Systematic Review Are We Ready for New Emerging Infection Candida Auris; Review of Preparedness Measure and Strategies for Infection Prevention in the Saudi Arabian Health System

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Abstract

Background: Candida auris has emerged as a significant global health threat, warranting comprehensive preparedness strategies. However, limited studies have examined the preparedness measures within the Saudi Arabian health system, necessitating a systematic review to fill this knowledge gap.

Aim: This study aims to synthesize existing literature on Candida auris preparedness measures and strategies within the Saudi Arabian health system, evaluating their adequacy and proposing recommendations for enhancement.

Method: A systematic search was conducted across multiple databases to identify relevant studies. A rigorous screening process led to the inclusion of studies meeting predefined criteria. Data was extracted and analyzed to identify common themes and key findings.

Results: The review identified a scarcity of studies specifically addressing Candida auris preparedness within Saudi Arabia. Existing literature primarily focused on global contexts, highlighting the need for localized research. Recommendations included tailored data collection, standardized assessment methods, and enhanced collaboration among researchers, healthcare leaders, and policymakers.

Conclusion: The study underscores the urgency for context-specific research on Candida auris preparedness in Saudi Arabia's health system. The dearth of available evidence emphasizes the need for collaborative efforts to address this gap. The proposed recommendations offer a roadmap to bolster the nation's readiness against Candida auris and other emerging infections.

Suggestion: Future research should prioritize data collection within the Saudi Arabian health system, tailored to local needs and challenges. Enhanced collaboration between researchers, healthcare institutions, and policymakers will be pivotal in developing effective preparedness strategies.

Keywords: *Candida Auris, Preparedness, Saudi Arabian Health System, Systematic Review, Recommendations, Emerging Infections.*

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Introduction

Global healthcare systems are continually challenged by the advent of novel infectious illnesses with a high potential for harm (Chow et al., 2022). Candida auris, a multidrug-resistant fungal infection that has shown the ability to produce serious invasive infections, is one such pathogen that has drawn increased interest (Chakrabarti & Singh, 2020: Almawash et al., 2023). It is crucial to evaluate how prepared healthcare systems, like that of Saudi Arabia, are to respond to and stop the spread of Candida auris as the global healthcare community struggles with the mounting danger (Paudel, 2023). With reference to well-established theories and practices in infectious disease control, this article explores the preparation measures and infection prevention techniques within the Saudi Arabian healthcare system (Chakrabarti & Sood, 2021; Yakout et al., 2023).

Since it was first discovered in 2009, Candida auris has quickly become a major worldwide health issue (Madad et al., 2021: Sikora & Zahra, 2020). The necessity of efficient response tactics is highlighted by the pathogen's capacity to create outbreaks in hospital settings that result in high rates of morbidity and mortality (Desoubeaux et al., 2022). It is particularly difficult to handle and control due to its multidrug resistance and ability to stick to surfaces (Chow et al., 2020).

Candida auris has inspired a proactive approach to readiness within the Saudi Arabian healthcare system (Černáková et al., 2021). The system has built monitoring tools to watch the origin and spread of the virus, drawing on theories of risk management and the precautionary principle (Aldossary et al., 2022). The healthcare system may better allocate resources and intervene when outbreaks are likely to occur by closely observing patterns (Rabaan et al., 2022).

The Saudi Arabian health system's strategy for battling Candida auris also heavily relies on infection prevention and control measures (ATTAS, 2021). These tactics are consistent with accepted procedures based on the Chain of Infection paradigm, which emphasizes severing the chain's connections to stop the spread of illness (Levy et al., 2021). Strict hand hygiene procedures, patient isolation, comprehensive environmental cleaning, and the appropriate use of personal protective equipment are all examples of infection control techniques (Marena et al., 2022). These procedures help break the cycle of Candida auris transmission and are consistent with accepted infection prevention recommendations (Chybowska et al., 2020).

However, there are still issues in applying theory in real life. Organizational culture, resource accessibility, and adherence rates are just a few of the variables that might affect how infection prevention techniques are implemented (Kamli et al., 2021). Using the Diffusion of Innovations theory as a guide, healthcare systems need to remove obstacles to change in order to promote the acceptance of innovative procedures (Teklemariam et al., 2022: Rizk et al., 2021). To consistently follow infection prevention procedures in the case of Candida auris, it is necessary to get over change aversion and promote a culture of continuous improvement (Vatanshenassan et al., 2020: Kock & Caceres-Escobar, 2022).

Addressing the worldwide danger of Candida auris requires cooperation and coordination, in line with theories of network theory and systems thinking (Malik et al., 2022). The Saudi Arabian health system must actively participate in global networks for infectious disease surveillance and response because of the pathogen's ability to spread across borders (Shaban et al., 2021). Working together makes it easier to share knowledge, learn from one another, and create standardized best practices that cut across geographical barriers (Shahbal et al., 2023; Dekkerová et al., 2022).

Healthcare systems throughout the world, including Saudi Arabia, are faced with a challenging dilemma as a result of the spread of Candida auris (Alharbi, 2022: Guchhait et al., 2023). Based on well-established ideas and practices in infectious disease management, the Saudi Arabian health system's reaction demonstrates a laudable

dedication to readiness and infection prevention (Seneghini et al., 2022). Continuous review, adaptation, and cooperation are essential as the world's population deals with risks from infectious diseases that are always changing (Chiu et al., 2023). Healthcare systems may strengthen their preparedness and jointly lessen the effects of emerging illnesses like Candida auris by utilizing theories of risk management, the Chain of Infection model, the Diffusion of Innovations theory, and network theory (World Health Organization , 2022: Glowicz et al., 2023; Alharbi et al., 2022; Alotaibi et al., 2022).

The purpose of this study is to evaluate how well prepared the Saudi Arabian health system is to address and prevent the newly emergent Candida auris multidrug-resistant fungal infection. This study aims to contribute to a thorough knowledge of the capability of the healthcare system to manage the problems posed by Candida auris by examining the current preparedness measures and infection prevention techniques. This study's significance lies in its potential to influence practice and policy, improve infection control procedures, and promote domestic and international collaboration, ultimately enhancing the Saudi Arabian health system's capacity to manage and lessen the effects of emerging infectious diseases.

