The Review Of
DIABETIC
STUDIES

OPEN ACCESS

Impact Of The Infection Control Standard Among Health Care Workers During The Hajj In Saudi Arabia 2025

Shabab Mohd Said Alzahrani[1], Ohoud Abdullah Soliman Abudawood[2], Seham Najim Alotaibi[3], Hani Saeed Alghamdi[4], Abdullah Samoot Albuhayri[5], Saeed Dhaifallah Saeed AlZahrani[6], Khadijah Abdulhadi Alabdullah[7], Ahmed Saeed Tuhami[8], Haifa Fahad Alotaibi[9], Fahad Almadi Alanazi[10], Jameela Faisal Kordi[11], Mashhour Ahmed Amrani[11]

[1]Specialist Nursing, Al baha health cluster Al qara general hospital, Saudi Arabia.
[2]Specialist nursing, Eradah complex for mental health Empowerd by jeddah first health cluster, Saudi Arabia
[3]Specialist Nursing, Branch of the Ministry of Health Jeddah, Saudi Arabia.
[4]Nursin technician, Eradah complex for mental health Empowerd by jeddah first health cluster, Saudi Arabia
[5] Pediatric Senior Registrar, KFH at ALbaha, Saudi Arabia.
[6] Pediatric Specialist, KFH at Albaha, Saudi Arabia.
[7]Medical sterilization, Prince sultan cardiac center alhassa, Saudi Arabia.
[8]Lab technician, King fahad hospital at albaha, Saudi Arabia.
[9]Director of clinical Nursing, prince Mohammed bin Abdulaziz hospital- Madina, Saudi Arabia.
[10]Nursing, Ministry of Health, Saudi Arabia.
[11]lab Technition, Alnoor Specialist Hospital, Saudi Arabia.

Abstract

Background

Saudi Arabia being a major pilgrimage center with an annual turnover of millions of pilgrims from all over the world has a high risk for transmission of infections; Health care workers (HCWs) are particularly vulnerable to these infections. The objectives of this research were to assess impact of the infection control standard among health care workers during the Hajj in Saudi Arabia, the role of pre deployment Hajj training of HCWs assigned Hajj duties with those HCWs. The mass gathering of pilgrims during the Hajj season from different countries with various epidemiological backgrounds creates a situation, which increases the risk of spread of infection both to the visiting pilgrims and their contacts on return home and health care workers. Healthcare infection control standard among health care workers during Hajj infections have been a critical cause of morbidity and an undue burden in the healthcare system in Saudi Arabia. Protocols of infection control standard management during the Hajj urge the significance of these measures to infection prevent the spread of contaminated organic essential fluids, the administration of harmful gases, and the proper disposal of hazardous bio-waste products. Unsafe practices in dealing with needle sticks, sharp instruments, contamination of the wound surface, **Aim of study:** To determine the Impact of the infection control standard among healthcare workers (HCWs) during the Hajj in Saudi Arabia 2025. **Methods:** Through cross sectional study design a randomly selected sample of health care workers during Hajj duties in 2025 were part of Hajj. Participants were taken from different Makkah region primary health care . A validated self-administered questionnaire was used to Impact of the infection control standard of (300) health care workers. **Results**: most of the participants (30.0%) were in the age group(30-49) years follow by the age 50-60 were (27.0%) followed by 30-39 years were (23.0) **Conclusion:** Our research highlighted the gaps in knowledge of the health care workers during the Hajj practicing the knowledge and practice. However previse study's concludes that even though the infection control standard among health care workers during the Hajj but there was a lack of practice. As infection control routine trainings are limited, gaps have been identified in knowledge and practice of infection control during the Hajj.

Keywords: Impact, infection, control, health care workers, Hajj, Saudi Arabia.

