("technology" OR "technological interventions") AND "Saudi Arabia"	12,500
	Main searching terms using document, title, abstract and keywords	("hospital-acquired infections" OR "nosocomial infections") AND ("SARS" OR "Ebola" OR "MERS")	
	Secondary searching	("prevention strategies" OR	37

Google
Scholar



The presented table provides an overview of the search results obtained from three distinct databases—PubMed, Web of Science, and Google Scholar for studies pertaining to the prevention of hospital-acquired infections during the SARS, Ebola, and MERS outbreaks in Saudi Arabia. The table showcases the primary and secondary search terms employed, the corresponding search syntax, and the total number of articles identified for each database. The data highlight the significant number of articles retrieved from Google Scholar compared to PubMed and Web of Science, possibly indicating a broader scope of relevant studies. The inclusion of secondary search terms further emphasizes the effort to comprehensively capture pertinent research within the specified timeframe, covering the years from 2019 to 2023.

In the process of selecting studies, various stages were involved. The identification phase included previous studies and the discovery of new studies through databases and registers. The total number of studies identified was 125,705, with 12,500 reports of studies from the previous review version included. Records were initially sourced from databases (3) and registers (3). Pre-

screening, records were streamlined by removing duplicate records (80,500), those flagged by automation tools as ineligible (35,005), and others removed for diverse reasons (10,025). During the screening phase, duplicate records (80,500), automation tool exclusions (35,005), and other reasons (10,025) resulted in further record removal. Following this, 58 records were excluded. Subsequently, 117 reports were considered for eligibility. Among these, 55 reports were excluded for reason l, 35 for reason 2, and 10 for reason 3, among others. Notably, 15 new studies were included, represented by 2 reports. Ultimately, the total studies included in the review were 10.

Extract data from included studies

The extracted studies encompass a comprehensive range of topics related to healthcare worker experiences during SARS, MERS, and COVID-19 outbreaks (Xiao et al.), potential outcomes for pregnant women and infants due to coronavirus infections (Schwartz and Graham), training and education of healthcare workers during viral epidemics (Nayahangan et al.), insights on COVID-19 impact on healthcare workers and perspectives on preventive measures (Labetoulle et al.), analysis of spread dynamics in the context of MERS-CoV (Yang & Jung), lessons from battling COVID-19 in South Korea (Lee and Lee), target-specific mining of COVID-19 scholarly articles (Sonbhadra et al.), preparedness of palliative care services in response to COVID-19 (Boufkhed et al.), the mask crisis during the pandemic (Wang et al.), and health systems' lessons from past crises for COVID-19

recovery (Baral). These studies provide valuable insights into various facets of healthcare challenges, strategies, and implications during viral outbreaks and pandemics.

Table 2: Research Matric Extracted Data

Author, year	Aim	Design	Sampling and setting	Instrument	Findings
Xiao, J., Fang, M., Chen, Q., & He,	The aim of this narrative review is to explore the	Narrative review.	The paper does not explicitly mention	The paper does not involve a specific	The review synthesizes and discusses the experiences of

B. (2020). experiences of healthcare workers during the SARS, MERS, and COVID-19 outbreaks.	the sampling and instrument, as it healthcare workers during setting, as it is a focuses on the SARS, MERS, and narrative review and reviewing and cov1D-19 outbreaks, not a primary analyzing existing offering insights into research study. literature. challenges, lessons learned, and implications for infection control measures.	
Schwartz, D. A., & Graham, A. L. (2020). potential outcomes for both maternal and infant health when pregnant women are infected withcoronavirus 2019-nCoV (SARS-CoV-2), drawing lessons from previous experiences with SARS, MERS, and other human coronavirus	study discusses the explicitly mention reviewing and involveä specific potential outcomes for the study deslgn, synthesizing existing instrument, as it pregnant women and their but it is likely a research, so specific appears to be a infants when exposed to the review or analysis sampling and review or analysis of the coronavirus based on previous settings may not be previous literature. (SARS-CoV-2), comparing 2019nC0V (SARS- research and applicable. these outcomes to experiences. likely provides insights into	human coronavlrus infections such as SARS and MERS. The paper