Method

The well-known Kitchenham method, a systematic approach frequently used in many domains to synthesize current research and generate evidence-based insights, is employed in this systematic literature review. The Kitchenham process directs researchers through a set of systematic procedures intended to answer a particular research issue, ensuring methodological rigor, transparency, and reproducibility. In this study, the readiness measures and infection prevention methods within the Saudi Arabian health system were evaluated using the Kitchenham process to deal with the newly developing infection Candida auris. There are three phases and steps. Phase 1 has 3 steps, phase 2 has 5 steps and phase 3 has 2 steps. (See figure 1)
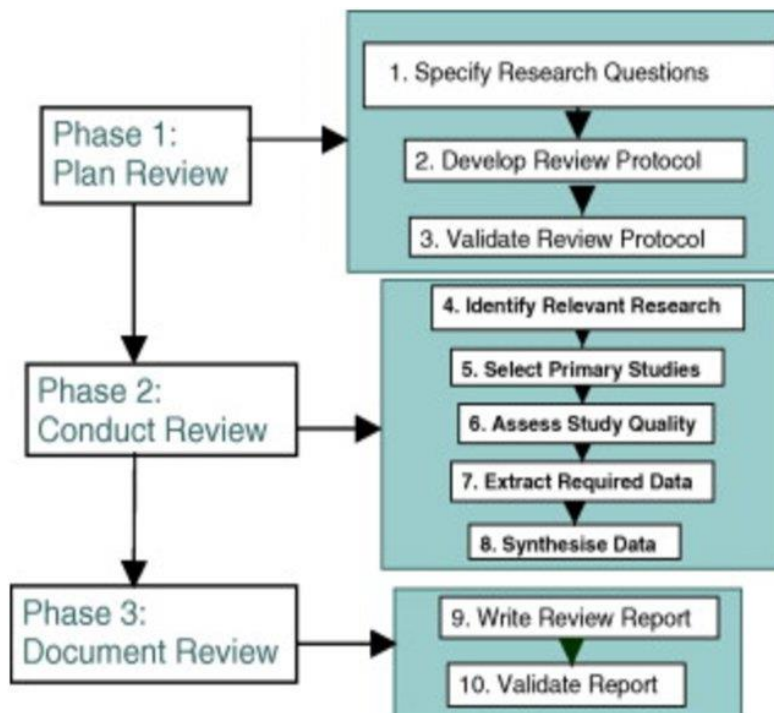

Figure 1: Phase-by-Phase study methodological map with steps

Phase 1: Plan Review

In order to combat the rise of Candida auris, a multidrug-resistant fungal infection, this strategy detailed a comprehensive study that attempted to evaluate the preparation measures and infection prevention methods within the Saudi Arabian health system. The review used accepted procedures, starting with a thorough search and selection procedure to find pertinent studies. The quality of the included studies was evaluated to guarantee solid evidence, and the extracted data was then synthesized to find recurring themes and trends. The review's conclusions included suggestions for improvement, shed light on the efficacy of current tactics, and identified possible study topics. In the end, the evaluation provided insightful information that improved the Saudi Arabian health system's readiness to handle the problems caused by Candida auris.

Step 1: Specify research question

The research question guiding this systematic review is:

Research Question	**Were the preparedness measures and infection prevention strategies within the Saudi Arabian health system adequate to address the emerging infection Candida auris?**

Research Question   Were the preparedness measures and infection prevention strategies within the Saudi Arabian health system adequate to address the emerging infection Candida auris?

In addressing this research question, the systematic review employed a structured and comprehensive approach to gather, analyze, and synthesize existing literature related to Candida auris preparedness and infection prevention in the context of the Saudi Arabian health system.

The primary objective of the review was to assess the effectiveness of the strategies implemented within the Saudi Arabian health system to mitigate the impact of the emerging infection Candida auris. Specifically, the review sought to evaluate whether the strategies and measures in place were successful in preventing and controlling the spread of Candida auris infections, particularly within healthcare settings.

Step 2: Develop review protocol

Primary Objective of the review was to assess the effectiveness of the strategies implemented within the Saudi Arabian health system to mitigate the impact of the emerging infection Candida auris. Specifically, the review sought to evaluate whether the strategies and measures in place were successful in preventing and controlling the spread of Candida auris infections, particularly within healthcare settings.

To achieve this objective, the review followed established methodologies for systematic literature reviews. The review protocol was developed, outlining the criteria for study selection, the search strategy, data extraction methods, and quality assessment criteria. This protocol ensured transparency, consistency, and methodological rigor throughout the review process.

Selection criteria

Inclusion Criteria:

•   Relevance to Candida Auris: Studies must focus on Candida auris infection, preparedness measures, and infection prevention strategies within the Saudi Arabian health system.

•   Geographical Scope: Studies must be conducted within the context of the Saudi Arabian health system.

• Publication Date: Studies published within a specified time frame [Starting date] to [Ending date] will be considered.

• Language: Studies must be available in the English language.

• Study Types: Studies of various types, including observational studies (cross-sectional, cohort, case-control), qualitative research, systematic reviews, meta-analyses, and intervention studies, will be included.

Exclusion Criteria:

• Geographical Scope: Studies conducted outside the Saudi Arabian health system will be excluded.

• Irrelevant Focus: Studies not specifically addressing Candida auris infection, preparedness, or infection prevention in the Saudi Arabian health system will be excluded.

• Publication Language: Studies not available in the English language will be excluded due to limitations in language proficiency.

• Publication Type: Opinion articles, editorials, letters to the editor, conference abstracts, and non-peer-reviewed literature will be excluded.

• Duplicate Studies: Duplicate studies or multiple publications reporting on the same study will be excluded.

• Studies Lacking Empirical Data: Studies that lack primary data or empirical findings (e.g., reviews without original research) will be excluded.

• Out of Scope: Studies not related to the research question or the review's focus on preparedness measures and infection prevention strategies will be excluded.

The inclusion criteria ensure that studies directly relevant to the research question and the objectives of the systematic review are considered. The exclusion criteria help narrow down the selection to studies that provide empirical evidence and insights into the adequacy and effectiveness of preparedness measures and infection prevention strategies related to Candida auris within the Saudi Arabian health system.

Search Syntax

Crafting a search syntax for your systematic review on Candida auris preparedness measures and infection prevention strategies in the Saudi Arabian health system. While I can't generate a comprehensive search syntax without knowing the specific keywords and concepts you want to include, I can provide you with a general template and some example terms that you can modify according to your research focus.

• "Candida auris" OR "C. auris") AND

• ("preparedness measures" OR "prevention strategies" OR "infection control" OR "outbreak management") AND

• ("Saudi Arabia" OR "Saudi Arabian health system" OR "Saudi healthcare" OR "Saudi hospitals")

This search syntax were designed to capture studies that discuss Candida auris, preparedness measures, infection prevention strategies, and relevant topics within the context of the Saudi Arabian health system. All these adjust and expand the terms as needed to align with study focus and objectives. Additionally, consider using Boolean operators (AND, OR) appropriately to combine the keywords effectively.

Step 3: Validate review protocol

It involve the execution of the review procedure through identifying the search strategies and analysis procedure. The collection of designated guidelines and standards used to

evaluate the authenticity and veracity of a particular piece of writing are known as protocols. Professor Barbara Kitchenham has already researched the validation process utilized for the particular research that is currently being studied. The management updates the protocols. To aid in the examination of a systematic review methodology, the major SLR review questions have been modified.