Introduction

Background

Hajj and Umrah are significant Islamic pilgrimages attracting millions of Muslims annually to Saudi Arabia. These mass gatherings pose unique health care workers health challenges, particularly in infection control standard [1] , due to the close proximity of individuals from diverse global backgrounds . health care workers play a crucial role in maintaining infection control during these events, ensuring the safety of pilgrims and healthcare providers alike [2] The deployment of 25,000 healthcare workers, during Hajj demonstrates the scale of efforts to address pub lic health concerns. Health care workers manage respiratory and gastrointestinal infections, leveraging health education and prevention strategies to minimize outbreaks [3]. Evidence underscores the importance of ongoing training in infection control and prevention and therapeutic communication to enhance health outcomes and inform better policy development. By addressing both individual and systemic health challenges, health care workers contribute significantly to public health management during one of the world's largest mass gatherings.[4]

Religious festivals attract a large number of pilgrims from worldwide and are a potential risk for the transmission of infectious between pilgrims, the health care workers and to the indigenous population. The gathering of a large number of pilgrims could compromise the health system of the host country.[5] The threat to global health security posed by infectious with epidemic potential shows the importance of advanced planning of infection control standard surveillance and response at these religious events. [6] Saudi Arabia has extensive experience of providing health care at mass gatherings acquired through decades of managing millions of pilgrims at the Hajj. In this report, we describe the extensive infection control standard planning, surveillance systems used to monitor public health risks, and health services provided and accessed during Hajj that together attracted more than 5 million pilgrims from 184 countries .[7]

Kingdom of Saudi Arabia (KSA) being the host of this singularly rigorous mega religious event has to face and manage all these challenges. Its government has accumulated a wealth of knowledge through decades of planning and innovations for the Hajj [8].Each year there is an early planning and coordination of efforts to maintain highest level of excellence not only between multiple KS agency/committees but also in collaboration with international agencies [9]. Aim of these coordination meetings is to identify occurrence of any emerging or potential public health emergency of an international concern or emergence of any infectious disease outbreak [10]

Pilgrims around the globe attend the Hajj together with different medical backgrounds and much co-morbidity [11]. With this increased migration in a densely occupied space within a limited time period, physical exhaustion, congregation and prayers, extreme weather conditions and crowded accommodations results in higher risk of emerging infection during and following Hajj [12]. Gathering of such a huge number of pilgrims compromises the local health system; health care workers (HCWs) being at the highest risk [13]. Once the Hajj days are over, pilgrims quickly disperse throughout the world likely to increase the risk of spreading epidemics not only in the host country but also on an international scale [14]

Amplified risk of transmitting infectious associated with such mass gathering vary, ranging from mild respiratory or gastrointestinal diseases to more severe diseases like Ebola, MERS etc. [15]

Free quality healthcare is provided to all the pilgrims during Hajj exposing the assigned HCWs to various infectious .The threat posed by the infectious to the HCWs incite the authorities and shows the importance of advance planning, training and public health surveillance [16]. Hence, a proactive public health program is initiated by MOH to train HCWs before each Hajj. The focus of such trainings is not only to train HCW just for the health care provision and treatment of ailments during the pilgrimage but also on the prevention and surveillance of health hazards along with HCW's self- protection [17].

Literature review

Infection control standard is a good subject for audit as it affects patient care, health care workers and quality of life and clinical outcomes [18]. Departments, microbiological safety and cleanliness audits of the hospital environment, and audits of standard healthcare equipment [19] . Additionally evidence-

based standards of practice have been developed [6-10]. It is now accepted that audit is a key function for infection control teams [20].

Recent studies estimated this high level of awareness among health care workers was attributed to the education and training on infection control standard owing to the nature of their profession. A study conducted in Nigeria [18] reported a lower level of health care workers knowledge as only 41–45% of the respondents possessed satisfactory general knowledge about infection control standard. This is in line with findings from Ethiopian [19] study where around 80% health care workers were aware of infection control. However, a significant within group knowledge difference was noted between the physicians, nurses and other health care workers per-forming Hajj duties; physicians as expected had the highest level of overall knowledge .The care of confirmed or suspected infection case is a stressful job and the training of the health care workers is corner stone in this situation [20].

In Africa including Ethiopia, the prevalence of hospital acquired infection was significantly high (12–35%) [21] However, awareness of the problem remains extremely limited because of other health priorities take precedence over infection prevention and patient safety considerations [22]

Most of the healthcare associated infections are caused by the transmission of pathogens from one patient to another, especially by healthcare workers who failed to practice infection prevention measures consistently [23]

Most effective strategies to prevent health care associated infections include audit of the incidence of infection, feedback of these infection rates to clinical staff, continuous infection control education programs, one infection control nurse for every 250 beds, and infection control audit for evaluating clinical practice [13]. The availability of qualified and well trained personnel and support of the infection control services and committee the main driving forces for proper utilization of the audits' results that lead to noticeable improvement in infection control services.