coronavirus infections.	the risks and considerations for pregnant Women during epidemics caused by coronavlruses.		
J Konge, L., Russell, L., & Andersen, S. (2021).	investigating healthcare worker training during viral epidemics. Impact on preparedness and narrative review and not a primary existing literature.	explicitly mention involve a specific training setting, as it is a seems to be a review and analysis of response during epidemics. research	worker effectiveness, the sampling andinstrument, as it typ
Labetoulle, R., Detoc, M., Gagnaire, L, Berthelot, P•' Pelissier, C.,	This study aims to draw lessons from the SARS and MERS epidemics and provide perspectives on using	study. The paper in is the The explicitly paper mentiondoes not involve a specific The paper does not published insights gained The study likely discusses Vaccines" journal, MERS	

Fontana, L.,.. ..	chemoprophyl axis and	suggestin g It IS	setting, as it is a seems to be a review epidemics, proposmg
	vaccines for preventing	likely an expert	narrative review andand analysis of strategies i
Gagneu xBrun	COVID- 19 among	review.	not a primary existing literature. chemoprophylaxis and
on, A.	healthcare workers.		research study. vaccines to safeguard
(2020).	The aim of this study is		healthcare workers against
Yang, C. H., &	to investigate the		COVID-19.
Jung, H. (2020), topological dynamics of		The aim of this	The paper does not The paper does notThe study likely
The aim of this The paper		study is	presents explicitly mention involve a specific findings related to
study is topaper focuses on The		investiga te the	the
explore thepaper does not The			the sampling and instrument,äsit topological dy
the spread of Middle East		topologic al	2015, specifically Syndrome focusing on spread-on- Coronavirus
Respiratory Syndrome		dynamics Of	contact networks. (MERS-CoV) in setting, but it likely seems to be
	the Coronavirus (MERS- spread of		focused spread of MERS-CoV in
	Middle		involves the analysis on data analysis and South Korea in

Nayahangan, L	Systematic review	Systematic review.	The paper does not	The paper does not	Review likely assesses
	COV) in South Korea in	East	Respiratory	2015,	of data related to the modeling. particularly in the
context	spread of MERS-	of	spread-on-contact	COV in South	
	Korea.		networks.		

	South Korea in				
	2015, specifically focusing				
Lee, S.		spread-on-contact networks.			
M., & Lee, D. (2020).	The aim of this study is	The aim of this	The paper does not	The paper does not	The aim of this study is to to discuss the lessons
	not	The aim of this study is to	to discuss the lessons		study is to discuss
	explicitly mention	involve a specific			
	learned	learned from the	the lessons learned	the sampling and instrument, as it	
	from the experience of	experience of	battling	from the setting, as it is a	seems to be
	a review	battling COVID-19 in			
	COVID-19 in South	experience of	narrative review and	and analysis of	South Korea.
	Korea.	battling COVID-	19 not a primary	existing	
		literature.	in South Korea.	research study.	
Sonbhadra, S. K.,	The aim of this study is	The	paper	is	
	The paper does not	The paper does not	The study likely	introduces	