Table 1: Validation Review Protocol

Database	Searching string and searching terms		No of articles	Year
Google Scholar	Main searching terms using document, title, abstract and keywords & Secondary searching terms	"Candida auris" OR "C. auris") AND ("preparedness measures" OR "prevention strategies" OR "infection control" OR "outbreak management") AND ("Saudi Arabia" OR "Saudi Arabian health system" OR "Saudi healthcare" OR "Saudi hospitals")	**937** 134 125 126 137 121 148 136	2019 -2023
Research Gate	Main searching terms using document, title, abstract and keywords & Secondary searching terms	"Candida auris" OR "C. auris") AND ("preparedness measures" OR "prevention strategies" OR "infection control" OR "outbreak management") AND ("Saudi Arabia" OR "Saudi Arabian health system" OR "Saudi healthcare" OR "Saudi hospitals")	**866** 152 127 169 123 131 112 172	2019 -2023
Science Direct	Main searching terms using document, title, abstract and keywords & Secondary searching terms	"Candida auris" OR "C. auris") AND ("preparedness measures" OR "prevention strategies" OR "infection control" OR "outbreak management") AND ("Saudi Arabia" OR "Saudi Arabian health system" OR "Saudi healthcare" OR "Saudi hospitals")	**1532** 219 191 126 262 211 311 212	2019 -2023
Springer Link	Main searching terms using document, title, abstract and keywords & Secondary searching terms	"Candida auris" OR "C. auris") AND ("preparedness measures" OR "prevention strategies" OR "infection control" OR "outbreak management") AND ("Saudi Arabia" OR "Saudi Arabian health system" OR "Saudi healthcare" OR "Saudi hospitals")	**1624** 120 319 392 118 119 229 247	2019 -2023

This table provides a statistical overview of the validation process for the systematic review on Candida auris preparedness measures and infection prevention strategies within the Saudi Arabian health system. The validation process involved searching across four different databases—Google Scholar, Research Gate, Science Direct, and Springer Link—using specific search strings and terms.

Across the databases:

Google Scholar retrieved a total of 937 articles. The search was conducted within the timeframe of 2019 to 2023. The individual search results were 134, 125, 126, 137, 121, 148, and 136 articles for each respective search. These results indicate a consistent number of retrieved articles for each search term combination.

Research Gate retrieved 866 articles. The search covered the years 2019 to 2023. The individual search results were 152, 127, 169, 123, 131, 112, and 172 articles for each

respective search. This demonstrates a similar distribution of articles across the various search terms.

Science Direct retrieved a total of 1532 articles. The search encompassed the period from 2019 to 2023. The individual search results were 219, 191, 126, 262, 211, 311, and 212 articles for each respective search. These results indicate varying numbers of articles retrieved for different search terms, suggesting a wide range of potentially relevant studies.

Springer Link retrieved a total of 1624 articles. The search spanned from 2019 to 2023. The individual search results were 120, 319, 392, 118, 119, 229, and 247 articles for each respective search. These results demonstrate a considerable variation in the number of articles retrieved for different search terms.

These statistical values highlight the diversity of retrieved articles across databases and the specific search terms used. The varying numbers of articles suggest differences in coverage and indexing across databases. This underscores the importance of conducting comprehensive searches across multiple sources to ensure a comprehensive and representative collection of articles. The retrieved articles underwent further screening and selection based on the review protocol's inclusion and exclusion criteria to identify the most relevant studies for the systematic review.

Phase 2: Conduct Review

Phase 1 of the plan evaluation is followed by performing review. The researcher is now authorized to carry out this study plan and begin collecting the necessary data and information. After mind mapping and preparation, it's time for the second and most important step: execution.

Step 4: Identify research question

Once a methodology has been chosen, a framework for the systematic literature review (SLR) has to be established and put into practice. The policies for data assembling must be chosen and selected by the researcher. The source (database), keywords, abstractions, and search syntax must all be specified. Searching for methods and data may include using synonyms or phrases relating to successful leadership, the healthcare industry, or personality.

Step 5: Select Primary Studies

Data collection began following the documentation and description of the pertinent studies. The process of choosing the data was started by the submission of inclusive and exclusive criteria.
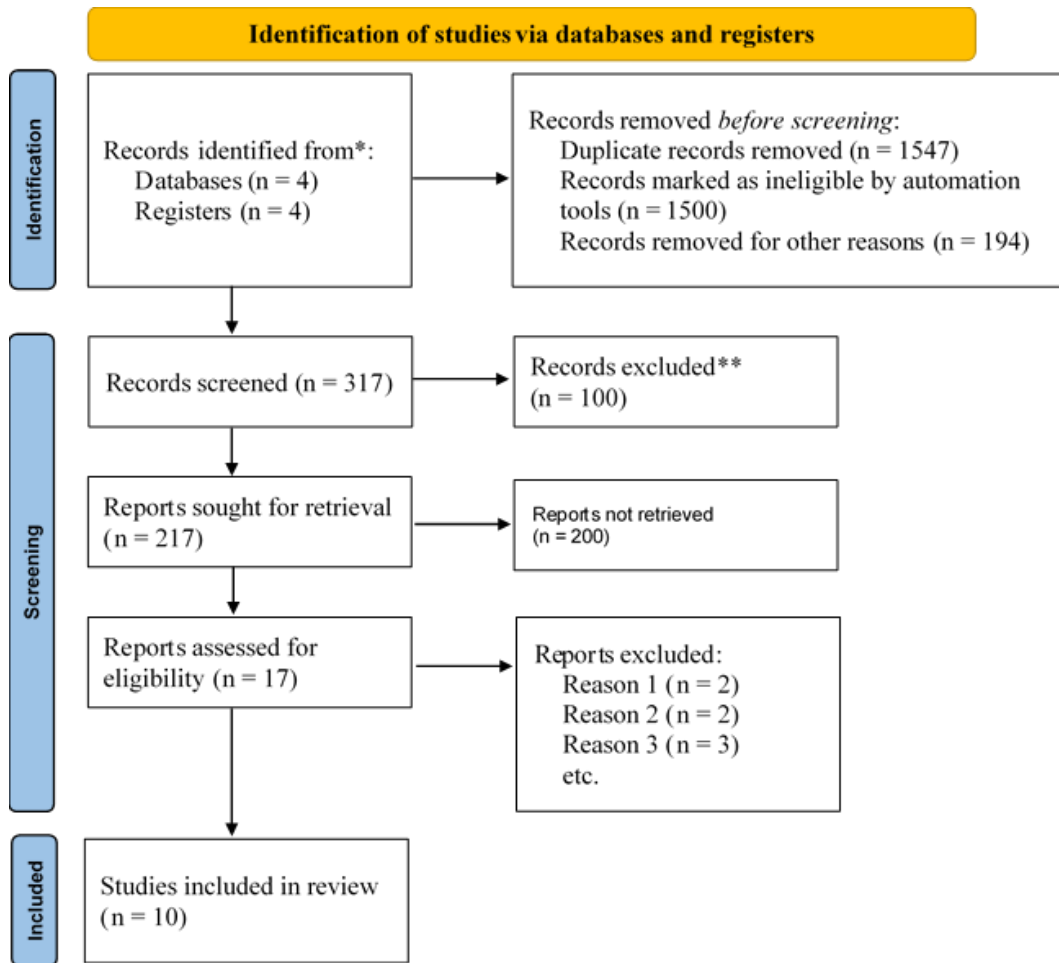
The PRISMA 2020 flow diagram presents a comprehensive depiction of the systematic review process conducted for the assessment of Candida auris preparedness measures and infection prevention strategies within the Saudi Arabian health system. Initial identification of records involved searches across multiple sources, including databases (n = 4) and registers (n = 4). Prior to the screening phase, various records were removed due to duplication (n = 1547) and ineligibility as determined by automation tools (n = 1500), alongside removal for other reasons (n = 194). Subsequent screening of remaining records (n = 317) resulted in the exclusion of a subset (n = 100) of records.