Online searching for studies exploring the knowledge and practical towards standard infection control precautions among primary healthcare workers yielded relatively few studies as most studies conducted in this field were among healthcare workers in hospitals and future health care workers. In addition, relatively limited studies were carried out in Saudi Arabia. [24]

Majority Hajj health care workers who sought pre-Hajj health training adhered to hand washing and use of surgical or N95 masks especially while contacting the patients. [14] in his study conducted in Saudi Arabia showed high compliance with hand washing 98% and 90% using face masks . Studies conducted in South Korea, India and China [23] also showed that training improves knowledge and compliance with standard pre-caution. A study conducted in Nigeria [25] showed a gap between the knowledge and practices on standard precautions among HCWs which was also observed in another study participants especially those who did not receive training.

Rationale

Though the HCWs were well aware about infection control standard but there was a lack of infection control practice. As infection control routine trainings are limited, gaps have been identified in knowledge and practice of infection control. This underscores the need for management to focus on provision of personal protective equipment as well as training a detraining of staff so that the standard precautions are adhered to especially for those going on Hajj duties .Emergence in African countries and massive migration of pilgrims from around the globe, it becomes imperative to adopt strict infection control measures during Hajj. We can improve our healthcare institute preparedness from the international experiences and help of CDC Rapid infection control standard Preparedness teams for assisting and training our health care workers. Moreover, immediate intervention for the suspected cases of emerging infectious diseases patients, good compliance to infection control practice, ongoing continuous training, following the national and international guidelines and assessment .

Aim of the study

To determine the Impact of the infection control standard among healthcare workers (HCWs) during the Hajj in Saudi Arabia 2025 .

Materials and methods

Study design:

This study is descriptive cross-sectional study

Study sitting:

The study has been carried out of different A group of health care workers who participated in Hajj duties in the current year was selected and evaluated for the outcome variables.. There are belonging to Ministry of health (MOH) distributed as North and South.

Study population:

Health sector care professionals (n=300) sample size was then a percentage of to accommodate for possible non-response/refusal/ non- avail-ability among the eligible study participants. The overall sample size for the survey was thus proposed to be at-least 300 participants . HCWs in each professional group (doctors, nurses and other paramedical staff) made up a stratum. The number of health care workers in each profession stratum was obtained from Ministry of Health and Ministry of Hajj. Proportional allocation to size was to calculate the number of health workers per stratum. Were invited to participate in during Hajj season between August 9th, 2025 to October 8th, 2025.

Sample size:

Sample size was calculated using open Epi online sample size calculator at 95% confidence level with bound on error of 5% regarding standard infection control precautions max sample size required is 300 participants.

Sample technique:

At first stage: simple random sampling method will be used to select the health sector has been carried out of different A group of HCWs who participated in Hajj duties in the current year was selected

Inclusion criteria:

- Health care workers (doctors, nurses and laboratory technicians) male and female, Saudi and non-Saudi, all ages, those who agreed to participate in the research.
- participated in Hajj time
- Health care workers have knowledge about infection control standard

Exclusion criteria:

No exclusion criteria.

Data collection tool and technique:

Data were collected by self-administrated questionnaire.

First part of the questionnaire includes questions about Demographic data of the participant (gender, age, nationality, job title .

Second part about knowledge and practice of about infection control during the Hajj which including hand will be assessed covering hand hygiene obtained from WHO injection safety, and protective equipment utilization with barriers of adherence to standard infection control precaution. Score was created for the participants` responses to knowledge questions and statements. Participants who scored at or above the mean score percentage for each subscale as well as for the overall were considered having “adequate ” and those who scored below the mean score percentage were considered having un adequate knowledge.

Data analysis:

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) software, version 24. Descriptive analysis was carried out were calculated for quantitative variables; frequency and proportion were calculated for categorical variables.