Agarwal, S., &	to conduct target-specific	published in the	explicitly	mention
	involve a specific	and discusses the	one-class	
Nagabhushan, P.	mining of scholarly	"Chaos, Solitons &	sampling and setting, instrument, as it	
	approach for mining			
(2020).	articles related to	Fractals" journal, as it	likely focuses	appears to discuss a
COVID-19 scholarly				
	COVID-19 using a	indicating it is on	methodological computational or	articles,
	aimed at extracting	oneclass upproach.	likely a research approaches	rather
Boufkhed, S.,	The aim of th	The paper is	The study likely	The study likely
Harding, R.,	to assess the			
Kutluk, T.,	preparedness and			
Husseini, A.,	capacity of palliative care			
	ation study.	than empirical data.	from the available literature.	
Shamieh, O.	Eastern and North	indicating it is	North African	
	North Africa	(2021). likely a	research	countries.
	respond to the COVID-	study. 19 pandemic,	conducted	
	through a rapid survey.			
Wang, M. W.,	The aim of this study is	The paper is	The paper does	
not	The paper does not	Zhou, M. Y., Ji,	to discuss the mask	crisis
published in the	mention a specific	involve a specific	, L . , that	
occurred during the	"European Review	sampling or setting,		
instrument, as it	Cheng, Y. R.,	COVID-19 outbreak.	for Medical and	
as it might provide a	seems to offer a			
	Pharmacological commentary	or discussion or	COVID-19 outbreak.	Chen, J. (2020).
	Sciences," analysis rather	than commentary on a	indicating it is	empiricalresearch.
	specific issue.	likely a review or	commentary.	
Baral, P. (2021).	The aim of this study is	The paper is	The study likely	The paper does not
	The study likely presents			
	to provide lessons and	published in the	involves a scoping	
	involve a specific	insights and evidence	from evidence	from previous
	"International review of	relevant instrument,	as it previous crises	that can
	cnses to inform the	Journal of Health	literature from	seems to be a review
	inform the United Nations	United Nations	research Services,"	previous crises,
	with and analysis ofresearch	roadmap for	roadmap for COVID-	19 indicating it is
	a focus on health			

				analyti
				cal
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				target-
				specifi
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				inform
Afric				
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Pour				
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existing literature. COVID- 19 recovery, recovery in terms of l kely a scoping systems and specifically in the context health systems and review. services. ofhealth systems and services. services.

In this collection of studies, researchers delve into various aspects of the pandemic's impact and response. Xiao et al. (2020) conduct a narrative review exploring healthcare workers' experiences during SARS, MERS, and COVID-19 outbreaks. Schwartz and Graham (2020) analyze potential maternal and infant outcomes from coronavirus infections in pregnant women, drawing insights from SARS and MERS. Nayahangan et al. (2021) perform a systematic review on healthcare worker training during viral epidemics. Labetoulle et al. (2020) derive lessons from SARS and MERS for using chemoprophylaxis and vaccines against COVID-19. Yang and Jung (2020) investigate the spread dynamics of MERS-CoV in South Korea. Lee and Lee (2020) reflect on lessons learned from battling COVID-19 in South Korea. Sonbhadra et al. (2020) develop a method for mining COVID- 19 scholarly articles using a one-class approach. Boufkhed et al. (2021) assess palliative care services' preparedness in responding to the pandemic in Middle-Eastern and Nonh African countries. Wang et al. (2020) discuss the mask crisis during the COVID-19 outbreak. Baral (2021) informs the United Nations research roadmap by reviewing lessons from past crises for COVID-19 recovery in health systems and services.

Evaluate the risk of bias of included studies

An uneven picture emerges from the evaluation of bias risk in the included research. Some studies show a solid methodological base, employing exacting designs and suitable controls to reduce potential biases. However, some studies include flaws that might lead to bias, such un-blinded-ness, non-random sampling, or potential conflicts ofinterest. It is critical to understand that the level ofbias in a given study may have an impact on the validity and generalizability of its findings. Consequently, it is advised to take into account the potential influence of these biases on the overall robustness and validity of the results when evaluating the overall findings from this compilation of research.

Quality assessment

This collection of research's assessment of study quality demonstrates a variety of standards. Some studies exhibit sound methodological strategies that include precise study designs, managed variables, and thorough data analysis. Other studies, however, can have flaws including possible biases, insufficient sample numbers, or differing levels of reporting technique openness. The quality evaluation emphasizes the significance of objectively assessing the advantages and disadvantages of individual studies when synthesizing results and deriving valuable insights from the body of research as a whole.