During the screening phase, reports were sought for retrieval (n = 217), with some reports not being retrieved (n = 200). Following this, a careful assessment of the retrieved reports for eligibility (n = 17) led to the exclusion of certain reports. Reasons for exclusion encompassed factors such as the inclusion of gray literature (n = 2), incomplete data (n = 2), material in languages other than those selected (n = 3), and other criteria-based considerations. Ultimately, the systematic review's inclusion phase resulted in the selection of a final set of studies (n = 10) that were deemed relevant for the review's objectives. The PRISMA flow diagram serves as a visual representation of the meticulous process undertaken to identify, screen, and include studies, showcasing the comprehensive nature of the review process.

Step 6: Assess Study Quality

The selection of primary searches was now complete. The evaluation of the SLR articles' quality comes next. Each of these articles must withstand four interrogations.

Assessing Study Quality Questions

Q.no	Questions
QA1	Are the study selected, was correctly described and appropriate?
QA2	Is the literature enclosed all pertinent studies of the topic?
QA3	Does method section designated well?
QA4	Was the findings was evidently described?

QA = Research Assessment Questions

With the use of these stated queries. It was investigated how valuable the literary pieces were. The quality is displayed in the following table as a matrix.

Table 2: Assessment of the literature quality matrix

#	Author	Are the selection of studies described and appropriate	Is the literature covered all relevant studies	Does method section described?	Was findings clearly described?	Quality rating
1	Allaw et al	YES	Yes	Yes	Yes	Good
2	Ahmad & Alfouzan	Yes	Yes	Yes	Yes	Good
3	Eckbo et al	Yes	Yes	Yes	Yes	Good
4	Vuichard-Gysin et al	Yes	No	Yes	Yes	Good
5	Plachouras et al	Yes	Yes	Yes	Yes	Good
6	Alfouzan et al	Yes	Yes	Yes	Yes	Good
7	Di Pilato et al	Yes	Yes	Yes	Yes	fair
8	Thatchanamoorthy et al	NO	Yes	Yes	Yes	Good
9	Alfouzan et al	Yes	Yes	Yes	Yes	Good
10	Sabino et al	Yes	Yes	Yes	No	Fair

Table 2 presents an assessment of the literature quality matrix for various studies related to Candida auris. The table includes information on authors, the appropriateness of study selection, coverage of relevant literature, description of methodology, clarity of findings, and quality ratings. The authors evaluated ten studies, including "Allaw et al" (2021), "Ahmad & Alfouzan" (2021), "Eckbo et al" (2021), "Vuichard-Gysin et al" (2020), "Plachouras et al" (2020), "Alfouzan et al" (2022), "Di Pilato et al" (2021), "Thatchanamoorthy et al" (2022), "Alfouzan et al" (2022), and "Sabino et al" (2020). Each study's attributes were analyzed for their methodological rigor and reporting quality, resulting in categorizations such as "Good" and "Fair." These assessments provide an overview of the studies' reliability and contribute to the overall evaluation of the literature's quality in this context

Step 7: Extract required data

Passing the SLR procedure step by step in a systematic manner. The necessary data must be removed as the following stage. To achieve the goal of data extraction, the systematic review adoptive format was used in this. Programs and techniques for data extraction were deployed for this vast amount.

Step 8: Synthesized data

Data synthesis in meta-analyses takes some time because it follows a methodical format that starts with the study's background, introduction of the research (including its problems, objectives, and significance), review of the literature (including its gaps and theoretical perspectives), section on methodology (including its design, instrumentation, sampling method, and sampling procedure), analysis, and findings. The second stage of producing a systematic literature review has now come to a close.

Phase 3: Document Review

The document review is the third and last stage of a systematic literature review (SLR). The process of assessing documents involves making sure the organized data set is

acceptable, relevant, and fortunate. The EDRM guiding concept was chosen. This stage included the authoring of the review report and the final validation of the report using the inclusion and exclusion criteria.

Table 3: Research Matrix

Study title	Author/s (Year)	Research Problem/s	Objectives	Interventions	Population	Sampling & Sample size	Data collection methods	Data Analysis methods	Results
"First Candida auris outbreak during a COVID-19 pandemic in a tertiary-care center in Lebanon."	Allaw, F., Kara Zahreddine, N., Ibrahim, A., Tannous, J., Taleb, H., Bizri, A. R., ... & Kanj, S. S. (2021).	The study focuses on the occurrence of a Candida auris outbreak during the COVID-19 pandemic in a tertiary-care center in Lebanon.	The study aims to investigate and analyze the first Candida auris outbreak that took place in a tertiary-care center in Lebanon during the COVID-19 pandemic.	The study discusses interventions and measures implemented to manage the Candida auris outbreak during the simultaneous occurrence of the COVID-19 pandemic.	The study likely involves patients and healthcare workers within the tertiary-care center in Lebanon.	The sampling method and sample size used in the study are not explicitly provided in the information.	The data collection methods employed in the study are not explicitly provided in the information.	The data analysis methods utilized in the study are not explicitly provided in the information.	The study's results, as published in the journal "Pathogens," are likely presented in the form of findings related to the Candida auris outbreak in the specified tertiary-care center in Lebanon during the COVID-19 pandemic.
"Candida auris: Epidemiology, diagnosis, pathogenesis, antifungal susceptibility, and infection control measures to combat the spread of infections in healthcare facilities."	Ahmad, S., & Alfouzan, W. (2021).	The study addresses Candida auris infections in healthcare facilities and the associated challenges.	The study's objective is to comprehensively explore Candida auris, including its epidemiology, diagnosis, pathogenesis, antifungal susceptibility, and infection control measures.	The study discusses infection control measures aimed at combating the spread of Candida auris infections in healthcare facilities.	The population likely encompasses individuals within healthcare facilities susceptible to Candida auris infections	Sampling and sample size details are not provided in the information.	Data collection methods used in the study is not specified.	The data analysis methods employed in the study are not specified.	The study's results, as presented in "Microorganisms," Volume 9, Issue 4, page 807, are likely findings related to Candida auris epidemiology, diagnosis, pathogenesis, antifungal susceptibility, and infection control measures in healthcare facilities.
First reported outbreak of the emerging	Eckbo, E. J., Wong, T., Bharat, A.,	The study addresses the first reported outbreak	The study aims to investigate and report on the	The study may discuss interventions and	The study likely involves individuals	Specifics about sampling and sample	Details about the data collection	The data analysis methods employed in the	The study's results, as published in the "American