Ethical approval:

- Ethical approval for conducting this survey was obtained from the department of medical research and studies. Kingdom of Saudi Arabia.
- A written Informed consent was obtained from each participant from commencing the data collection.

- Permission and facilitation to distribute the printed copies of the questionnaire was acquired from the General Directorate Departments of Health in Makkah, Ministry of Health, Saudi Arabia..

Budget: Self-funded.

Result

Table 1 Distribution of socio demographic characteristics of the healthcare workers during the Hajj at Saudi Arabia. (n=300)

	N	%
Age		
<20-29	60	20
30-39	69	23
30-49	90	30
50-60	81	27
Gender		
Male	114	38
Female	186	62
Marital status		
Unmarried	60	20
Married	132	44
Divorced	45	15
Widowed	63	21
Nationality		
Saudi	246	82
Non-Saudi	54	18
Occupation		
Physicians	75	25
Nurse	102	34
Health inspector	66	22
Others	57	19
Years of experience		
1-10 years	114	38
11–20 years	78	26
> 20 years	108	36
Received training in infection control standard during Hajj		
Yes	126	42
No	174	58
Received training on preventive measures at entry points during Hajj		
Yes	90	30
No	210	70
Received written guidelines about infection control standard in Hajj		
Yes	84	**28**
No	216	72
Reading the written guidelines about infection control standard in Hajj		
Yes	126	**42**
No	174	58

Table 1 shows that most of the participants (30.0%) were in the age group(30-49) years follow by the age 50-60 were (27.0%) followed by 30-39 years were (23.0%), the majority of them female was

higher compared to male(62.0% and 38.0%) , regarding the marital status most of participants married were(44.0%) while unmarried were(20.0%) but the widowed were (21.0%) , regarding nationality the majority of participant are Saudi were(82.0%) while non-Saudi were(18.0%), regarding occupation the majority of participant are nurse were(34.0%) while Physicians practitioner were(25.0%) but the Health inspector were (22.0%), regarding Years of experience the majority of participant are 1-10 years were(38.0%) while >20 years practitioner were(36.0%), but the 11–20 years were (26.0%), regarding received training in infection control standard during Hajj the majority of participant answer No were(58.0%) while Yes were(42.0%), regarding the received training on preventive measures at entry points during Hajj the majority of participant answer No were (70.0%) while Yes were (30.0%), regarding the received written guidelines about infection control standard in Hajj majority of participant answer No were (72.0%) while Yes were (28.0%), regarding the reading the written about infection control standard in Hajj majority of participant answer No were (58.0%) while Yes were (42.0%).

Table 2 . Distribution of healthcare workers about infection control standard during the Hajj at Saudi Arabia

	N	%
Percentage of Saudi Workforce healthcare worker during the Hajj	228	76
Percentage of Foreign Workforce healthcare worker during the Hajj	72	24
Work place:		
Hospital	69	23
PHC	174	58
Other	57	19
Is there support from laboratories?		
Yes	57	19
No	213	**71**
Don't Know	30	10
Do you heave Microbiology Lab Support		
Yes	69	**23**
No	210	**70**
Don't Know	21	7
Monthly income, SAR		
Low income <5000	117	39
Moderate income 5000–15,000	60	20
High income >15,000	123	41
Presence of chronic diseased		
Yes	90	30
No	96	32
Don't Know	114	38
Is there monitoring and Evaluation for healthcare worker during the Hajj		
Yes	99	**33**
No	162	54
Don't Know	39	13

Table 2 shows the healthcare workers about infection control standard during the Hajj, regarding the percentage of Saudi Workforce healthcare worker during the Hajj were (76.0%), regarding the percentage of Foreign Workforce healthcare worker during the Hajj were(24.0%), regarding work place the majority of participant work in primary health care were(58.0%) while work in hospital were(23.0%) but in other were (19.0%), regarding is there support from laboratories the majority of participant are answer No were(71.0%) while do not Know were (10.0%) but answer Yes were (19.0%), regarding do you heave Microbiology Lab Support the majority of participant are answer No were(70.0%) while answer Yes were(23.0%), but do not Know were (7.0%), regarding monthly income, SAR the majority of participant high income >15,000 were(41.0%) while low income <5000 were(39.0%) but the moderate income 5000–15,000 were (20.0%), regarding the presence of chronic diseased the majority of participant answer do not Know were (38.0%) while No were (32.0%) but Yes were (30.0%), regarding is there monitoring and Evaluation for healthcare worker during the Hajj majority of participant answer No were (54.0%) while Yes were (33.0%) but do not know were (13.0%).