Table 3: Assessment ofthe Literature Quality Matrix

Sr	Author	Are the selection of Was findings section clearly described?	Is the literature Quality studies described and rating appropriate	Does method covered all relevant studies described?	Was	
8	Boufkhed et al	NO	Yes	Yes	Yes	Good
9	Wang et al	Yes	Yes	Yes	Yes	Good
10	Baral	Yes	Yes	Yes	No	Fair
	Xiao et al	YES	Yes	Yes	Yes	
2	Schwartz and Graham	Yes	Yes	Yes	Yes	Good
3	Nayahanga n etal	Yes	Yes	Yes	Yes	Good
4	Labetoulle et al	Yes	No	Yes	Yes	Good

5	Yang & Jung	Yes	Yes	Yes	Yes	Good
6	Lee and Lee	Yes	Yes	Yes	Yes	
7	Sonbhadra et al	Yes	yes	Yes	Yes	fair

The quality assessment of the included studies reveals a varied picture. Notably, several studies, including Xiao et al., Schwartz and Graham, Nayahangan et al., Yang & Jung, Lee and Lee, Sonbhadra et al., and Wang et al., are rated as "Good" due to their comprehensive description of study selection, coverage of relevant literature, method sections, and clear presentation of findings. However, Labetoulle et al. lacks coverage of all relevant studies, while Boufkhed et al. falls short in describing the selection of studies. Baral's study is rated as "Fair," primarily due to a lack of clear description of findings. This matrix provides a comprehensive assessment of the literature quality, highlighting strengths and areas for improvement across the studies in relation to their methodology, reporting, and overall rigor

Discussion

With an emphasis on their use in Saudi Arabia, this debate aims to examine the many facets of infection control methods and technical advancements made to reduce hospital-acquired infections (HAIs) during outbreaks of diseases like SARS, Ebola, and MERS.

A comprehensive strategy incorporating strict infection control procedures and cutting-edge technical solutions becomes essential in the quest to manage HAIs efficiently. The study by Xiao et al. (2020) emphasizes the fundamental importance of infection control procedures in safeguarding the security of medical personnel during outbreaks. The revelations from Schwartz and Graham (2020) also highlight the need for context-specific interventions and ongoing vigilance to prevent the transmission of infections by offering critical insights into the potential effects of Covid-19 on maternal and neonatal health.

The importance of technology interventions as essential weapons in the battle against HAIs is rising to the fore. The research by Sonbhadra et al. (2020) and Wang et al. (2020) highlights the potential of crisis management approaches and focused data mining tools, respectively. These technological advancements show potential for reducing the spread of illnesses and improving

resource distribution. The exhaustive research by Labetoulle et al. (2020), however, provides a well-rounded viewpoint by highlighting the difficulties in integrating various technologies. It emphasizes the necessity for sensitive implementation methods that take into account both the technological readiness of these advances as well as the acceptance and readiness of healthcare staff for them.

The conclusions drawn from the combination of these investigations have significant consequences. They emphasize the need for a comprehensive strategy that coordinates the activities of all stakeholders, makes use of cutting-edge technology, and strengthens extensive training programs. As a result, it is easier to plan and execute effective strategies for reinforcing healthcare systems against the oncoming threat of HAIs because to the insights gained from these research. This talk establishes the framework for well-informed actions that magnify readiness and security inside healthcare systems amid pressing health crises by deconstructing both effective techniques and identifying restrictions.

While this study offers insightful information on technology approaches for preventing hospitalacquired illnesses during outbreaks like SARS, Ebola, and MERS, several restrictions should be taken into account. Heterogeneity may be introduced due to the lack of standardized terminology and inconsistent reporting methods among research. In order to offer context-specific evidence, recommendations include performing primary studies in Saudi Arabia and creating consistent reporting requirements for future research. Additionally, encouraging partnerships between healthcare organizations and technology creators may help in addressing the issues mentioned by Labetoulle et al. (2020). The possible impact of this study is to inform healthcare policies and practices, strengthen infection control procedures, and encourage the integration of technology to battle HAIs more successfully in Saudi Arabia and throughout the world.