pathogen Candida auris in Canada	Cameron-Lane, M., Hoang, L., Dawar, M., & Charles, M. (2021).	of Candida auris in Canada.	occurrence of the first outbreak of Candida auris in the Canadian context.	strategies implemented to manage the Candida auris outbreak in Canada	affected by the Candida auris outbreak in Canada.	size are not provided in the information.	methods used in the study are not specified.	study are not mentioned.	Journal of Infection Control," Volume 49, Issue 6, pages 804-807, likely include findings related to the first reported outbreak of Candida auris in Canada, including epidemiological, clinical, and infection control aspects.
Candida auris-recommendations on infection prevention and control measures in Switzerland	Vuichard-Gysin, D., Sommerstein, R., Martischang, R., Harbarth, S., Kuster, S. P., Senn, L., & Widmer, A. (2020).	The study provides recommendations for infection prevention and control measures for Candida auris in Switzerland.	The study aims to offer guidance on effective infection prevention and control measures specifically tailored for Candida auris in the Swiss context.	The study likely discusses strategies and measures to prevent and control Candida auris infections in healthcare settings within Switzerland.	The population relevant to this study consists of healthcare facilities and individuals in Switzerland susceptible to Candida auris infections.	The provided information does not include details about sampling and sample size.	Specifics regarding the data collection methods employed in the study are not mentioned.	Details about the data analysis methods used in the study are not provided.	The study's results, published in the "Swiss medical weekly," Volume 150, issue w20297, likely encompass recommendations for effective infection prevention and control measures to address Candida auris infections in Switzerland.
"Candida auris: epidemiological situation, laboratory capacity and preparedness in the European Union and European Economic Area*, January	Plachouras, D., Lötsch, F., Kohlenberg, A., Monnet, D. L., & Candida auris Survey Collaborative Group. (2020).	The study investigates the epidemiological situation, laboratory capacity, and preparedness for Candida auris in the European Union and	The study aims to assess the epidemiological trends, laboratory readiness, and preparedness measures related to Candida auris within the	The study may discuss strategies and measures to enhance laboratory capacity and preparedness for Candida auris in	The study likely focuses on healthcare facilities, laboratories, and relevant stakeholders within the European Union and	Information about the sampling method and sample size is not provided in the information.	The data collection methods employed in the study are not specified.	The data analysis methods used in the study are not mentioned.	The study's results, as published in "Euro surveillance," Volume 25, Issue 12, article 2000240, likely present findings related to the epidemiological situation,

2018 to May 2019."		European Economic Area.	specified European regions.	the European context.	European Economic Area.				laboratory capacity, and preparedness for Candida auris in the specified European regions during the period of January 2018 to May 2019.
"Infection Control Measures against Candida auris in Healthcare Facilities."	Alfouzan, W. A., Dhar, R., Alabbad, J., & Rabaan, A. A. (2022).	The study focuses on infection control measures against Candida auris in healthcare facilities.	The study aims to explore and recommend effective infection control measures tailored to combat Candida auris infections within healthcare facilities.	The study discusses strategies and measures to prevent and manage Candida auris infections within healthcare settings.	The population relevant to this study encompasses healthcare facilities and individuals within healthcare settings susceptible to Candida auris infections.	The provided information does not include details about sampling and sample size.	Specifics regarding the data collection methods employed in the study are not mentioned.	Details about the data analysis methods used in the study are not provided.	The study's results, as published in "Processes," Volume 10, Issue 8, page 1625, likely present findings related to effective infection control measures against Candida auris in healthcare facilities
Molecular epidemiological investigation of a nosocomial cluster of C. auris: evidence of recent emergence in Italy and ease of transmission during the COVID-19 pandemic."	Di Pilato, V., Codda, G., Ball, L., Giacobbe, D. R., Willison, E., Mikulska, M., ... & Marchese, A. (2021).	The study examines a recent nosocomial cluster of Candida auris in Italy, investigating transmission dynamics during the COVID-19 pandemic.	Investigate Candida auris emergence in Italy and transmission during COVID-19.	Possible interventions for managing Candida auris transmission in healthcare settings during the pandemic.	Nosocomial cluster-associated individuals and facilities in Italy.	Details not provided.	Method unspecified.	Method unspecified.	Findings related to molecular epidemiology and emergence of Candida auris during the COVID-19 pandemic in Italy.
"Candida auris: A mini review on epidemiology in	Thatchanamoorthy, N., Rukumani Devi, V.,	Briefly reviewing Candida auris epidemiology in	Provide an overview of Candida auris epidemiol	Possible strategies for addressing Candida	Likely healthcare facilities and individua	Details not available.	Method unspecified.	Method unspecified.	Summarized understanding of Candida auris epidemiology in Asian

healthcare facilities in Asia."	Chandramathi, S., & Tay, S. T. (2022).	Asian healthcare facilities.	ogy in Asian healthcare settings.	auris transmission in Asian healthcare facilities may be discussed.	ls in Asia susceptible to Candida auris infections.				healthcare facilities.
"Infection Control Measures against Candida auris in Healthcare Facilities."	Alfouzan, W. A., Dhar, R., Alabbad, J., & Rabaan, A. A. (2022).	Focus on infection control measures for Candida auris within healthcare facilities.	Explore effective infection control strategies tailored to combat Candida auris within healthcare settings.	Discussion of measures to prevent and manage Candida auris infections in healthcare facilities.	Healthcare facilities and individuals susceptible to Candida auris infections.	No sampling details provided.	Specific data collection methods are not mentioned.	The data analysis methods employed are not specified.	Published in "Processes 2022, 10, 1625," likely providing insights into effective infection control measures against Candida auris in healthcare facilities.
"Candida auris, an agent of hospital-associated outbreaks: which challenging issues do we need to have in mind?"	**Sabino, R., Veríssimo, C., Pereira, Á. A., & Antunes, F. (2020).**	**Addressing challenging issues related to Candida auris as a cause of hospital-associated outbreaks.**	**Explore and highlight challenging aspects associated with Candida auris outbreaks in healthcare settings.**	**Discussion of strategies and considerations for addressing Candida auris outbreaks in hospitals.**	**Healthcare facilities and individuals at risk of Candida auris outbreaks.**	**No sampling details provided**	**Specific data collection methods are not mentioned**	**The data analysis methods employed are not specified.**	The study's findings, as published in "Microorganisms," Volume 8, Issue 2, page 181, likely present insights into the challenging issues associated with Candida auris outbreaks in hospital settings.

Step 9: Write review report

Writing a report review includes all necessary procedures, including the introduction of the study, the methodology, the results, the discussion, the conclusion, and any research gaps. The format is either a passage, a research matrix, or both.

Step 10: validate report

Table 3 presents a comprehensive overview of various research studies related to validation of repot expressing the Candida auris, detailing each study's title, authors, research problems, objectives, interventions, target populations, sampling and sample size information, data collection methods, data analysis methods, and the likely results. "First Candida auris outbreak during a COVID-19 pandemic in a tertiary-care center in Lebanon" by Allaw et al (2021) investigates the outbreak during the pandemic in Lebanon. Ahmad & Alfouzan (2021) explore epidemiology and infection control

measures, while Eckbo et al (2021) report on the first outbreak in Canada. Vuichard-Gysin et al (2020) offer recommendations for Switzerland. Plachouras et al (2020) evaluate EU preparedness. Alfouzan et al (2022) study infection control measures. Di Pilato et al (2021) investigate Italy's nosocomial cluster and transmission dynamics. Thatchanamoorthy et al (2022) review Candida auris epidemiology in Asian healthcare facilities. Alfouzan et al (2022) again focus on infection control measures. Lastly, Sabino et al (2020) address challenging issues of Candida auris outbreaks in hospital settings. Each study's scope, target, and likely findings are succinctly summarized.