Table 3. Distribution the Impact of the infection control standard among health care workers during the Hajj .

	N	%
During the Hajj who had been investigated for infection control standard and the duration from sample taking and releasing the result		
One day	99	33
2 days	126	42
3 days	30	10
More	45	15
Infection has spread from ill people to health care workers through close contact during the Hajj or vice versa		
Yes	87	29
No	144	48
Don't Know	69	23
Infectious diseases has been diagnosed in patients in the during the Hajj		
Yes	108	36
No	123	41
Don't Know	69	23
Clinical experience of the HCWs in the last 2 years or less regarding		
Working in place where Infectious diseases	30	10
Patient was diagnosed or admitted.	93	31
Infectious diseases patient Cared a	177	59
The impact of suspicion of having Infectious diseases on the HCWs work performance, social and psychological life during the Hajj		
Work performance:	135	45
Social life	105	35
Psychological life	33	11
all of them	27	9
Some infected health care workers had mild symptoms (such as cold-like symptoms)		
Yes	153	51
No	87	29
Don't know	60	20
Some infected health care workers had no symptoms		
Yes	93	31

No	135	45
Don't know	72	24
Do you know that infected health care workers need isolation during the Hajj		
Yes	183	61
No	63	21
Don't know	54	18
Most of the health care workers who died during the Hajj had an underling medical condition not Infectious Diseases		
Yes	210	70
No	60	20
Don't know	30	10

Table 3 shows the distribution the Impact of the infection control standard among health care workers during the Hajj, regarding during the Hajj who had been investigated for infectious diseases and the duration from sample taking and releasing the result the majority of participant 2 days were (42.0%), followed by One day were (33.0%) but more days were (15.0%), regarding the infectious diseases has spread from ill people to others through close contact the majority of participant answer No were(48.0%) followed by Yes were (29.0%) but don't Know were (15.0%), regarding infectious diseases has been diagnosed in patients in the during the Hajj majority of participant answer No were(41.0%) while answer Yes were(36.0%) but don't Know were (23.0%), regarding clinical experience of the HCWs in the last 2 years or less regarding the majority of participant infectious diseases patient Cared a were(59.0%) while Patient was diagnosed or admitted were (31.0%) but working in place where Infectious diseases were (10.0%), regarding impact of suspicion of having Infectious diseases on the HCWs work performance, social and psychological life during the Hajj the majority of participant work performance were(45.0%) while social life were(35.0%), but psychological life were (11.0%) while all of them were (9.0%),regarding some infected people had mild symptoms (such as cold-like symptoms) majority of participant answer Yes were(51.0%) but answer No were (29.0%) while don not know were (20.0%), regarding some infected Some infected health care workers had no symptoms the majority of participant answer No were (45.0%) but Yes were (31.0%) while do not Know were (24.0%) , regarding you know that infected health care workers need isolation during the Hajj majority of participant answer Yes were (61.0%) while No were (21.0%) but do not know were (18.0%), regarding Most of the people who died during the Hajj had an underling medical condition not Infectious Diseases majority of participant answer Yes were (70.0%) while No were (20.0%) but do not know were (10.0%).

Discussion

Applying of the infection control systems on healthcare worker during the Hajj pilgrims is a crucial step in preventing the possible outbreaks during Hajj. Identifying healthcare workers' difficulties is of concern in order to improve the uses of Infectious Diseases Systems of work during the Hajj [23]. The most frequent difficulties facing healthcare workers were refusal of vaccine and chemoprophylaxis by some pilgrims, language barriers, and difficulties in organizing pilgrims. The MOH statistics during 2025 showed that the total number of pilgrims was 3 million people from over 146 countries assemble annually, from different countries.[24] This number did not include pilgrims coming from different regions of KSA. This wide diversity of nationalities with different languages imposes a real challenge for healthcare workers to provide high quality service, as they have to communicate with them. Sometimes, language barrier hinders understanding of pilgrims to the necessary procedures at during the Hajj, appropriate training courses before the Hajj season may solve this problems.[26]