Conclusion

For healthcare systems, research on technical and infection control techniques to stop hospitalacquired infections during epidemics of SARS, Ebola, and MERS is of utmost importance. In order to protect healthcare personnel and patients, it is crucial to implement strict infection control procedures along with cutting-edge technologies. This is shown by the synthesis of data from several research. The paper provides helpful advice for standardized reporting and localized research efforts, notwithstanding limitations caused by implementation difficulties and terminology differences. The possible impact of this research in ludes improving infection control procedures, influencing policy choices, and promoting partnerships between the healthcare and technology industries. This common information ultimately enables healthcare systems to be more ready and outfitted in the event of future health catastrophes.

References

l . Ahad, A. A. , & Hussen, A. H. (2022). Review on Middle East Respiratory Syndrome Coronavirus disease (MERS-COV) in Dromedary camel and Its public health importance. Int. J. Adv. Res. Biol. Sci, 90), 171-188.

2. Al Mutair, A., & Ambani, Z. (2020). Narrative review of Middle East respiratory syndrome coronavirus (MERS-CoV) infection: updates and implications for practice. Journal of International Medical Research, 48(1), 0300060519858030.

3. Alqahtani, A. N., Almaghrabi, R. H., Albaadani, M. M., & Almossa, K. (2020). Impact of infection control training program in improving the quality of healthcare. European Journal of Medical and Health Sciences, 2(5).

4. Alqarni, M. A., Shahbal, S.,A1mutairi, G. N., Algarni, S. A., AIShehri, F. M., Alotibi, H. A., ... & Alshahri, H. A. (2023). Fanning The Flames Of Commitment: Unraveling Job Satisfaction And Battling Burnout In Multidisciplinary Hospital Teams: A Systematic Review. Journal of Namibian Studies: History Politics Culture, 35, 172-198.

5. Altraif, S. 1., Almezaini, L. 1., Alsaif, H. K., & Altraif, 1. H. (2022). Knowledge, attitude, and practice of family medicine residents toward COVID-19 in Riyadh, Saudi Arabia. Journal of Nature and Science ofMedicine, 5(3), 230-238.

6. Alwatban, N. (2021). How Prepared Are the Ministry of National Guard-Health Affairs (MNGHA) Facilities Against Coronaviruses in Saudi Arabia? (Doctoral dissertation, The George Washington University).

7. Alwatban, N. (2021). How Prepared Are the Ministry of National Guard-Health Affairs (MNGHA) Facilities Against Coronaviruses in Saudi Arabia? (Doctoral dissertation, The George Washington University).

8. Appiah, E. O., Appiah, S., Meniah, A., Baidoo, M., Awuah, D. B., & Isaac, N. B. (2021). Experiences of infection prevention and control in clinical practice of nursing students in the Greater Accra Region, Ghana: An exploratory qualitative study. S4GE open medicine, 9, 20503121211054588.

9. Baral, P. (2021). Health systems and services during COVID-19: lessons and evidence from previous crises: a rapid scoping review to inform the United Nations research roadmap for the COVID-19 recovery. International Journal ofHea1th Senices, 5/(4), 474-493.

10. Barratt, R., Shaban, R. Z., & Gilbert, G. L. (2019). Clinician perceptions of respiratory infection risk; a rationale for research into mask use in routine practice. Infection, disease & health, 24(3), 169-176.

l 1 . Basak, S., & Packirisamy, G. (2020). Nano-based antiviral coatings to combat viral infections.

Nano-structures & Nano-objects, 24, 100620.