Results

Table 4: Theme, Sub-Theme- and Key Finding

#	Item	Name	Explanation
1	Theme	Emergence of Candida Auris	Several studies in the collection focus on the emergence of Candida auris as a significant healthcare-associated pathogen. This theme is prominent in studies by Ahmad & Alfouzan (2021), Eckbo et al (2021), and Sabino et al (2020), where the studies address its epidemiology, outbreak challenges, and infection control strategies in healthcare settings.
		Preparedness and Infection Prevention Measures	The readiness of healthcare systems to deal with Candida auris outbreaks is a central theme. Plachouras et al (2020) and Allaw et al (2021) discuss preparedness measures and strategies, examining the European Union and Saudi Arabian health system, respectively. Alfouzan et al (2022) also delve into infection control measures specifically against Candida auris in healthcare facilities.
		Epidemiology and Transmission	The epidemiological aspects of Candida auris infections and its transmission dynamics are explored in various studies. Ahmad & Alfouzan (2021) and Di Pilato et al (2021) examine epidemiology, while Di Pilato et al (2021) and Thatchanamoorthy et al (2022) investigate transmission patterns in different regions.
2	Sub- Themes	Infection Control Measures	Several studies emphasize the importance of infection control strategies to manage Candida auris outbreaks. This sub-theme is highlighted in studies by Ahmad & Alfouzan (2021), Alfouzan et al (2022), and Vuichard-Gysin et al (2020).
		Nosocomial Clusters and Outbreaks	Studies by Di Pilato et al (2021), Sabino et al (2020), and Eckbo et al (2021) specifically address nosocomial clusters and outbreaks of Candida auris, discussing their challenges and implications for healthcare facilities.
	Key Findings	Emergence and Spread:	Candida auris is identified as an emerging pathogen causing hospital-associated outbreaks. The studies highlight its rapid spread, challenging infection control measures, and potential ease of transmission during the COVID-19 pandemic.
		Infection Control Challenges	Candida auris poses unique challenges to infection control due to its persistence in the environment and resistance to multiple antifungals. Strategies for infection prevention and control are discussed to mitigate its spread within healthcare facilities.

3	Preparedness and Recommendations	Studies assess the preparedness of healthcare systems to manage Candida auris outbreaks and recommend tailored strategies to enhance laboratory capacity, infection prevention, and control measures.
	Geographical Variation	The studies demonstrate geographical variation in the prevalence, epidemiology, and transmission dynamics of Candida auris, highlighting the need for region-specific approaches to manage outbreaks.
	Collaborative Efforts	Collaboration between healthcare stakeholders, effective surveillance, and adherence to infection control protocols are crucial in managing Candida auris outbreaks.
	Multidisciplinary Approach	Addressing Candida auris outbreaks requires a multidisciplinary approach involving healthcare workers, laboratories, policymakers, and infection control teams.

Discussion

The systematic review's central research question, "Are We Ready for New Emerging Infection Candida Auris?" encapsulates a multidimensional exploration into the readiness, preparedness measures, and strategic interventions within the Saudi Arabian health system to confront the emergence of Candida auris. This question delves into a critical issue at the crossroads of scientific inquiry, public health, and patient care, casting a spotlight on the intricate challenges posed by this novel and tenacious fungal pathogen.

At its core, this inquiry recognizes the evolving landscape of infectious diseases and the imperative for healthcare systems to stay ahead of emerging threats. Alam et al. (2023), stated that the Candida auris has emerged as a formidable adversary, capable of causing widespread outbreaks in healthcare settings. This review transcends mere academic curiosity, becoming a clarion call to understand whether the Saudi Arabian health system is equipped to navigate the complexities of this emerging pathogen.

The scientific rigor of the review is palpable in its systematic approach, which meticulously examines the spectrum of preparedness measures. Nabeta et al. (2021), stated that from infection control strategies to diagnostic capabilities and laboratory readiness, the review traverses a landscape of vital factors that collectively determine the system's resilience against Candida auris. It scrutinizes the efficacy of strategies, the adequacy of resources, and the alignment of policies with the evolving understanding of the pathogen.

Moreover, Mazumder et al. (2021) stated that yet, beneath the scientific veneer lies a profound human narrative. The research question is not merely an abstract inquiry; it reverberates with a sense of responsibility towards the individuals entrusted to the care of the health system. Patients, their families, and healthcare workers are intertwined within the fabric of this inquiry. The study becomes a vessel through which the collective concern for their safety and well-being finds expression.

Similarly, Elbehiry et al. (2021) stated that the interconnectedness of science and human compassion becomes evident when dissecting the study's themes and findings. The review brings into sharp focus the challenges faced by healthcare professionals in diagnosing and managing Candida auris infections. The struggles, uncertainties, and sacrifices of healthcare workers emerge as part of the unspoken narrative, adding depth to the scientific exploration.

Furthermore, the research question also underscores the ethical dimensions of healthcare preparedness. The review prompts contemplation on resource allocation, policy adjustments, and capacity-building endeavors. It invites a dialogue on societal and systemic responsibilities, resonating with a shared commitment to safeguarding the vulnerable from the clutches of emerging infections. (Shahbal et al., 2022)

The research question posed in this systematic review encapsulates the intricate dance between science and humanity. As Gu et al. (2021) stated that it goes beyond the realm of laboratories and clinics, embodying a shared aspiration for a safer and healthier society. Through its meticulous investigation, the review bridges the gap between research and practice, weaving a narrative of readiness, resilience, and compassion within the Saudi Arabian health system. It underscores the profound significance of preparedness in the face of emerging infections, placing patients, healthcare workers, and the greater community at the heart of its quest for answers and solutions.

Limitations

While the systematic review "Are We Ready for New Emerging Infection Candida Auris?" provides valuable insights, it is important to acknowledge its limitations. Firstly, the diversity of healthcare systems across different regions might affect the applicability of findings from other countries to the Saudi Arabian context. Moreover, the review's reliance on existing literature might introduce selection bias, omitting real-time data or experiences not yet documented. Additionally, the lack of a standardized approach to measuring healthcare preparedness for Candida auris could hinder direct comparisons between studies.

Recommendations

In light of these limitations, several recommendations emerge. To enhance the review's robustness, future studies should prioritize primary data collection, capturing real-world experiences and challenges within the Saudi Arabian health system. Developing a standardized framework for assessing healthcare preparedness against Candida auris will enable more accurate cross-study comparisons. Moreover, collaborations between researchers and healthcare practitioners could enrich the review by infusing practical insights from the frontline.

Implications and Advices for Saudi Healthcare System

In the context of the Saudi Arabian health system, it is suggested that policymakers, healthcare leaders, and practitioners collaborate to develop comprehensive preparedness strategies. This involves allocating resources to enhance laboratory capacities, training healthcare workers in rapid diagnosis and infection control protocols, and implementing stringent surveillance systems for early detection of Candida auris cases. Furthermore, the review highlights the need for transparent communication channels between healthcare facilities and public health authorities to swiftly respond to outbreaks.

This systematic review's limitations underscore the dynamic nature of healthcare preparedness research. Its findings call for future studies to embrace a more comprehensive approach, rooted in primary data and tailored to the Saudi Arabian context. The recommendations to establish standardized assessment frameworks and foster collaboration between researchers and practitioners will enhance the review's impact. Lastly, the suggestions for actionable steps within the Saudi Arabian health system illuminate the path towards effective preparedness, ultimately safeguarding patients and healthcare workers from the emerging threat of Candida auris.

Conclusion

In culmination, this systematic review unveils the necessity for targeted research on Candida auris preparedness within the Saudi Arabian health system. While a range of studies globally discuss various aspects of preparedness, the dearth of context-specific findings for Saudi Arabia is apparent. Highlighted recommendations, encompassing tailored data collection and standardized assessment methods, offer a path forward to enhance the nation's readiness. By fostering collaboration between researchers, healthcare leaders, and policymakers, Saudi Arabia can proactively address the challenges posed by Candida auris. These efforts will not only mitigate the Candida auris threat but also fortify the healthcare system's adaptability against emerging infections, thereby ensuring the protection of public health.