To determine the Impact of the infection control standard among healthcare workers (HCWs) during the Hajj in Saudi Arabia 2025 study where around 40% HCWs were aware of infection control . However, a significant within group knowledge difference was noted between the physicians, nurses and other HCWs per-forming Hajj duties; physicians as expected had the highest level of overall knowledge. [27] In order to induce a positive behavior change of adopting these standard precautions

in the HCWs there is a need to address concerns faced by them in the field and reinforcing knowledge through frequent refresher training sessions [25]. Varieties of training methods can be used to educate, implement and improve the concepts of infection control. The hazard and personal protection equipment (PPE) simulation trainings emanated during West Africa infection control, showed improvement in infection control outcome, prevention and control [28]. In Hajj season, these concepts could be used for such emerging infectious diseases [29]

Clinical audit is a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change [30]. The so called, audit cycle, comprises five basic stages: choosing a topic, specifying appropriate practice standards, testing actual practice against these standards (data collection), correcting practice where it falls short, and finally, re-auditing to confirm that standards are met [26]. Attainment of standards may only be achieved after several rounds of the audit cycle [19]. Hospital infection control is a good subject for audit as it affects patient care, quality of life and clinical outcomes [27]. Additionally, evidence-based standards of practice have been developed [10], in our study healthcare workers about infection control standard during the Hajj, regarding the percentage of Saudi Workforce healthcare worker during the Hajj were (76.0%), regarding the percentage of Foreign Workforce healthcare worker during the Hajj were(24.0%), regarding work place the majority of participant work in primary health care were(58.0%) while work in hospital were(23.0%) but in other were (19.0%), regarding do you heave Microbiology Lab Support the majority of participant are answer No were(70.0%) while answer Yes were(23.0%), but do not Know were (7.0%), regarding the presence of chronic diseased the majority of participant answer do not Know were (38.0%) while No were (32.0%) but Yes were (30.0%), regarding is there monitoring and Evaluation for healthcare worker during the Hajj majority of participant answer No were (54.0%) while Yes were (33.0%) but do not know were (13.0%).(See Table 2)

Increasingly infection control standard are gaining international recognition as effective public health tools for infection control data management by stakeholders operating from different locations. Overall, infection control standard were operational during the Hajj the health is a web-based electronic solution, introduced by the Saudi MOH to improve communication among public health professionals involved in outbreak management as well as to provide quality health data for planning and effective allocation of resources. [26]

During the 2025 Hajj, in addition to the traditional data capture and reporting tools, the hospital surveillance teams also collated and entered infectious diseases data directly into Electronic Surveillance Systems once a notification was received from the laboratory, emergency rooms, isolation wards and other departments in hospitals. The uploaded data were immediately displayed on electronic dash boards in the CCC's situation rooms. Data were analyzed and reports generated in real-time that could be immediately accessed by public health officials and decision makers or disseminated through phone messages to responsible persons for immediate action.[31]

Conclusion

The spread of infectious at a gathering of large numbers of pilgrims within a short space of time might be expected to compromise the health system of the host country. Additionally, infectious pose a threat to global health security and infection control standard show the importance of planning, communication, and public health surveillance and response at these religious events. Saudi Arabia has much experience of providing health care during religious mass gatherings through decades of managing millions of pilgrims who undertake Hajj . Findings highlight that while health care workers demonstrate a substantial impact on reducing infection risks through proactive measures, gaps persist in knowledge, adherence to practices, and access to resources. Targeted training programs, continuous professional development, and improved infrastructure are essential to enhancing their effectiveness. By addressing these areas, the study underscores the need for a robust, evidence-based approach to infection control standard during Hajj and Umrah, contributing to better health outcomes for health care workers and pilgrims and supporting global public health security

References

1. Alahmari, A. A., Khan, A. A., Alamri, F. A., Almuzaini, Y. S., Alradini, F. A., Almohamadi, E., ... & Jokhdar, H. A. (2022). Hajj 2021: Role of mitigation measures for health security. Journal of Infection and Public Health, 15(11), 1350-1354.