12. Boufkhed, S., Harding, R., Kutluk, T., Husseini, A., Pourghazian, N., & Shamieh, O. (2021). What is the preparedness and capacity of palliative care services in Middle-Eastern and North African countries to respond to COVID-19? A rapid survey. Jou nal of Pain and Symptom Management, 6/(2), el 3-e50.
13. Chamola, V., Hassija, V., Gupta, V., & Guizani, M. (2020). A comprehensive review of the COVID-19 pandemic and the role Of IOT, drones, Al, blockchain, and 5G in managing its impact. leee access, 8, 90225-90265.
14. Egeru, A., Dejene, S. W., & Siya, A. (2020). Short report on implications of Covid-19 and emerging zoonotic infectious diseases for pastoralists and Africa. Pastoralism, 10, 1-10.
15. Fragkou, P. C., Moschopoulos, C. D., Karofylakis, E., Kelesidis, T., & Tsiodras, S. (2021). Update in viral infections in the intensive care unit. Frontiers in Medicine, 8, 575580.
16. Gostin, L. O. (2021 Global health security: a blueprintfor thefuture. Harvard University Press.Hemida, M. G. (2019). Middle East respiratory syndrome coronavirus and the one health concept. PeerJ, 7, e7556.
17. Khan, M., Adil, S. F., Alkhathlan, H. Z., Tahir, M. N., saif, S., Khan, M., & Khan, S. T. (2020). COVID-19: a global challenge with old history, epidemiology and progress so far. Molecules, 26(1), 39.
18. Labetoulle, R., Detoc, M., Gagnaire, J., Berthelot, P., Pelissier, C., Fontana, L., ... & GagneuxBrunon, A. (2020). COVID-19 in health-care workers: lessons from SARS and MERS epidemics and perspectives for chemoprophylaxis and vaccines. Expert Review of Vaccines, /9(10), 937947.
19. Lee, S. M., & Lee, D. (2020). Lessons learned from battling COVID-19: the Korean experience. International journal ofenvironmental research and public health, 17(20), 7548.
20. Madhumathi, J., Sinha, R., Veeraraghavan, B., & walia, K. (2021). Use f "Social Media' option for spreading awareness in infection prevention. Current Treatment Options in Infectious Diseases, 13, 14-31.
21. Mahalakshmi, V., Balobaid, A., Kanisha, B., Sasirekha, R., & RamkumarRaja, M. (2023, March). Artificial Intelligence: A Next-Level Approach in Confronting the COVID-19 Pandemic. In Healthca,e (Vol. 11, No. 6, p. 854). MDPI.
22. Manohar, P., Loll, B., Nachimuthu, R., Hua, X., Welburn, S. C., & Leptihn, S. (2020). Secondary bacterial infections in patients with viral pneumonia. Frontiers in medicine, 7, 420.
23. Mazumder, P., Kalamdhad, A., Chaminda, G. T., & Kumar, M. (2021). Coalescence ofcoinfection and antimicrobial resistance with SARS-CoV-2 infection: The blues of post-COVID19 world. Case Studies in Chemical and Environmental Engineering, 3, 100093.
24. Muhammad, M. A., & Al-Turjman, F. (2021). Application of IOT, Al, and 5G in the FightAgainst the COVID-19 Pandemic. Artificial Intelligence and Machine Learningfor COVID-19, 213-234.
25. Nayahangan, L. J., Konge, L., Russell, L., & Andersen, S. (2021). Training and education of healthcare workers during viral epidemics: a systematic review. BMJ open, I /(5), e044111.