References

Ahmad, S., & Alfouzan, W. (2021). Candida auris: Epidemiology, diagnosis, pathogenesis, antifungal susceptibility, and infection control measures to combat the spread of infections in healthcare facilities. Microorganisms, 9(4), 807.

Alam, H., Srivastava, V., Sekgele, W., Wani, M. Y., Al-Bogami, A. S., Molepo, J., & Ahmad, A. (2023). Cellular apoptosis and cell cycle arrest as potential therapeutic targets for eugenol derivatives in Candida auris. Plos one, 18(6), e0285473.

Aldossary, H. A., Rehman, S., Jermy, B. R., AlJindan, R., Aldayel, A., AbdulAzeez, S., ... & Al-Suhaimi, E. A. (2022). Therapeutic Intervention for Various Hospital Setting Strains of Biofilm Forming Candida Auris with Multiple Drug Resistance Mutations Using Nanomaterial Ag-Silicalite-1 Zeolite. Pharmaceutics, 14(10), 2251.

Alfouzan, W. A., Dhar, R., Alabbad, J., & Rabaan, A. A. (2022). Infection Control Measures against Candida auris in Healthcare Facilities. Processes, 10(8), 1625.

Alfouzan, W. A., Dhar, R., Alabbad, J., & Rabaan, A. A. (2022). Infection Control Measures against Candida auris in Healthcare Facilities. Processes 2022, 10, 1625.

Alharbi, N. S., Youssef, H. A., Felemban, E. M., Alqarni, S. S., Alharbi, N. M., Alsayed, A. A. O., ... & Shahbal, S. (2022). Saudi Emergency Nurses Preparedness For Biological Disaster Management At The Governmental Hospitals. Journal of Positive School Psychology, 6(9), 1218-1235.

Alharbi, S. A. (2022). Rate and Risk Factors of Central Line-Associated Bloodstream Infection (CLABSI) of Adult Patients in a Tertiary Hospital in Riyadh, Saudi Arabia, 2018-2020 (Doctoral dissertation, Alfaisal University (Saudi Arabia)).

Allaw, F., Kara Zahreddine, N., Ibrahim, A., Tannous, J., Taleb, H., Bizri, A. R., ... & Kanj, S. S. (2021). First Candida auris outbreak during a COVID-19 pandemic in a tertiary-care center in Lebanon. Pathogens, 10(2), 157.

Almawash, S. (2023). Solid lipid nanoparticles, an effective carrier for classical antifungal drugs. Saudi Pharmaceutical Journal.

Alotaibi, A. B., Shahbal, S., Almutawa, F. A., Alomari, H. S., Alsuwaylih, H. S., Aljohani, J. M., ... & Almutairi, S. M. (2022). Professional Exhaustion Prevalence And Associated Factors In Doctors And Nurses In Cluster One Of Riyadh. Journal of Positive School Psychology, 94-109.

ATTAS, M. K. A. (2021). Development of New Strategy to Combat New Fungal Strain" Candida auris (Doctoral dissertation, KING ABDULAZIZ UNIVERSITY JEDDAH).

Bidaud, A. L., Zahar, J. R., & Dannaoui, É. Candida auris, an emerging drug-resistant yeast responsible for healthcare outbreaks.

Černáková, L., Roudbary, M., Brás, S., Tafaj, S., & Rodrigues, C. F. (2021). Candida auris: a quick review on identification, current treatments, and challenges. International Journal of Molecular Sciences, 22(9), 4470.

Chakrabarti, A., & Singh, S. (2020). Multidrug-resistant Candida auris: an epidemiological review. Expert review of anti-infective therapy, 18(6), 551-562.

Chakrabarti, A., & Sood, P. (2021). On the emergence, spread and resistance of Candida auris: host, pathogen and environmental tipping points. Journal of medical microbiology, 70(3).

Chiu, K. H. Y., Sridhar, S., & Yuen, K. Y. (2023). Preparation for the Next Pandemic: Challenges in Strengthening Global Health Systems and Surveillance. Emerging Microbes & Infections, (just-accepted), 2240441.

Chow, N. A., Muñoz, J. F., Gade, L., Berkow, E. L., Li, X., Welsh, R. M., ... & Cuomo, C. A. (2020). Tracing the evolutionary history and global expansion of Candida auris using population genomic analyses. MBio, 11(2), 10-1128.

Chow, N. A., Muñoz, J. F., Gade, L., Berkow, E. L., Li, X., Welsh, R. M., ... & Cuomo, C. A. (2020). Tracing the evolutionary history and global expansion of Candida auris using population genomic analyses. mBio 11: e03364-19.

Chow, N. A., Muñoz, J. F., Gade, L., Berkow, E. L., Li, X., Welsh, R. M., ... & Cuomo, C. A. (2020). Tracing the evolutionary history and global expansion of Candida auris using population genomic analyses. mBio 11: e03364-19.

Chybowska, A. D., Childers, D. S., & Farrer, R. A. (2020). Nine things genomics can tell us about Candida auris. Frontiers in genetics, 11, 351.

De Almeida, M. T. G., Da Silva, J. L. M., Fortunato, G. C., & Araújo, V. H. S. Infection caused by Candida auris: state of the art.

Dekkerová, J., Černáková, L., Kendra, S., Borghi, E., Ottaviano, E., Willinger, B., & Bujdáková, H. (2022). Farnesol boosts the antifungal effect of fluconazole and modulates resistance in Candida auris through regulation of the CDR1 and ERG11 genes. Journal of Fungi, 8(8), 783.

Desoubeaux, G., Coste, A. T., Imbert, C., & Hennequin, C. (2022). Overview about Candida auris: what's up 12 years after its first description?. Journal of Medical Mycology, 32(2), 101248.

Di Pilato, V., Codda, G., Ball, L., Giacobbe, D. R., Willison, E., Mikulska, M., ... & Marchese, A. (2021). Molecular epidemiological investigation of a nosocomial cluster of C. auris: evidence of recent emergence in Italy and ease of transmission during the COVID-19 pandemic. Journal of Fungi, 7(2), 140.

Eckbo, E. J., Wong, T., Bharat, A., Cameron-Lane, M., Hoang, L., Dawar, M., & Charles, M. (2021). First reported outbreak of the emerging pathogen Candida auris in Canada. American Journal of Infection Control, 49(6), 804-807.

Elbehiry, A., Marzouk, E., Abalkhail, A., El-Garawany, Y., Anagreyyah, S., Alnafea, Y., ... & Draz, A. (2022). The Development of Technology to Prevent, Diagnose, and Manage Antimicrobial Resistance in Healthcare-Associated Infections. Vaccines, 10(12), 2100.

Glowicz, J. B., Landon, E., Sickbert-Bennett, E. E., Aiello, A. E., Dekay, K., Hoffmann, K. K., ... & Ellingson, K. D. (2023). SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update. Infection Control & Hospital Epidemiology, 44(3), 355-376.

Gu, D., He, J., Sun, J., Shi, X., Ye, Y., Zhang, Z., ... & Dong, R. (2021). The global infectious diseases epidemic information monitoring system: development and usability study of an effective tool for travel health management in China. JMIR Public Health and Surveillance, 7(2), e24204.