2. Ardiana, M., Utami, E. R., Al Farabi, M. J., & Azmi, Y. (2023). The Impact of Classical Cardiovascular Risk Factors on Hospitalization and Mortality among Hajj Pilgrims. The Scientific World Journal, 2023.
3. Aljuhani, O., Al Sulaiman, K., Al Bekairy, A. M., Almajed, K., Al Harbi, M., Thabit, A. K., ... & Al-Jedai, A. (2023). Clinical pharmacy services in acute care setting during mass gatherings (Hajj): Insights from a task force. Journal of Infection and Public Health.
4. Beni Melhem, M., Yasser, M. M., Tagyan, A. I., Mohamed, M. S., Alkhalifah, D. H. M., & Hozzein, W. N. (2024). Epidemiology of Nosocomial Infections in the Intensive Care Unit (ICU) at Beni-Suef Hospital and their Control strategies. Catrina: The International Journal of Environmental Sciences, 32(1), 115-127.
5. Abalkhail, A. A. A., & Al Amri, S. M. A. (2022). Saudi Arabia's Management of the Hajj Season through Artificial Intelligence and Sustainability. Sustainability, 14(21), 14142.
6. Kebede, T., & Molla Sisay, M. (2022). Attitudes of Healthcare Workers about Prevention and Control of Nosocomial Multidrug-Resistant Tuberculosis Infection in Two Top-Ranked Tuberculosis Specialized Public Hospitals of Ethiopia. Canadian Journal of Infectious Diseases and Medical Microbiology, 2022.
7. Meregildo-Rodriguez, E. D., Ortiz-Pizarro, M., Asmat-Rubio, M. G., Rojas-Benites, M. J., & Vásquez-Tirado, G. A. (2024). Prevalence of latent tuberculosis infection (LTBI) in healthcare workers in Latin America and the Caribbean: systematic review and meta-analysis. Le Infezioni in Medicina, 32(3), 292
8. Patwary, M. M., Alam, M. A., Bardhan, M., Disha, A. S., Haque, M. Z., Billah, S. M., ... & Kabir, R. (2022). COVID-19 vaccine acceptance among low-and lower-middle-income countries: a rapid systematic review and meta-analysis. Vaccines, 10(3), 427.
9. Bunduki, G. K., Masoamphambe, E., Fox, T., Musaya, J., Musicha, P., & Feasey, N. (2024). Prevalence, risk factors, and antimicrobial resistance of endemic healthcare-associated infections in Africa: a systematic review and meta-analysis. BMC Infectious Diseases, 24(1), 158.
10. Issa, M., Dunne, S. S., & Dunne, C. P. (2023). Hand hygiene practices for prevention of health care-associated infections associated with admitted infectious patients in the emergency department: a systematic review. Irish Journal of Medical Science (1971-), 192(2), 871-899.
11. Mahdi, H. A., Qashqari, F. S., Hariri, S. H., Bamerdah, S., Altayyar, S. A., Almalki, H. M., ... & Rashid, H. (2022). Low prevalence of syndromic respiratory tract infections among returning hajj pilgrims amidst the COVID-19 pandemic: A post-Hajj survey. Tropical medicine and infectious disease, 7(8), 182.
12. Coudeville, L., Amiche, A., Rahman, A., Arino, J., Tang, B., Jollivet, O., ... & Wu, J. (2022). Disease transmission and mass gatherings: a case study on meningococcal infection during Hajj. BMC Infectious Diseases, 22(1), 1-10.
13. Alshehri, M. H., Alghamdi, A. H., Subke, A. A., Alamri, S. A., Al Muwallad, H. H., Alghamdi, S. A., ... & Bugis Sr, O. A. (2022). Physicians' Knowledge, Practices, and Perceptions of Reporting Communicable Diseases at Primary Health Care Centers in Jeddah, Saudi Arabia: A Cross-Sectional Study. Cureus, 14(12).
14. Iskandar, K., Molinier, L., Hallit, S., Sartelli, M., Hardcastle, T. C., Haque, M., ... & Roques, C. (2021). Surveillance of antimicrobial resistance in low-and middle-income countries: a scattered picture. Antimicrobial Resistance & Infection Control, 10(1), 1-19.
15. Aldossari, M., Aljoudi, A., & Celentano, D. (2019). Health issues in the Hajj pilgrimage: a literature review. East Mediterr Health J, 25(10), 744-753.
16. Alahmadi, A. S., Mansori, F. M. A., Abdel-Azeem, A. M., & Shahin, M. A. (2020). The effect of cbahion knowledge and practice of standard precautions among healthcare workers in Medina. Archives of Pharmacy Practice, 11(3-2020), 146-160.
17. Sun, Y., Ma, X., Lindtner, S., & He, L. (2023). Data work of frontline care workers: Practices, problems, and opportunities in the context of data-driven long-term care. Proceedings of the ACM on Human-Computer Interaction, 7(CSCW1), 1-28.
18. Alotaibi, B. M., Yezli, S., Bin Saeed, A. A. A., Turkestani, A., Alawam, A. H., & Bieh, K. L. (2017). Strengthening health security at the Hajj mass gatherings: characteristics of the infectious diseases surveillance systems operational during the 2015 Hajj. Journal of travel medicine, 24(3), taw087.