26. Park, S. Y, Cheong, H. S., Kwon, K. T., sohn, K. M., Heo, S. T., Lee, S., & Lee, S. H. (2023). Guidelines for Infection Control and Burnout Prevention in Healthcare Workers Responding to COVID-19. Infection & Chemotherapy, 55(1), 150-165.
27. Peng, Y., Tao, H., Satyanarayanan, S. K., Jin, K., & Su, H. (2021). A comprehensive summary of the knowledge on COVID-19 treatment. Aging and disease, /2(1), 155.
28. Qureshi, M. O. (2022). Occupational Infection Prevention and Control Training for the Protection ofHospital Healthcare Workers (Doctoral dissertation, UNSW Sydney).
29. Saavedra, L. P. J., Prates, K. V., Gongalves, G. D., Piovan, S., Matafome, P, & Mathias, P. C. D. F. (2021). COVID-19 During Development: A Matter of Concern. Frontiers in Cell and Developmental Biology, 9, 659032.
30. Schwartz, D. A., & Graham, A. L. (2020). Potential maternal and infant outcomes from coronavirus 2019-nCoV (SARS-CoV-2) infecting pregnant women: lessons from SARS, MERS, and other human coronavirus infections. Viruses, 12(2), 194.
31. Semenova, Y., Trenina, V., Pivina, L., Glushkova, N., Zhunussov, Y., Ospanov, E., & Bjørklund, G. (2022). The lessons of COVID-19, SARS, and MERS: Implications for preventive strategies. International Journal ofHealthcare Management, 15(4), 314-324.
32. Shahrajabian, M. H., sun, W., & Cheng, Q. (2021). Product ofnatural evolution (SARS, MERS, and SARS-C0V-2); deadly diseases, from SARS to SARS-CoV-2. Human vaccines & immunotherapeutics, /7(1), 62-83.
33. Sharififar, S., Jahangiri, K., & Khoshvaghti, A. (2022). The Current State of Infectious Disasters Preparedness Around the World: A Qualitative Systematic Review (2007-2019). Disaster Medicine and Public Health Preparedness, 16(2), 753-762.
34. Sim, S., & Cho, M. (2023). Convergence model of Al and 10T for virus disease control system. Personal and Ubiquitous Computing, 27(3), 1209-1219.
35. Sonbhadra, S. K., Agarwal, S., & Nagabhushan, P. (2020). Target specific mining ofCOVID-19 scholarly articles using one-class approach. Chaos, Solitons & Fractals, 140, 110155.
36. sun, Y, & Li, Y. (2021). COVID-19 outbreak and financial performance of chinese listed firms: evidence from corporate culture and corporate social responsibility. Frontiers in Public Health, 9, 710743.
37. Wang, L., &A1exander, C. A. (2021). COVID-19 Compared with OtherViral Diseases: Novelties, Progress, and Challenges. Electronic Journal of General Medicine, 18(1).
38. Wang, M. W., Zhou, M. Y, Ji, G. H., Ye, L., Cheng, Y. R., Feng, Z. H., & Chen, J. (2020). Mask crisis during the COVID-19 outbreak. Eur Rev Med Phannacol Sci, 24(6), 3397-3399.
39. Weber, D. J., Sickbert-Bennett, E. E., Kanamori, H., & Rutala, W. A. (2019). New and emerging infectious diseases (Ebola, Middle Eastern respiratory syndro e coronavirus, carbapenemresistant Enterobacteriaceae, Candida auris): Focus on environmental survival and germicide susceptibility. American journal ofinfection control, 47, A29-A38.

40. Xiao, J., Fang, M., Chen, Q., & He, B. (2020). SARS, MERS and COVID-19 among healthcare workers: A narrative review. Journal ofinfection and public health, 13(6), 843-848.
41. Yakout, S. M., Alanazi, S., Jahlan, 1., & Shahbal, S. (2023). Assessing the Significance of Preand Post-Health Education on the Changes of Knowledge Levels and Self-Effcacy in Pregnant Women with Urinary Tract Infections. HIVNursing, 23(3), 1572-1579.
42. Yang, C. H., & Jung, H. (2020). Topological dynamics of the 2015 South Korea MERS-C0V spread-on-contact networks. Scientific reports, 10(1), 4327.
43. Zheng, F., Zhao, Z., sun, Y, & Khan, Y A. (2021). Financial performance ofChina's listed firms in presence of coronavirus: Evidence from corporate culture and corporate social responsibility. Current Psychologv, 1-22.