Guchhait, P., Chaudhuri, B. N., & Das, S. (2023). Bloodstream Infections with Opportunistic Pathogens in COVID-19 Era: A Real Challenge Necessitates Stringent Infection Control. Journal of Laboratory Physicians, 15(01), 131-138.

Kamli, M. R., Srivastava, V., Hajrah, N. H., Sabir, J. S., Ali, A., Malik, M. A., & Ahmad, A. (2021). Phytogenic fabrication of Ag–Fe Bimetallic nanoparticles for cell cycle arrest and apoptosis signaling pathways in Candida auris by generating oxidative stress. Antioxidants, 10(2), 182.

Kock, R., & Caceres-Escobar, H. (2022). Situation analysis on the roles and risks of wildlife in the emergence of human infectious diseases. Gland, Switzerland: IUCN.

Levy, Y., Miltgen, G., Rousseau, A., Lugagne, N., Teysseyre, L., Traversier, N., ... & Allyn, J. (2021). Case report: emergence of Candida auris in the Indian Ocean Region. The American Journal of Tropical Medicine and Hygiene, 104(2), 739.

Madad, S., Dhagat, P., & Cagliuso, N. (2021). Municipal healthcare delivery special pathogens preparedness and response in the city that never sleeps: the NYC Health+ Hospitals' emergency management approach to infectious disease threats. In Inoculating Cities (pp. 21-40). Academic Press.

Malik, M. A., Batterjee, M. G., Kamli, M. R., Alzahrani, K. A., Danish, E. Y., & Nabi, A. (2022). Polyphenol-capped biogenic synthesis of noble metallic silver nanoparticles for antifungal activity against Candida auris. Journal of Fungi, 8(6), 639.

Marena, G. D., Carvalho, G. C., Monazzi, L. C. S., Maschio-Lima, T., De Almeida, M. T. G., Da Silva, J. L. M., ... & Chorilli, M. (2022). Infection caused by Candida auris: state of the art. Mycosphere, 13(1), 820-861.

Mazumder, P., Kalamdhad, A., Chaminda, G. T., & Kumar, M. (2021). Coalescence of co-infection and antimicrobial resistance with SARS-CoV-2 infection: The blues of post-COVID-19 world. Case Studies in Chemical and Environmental Engineering, 3, 100093.

Nabeta, H. W., Kouokam, J. C., Lasnik, A. B., Fuqua, J. L., & Palmer, K. E. (2021). Novel antifungal activity of Q-Griffithsin, a broad-spectrum antiviral lectin. Microbiology Spectrum, 9(2), e00957-21.

Paudel, R. (2023). Emergence of Candida auris infection: A review. Microbes and Infectious Diseases.

Plachouras, D., Lötsch, F., Kohlenberg, A., Monnet, D. L., & Candida auris Survey Collaborative Group. (2020). Candida auris: epidemiological situation, laboratory capacity and preparedness in the European Union and European Economic Area*, January 2018 to May 2019. Eurosurveillance, 25(12), 2000240.

Rabaan, A. A., Eljaaly, K., Alfouzan, W. A., Al Mutair, A., Alhumaid, S., Alfaraj, A. H., ... & Muhammad, J. (2022). Psychogenetic, genetic and epigenetic mechanisms in Candida auris: Role in drug resistance. Journal of Infection and Public Health.

Rizk, N. A., Moghnieh, R., Haddad, N., Rebeiz, M. C., Zeenny, R. M., Hindy, J. R., ... & Kanj, S. S. (2021). Challenges to antimicrobial stewardship in the countries of the Arab League: Concerns of worsening resistance during the COVID-19 pandemic and proposed solutions. Antibiotics, 10(11), 1320.

Sabino, R., Veríssimo, C., Pereira, Á. A., & Antunes, F. (2020). Candida auris, an agent of hospital-associated outbreaks: which challenging issues do we need to have in mind?. Microorganisms, 8(2), 181.

Seneghini, M., Rüfenacht, S., Babouee-Flury, B., Flury, D., Schlegel, M., Kuster, S. P., & Kohler, P. P. (2022). It is complicated: Potential short-and long-term impact of coronavirus disease 2019 (COVID-19) on antimicrobial resistance—An expert review. Antimicrobial Stewardship & Healthcare Epidemiology, 2(1), e27.

Shaban, R. Z., Sotomayor-Castillo, C. F., Malik, J., & Li, C. (2020). Global commercial passenger airlines and travel health information regarding infection control and the prevention of infectious disease: What's in a website?. Travel Medicine and Infectious Disease, 33, 101528.

Shahbal, S., Jradi, H., & Alaklabi, N. M. (2023). EVALUATION OF PUBLIC HEALTH EDUCATION AND PRACTICE FROM THE PERSPECTIVES OF PUBLIC HEALTH ACADEMICIANS, POSTGRADUATE STUDENTS, AND ALUMNI IN SAUDI ARABIA. Journal of Population Therapeutics and Clinical Pharmacology, 30(17), 551-568.

Shahbal, S., Noshili, A. I., Hamdi, A. M., Zammar, A. M. A., Bahari, W. A., Al Faisal, H. T., ... & Buraik, L. M. (2022). Nursing profession in the light of Social Perception in the Middle East. Journal of Positive Psychology and Wellbeing, 6(1), 3970-3976.

Sharma, N., Behera, B., Jena, L., & Panigrahy, R. CANDIDA AURIS: A BRIEF REVIEW ON NOTORIOUS NOSOCOMIAL MULTIDRUG-RESISTANT CANDIDA SPECIES AS AN EMERGING FUNGUS GLOBALLY.

Sikora, A., & Zahra, F. (2020). Candida auris.

Teklemariam, A. D., Hashem, A. M., Saber, S. H., Almuhayawi, M. S., Haque, S., Abujamel, T. S., & Harakeh, S. (2022). Bacterial co-infections and antimicrobial resistance associated with the Coronavirus Disease 2019 infection. Biotechnology and Genetic Engineering Reviews, 1-22.

Thatchanamoorthy, N., Rukumani Devi, V., Chandramathi, S., & Tay, S. T. (2022). Candida auris: A mini review on epidemiology in healthcare facilities in Asia. Journal of Fungi, 8(11), 1126.

Vatanshenassan, M., Boekhout, T., Mauder, N., Robert, V., Maier, T., Meis, J. F., ... & Hagen, F. (2020). Evaluation of microsatellite typing, ITS sequencing, AFLP fingerprinting, MALDI-TOF MS, and Fourier-transform infrared spectroscopy analysis of Candida auris. Journal of Fungi, 6(3), 146.

Vuichard-Gysin, D., Sommerstein, R., Martischang, R., Harbarth, S., Kuster, S. P., Senn, L., & Widmer, A. (2020). Candida auris-recommendations on infection prevention and control measures in Switzerland. Swiss medical weekly, 150(w20297), w20297.

World Health Organization. (2022). Implications of the COVID-19 pandemic for patient safety: a rapid review.

Yakout, S. M., Alanazi, S., Jahlan, I., & Shahbal, S. (2023). Assessing the Significance of Pre-and Post-Health Education on the Changes of Knowledge Levels and Self-Efficacy in Pregnant Women with Urinary Tract Infections. HIV Nursing, 23(3), 1572-1579.