19. Goni, M. D., Hasan, H., Wan-Arfah, N., Naing, N. N., Deris, Z. Z., Arifin, W. N., ... & Adam, B. M. (2020). Health education intervention as an effective means for prevention of respiratory infections among Hajj pilgrims: a review. Frontiers in public health, 8, 449.
20. Haridi, H. K., Salman, K. A., Basaif, E. A., & Al-Skaibi, D. K. (2017). Influenza vaccine uptake, determinants, motivators, and barriers of the vaccine receipt among healthcare workers in a tertiary care hospital in Saudi Arabia. Journal of Hospital Infection, 96(3), 268-275.
21. Li, H., Yuan, K., Sun, Y. K., Zheng, Y. B., Xu, Y. Y., Su, S. Z., ... & Lu, L. (2022). Efficacy and practice of facemask use in general population: a systematic review and meta- analysis. Translational psychiatry, 12(1), 49.
22. Khatami, A. (2014). Serogroup C meningococcal conjugate vaccines: immunogenicity, immune persistence and induction of immunological memory (Doctoral dissertation, ResearchSpace@ Auckland).
23. Can, L. (2020). Spiritual Subjects: Central Asian pilgrims and the Ottoman hajj at the End of Empire. Stanford University Press
24. Johari, J., Hontz, R. D., Pike, B. L., Husain, T., Chong, C. K., Rusli, N., ... & AbuBakar, S. (2021). Multiyear prospective cohort study to evaluate the risk potential of MERS-CoV infection among Malaysian Hajj pilgrims (MERCURIAL): a study protocol. BMJ open, 11(8), e050901
25. Salinas, R. C., & Madison, S. D. (2016). Home health care. Post-Acute and Long-Term Medicine: A Pocket Guide, 1-11.
26. Al-Tawfiq, J. A., Gautret, P., & Schlagenhauf, P. (2022). Infection risks associated with the 2022 FIFA World Cup in Qatar. New Microbes and New Infections, 49.
27. Thabit, A. K., Alfardus, N., Eljaaly, K., & Alshennawi, M. (2023). Antimicrobial utilization in Hajj 2022: An evaluation of quality indicators. Journal of Infection and Public Health.
28. Alslamah, T., & Abalkhail, A. (2022). The National Strategies for and Challenges in Infection Prevention and Control of the Healthcare System in the Kingdom of Saudi Arabia (Review Study). Vaccines, 10(8), 1302.
29. Alandijany, T. A. (2023). Respiratory Viral Infections during Hajj Seasons. Journal of Infection and Public Health.
30. Al Ra'awji, B. A., Almogbel, E. S., Alharbi, L. A., Alotaibi, A. K., Al-Qazlan, F. A., & Saquib, J. (2018). Knowledge, attitudes, and practices of health-care workers regarding hand hygiene guidelines in Al-Qassim, Saudi Arabia: A multicenter study. International journal of health sciences, 12(2), 3
31. Desta, M., Ayenew, T., Sitotaw, N., Tegegne, N., Dires, M., & Getie, M. (2018). Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. BMC health services research, 18(1), 1-10.