A Mixed-Methods Study to Investigate the Awareness by Pilgrims and the Saudi Authorities of Health Risks Arising From the Hajj Pilgrimage in Saudi Arabia

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This thesis is submitted for the degree of Doctor of Philosophy at

University College London

January 2023

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Declaration

'I, **Mater Matar Almehmadi**, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.'

Signature:

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Acknowledgements

I would first like to express my deepest thanks both to my supervisor, Professor David Alexander and my second supervisor, Dr. Gianluca Pescaroli for their great support and encouragement.

Next, I wish to express my love and appreciation to my family, especially to my wife Nassem whom, despite illness, has always been there to support me during my PhD journey. I will also mention with affection my son, Abdulrhman and my two daughters, Fajer and Jwana who are very dear to me.

My own parents have been incredibly supportive during this extended period of study as well as my three older brothers, Mutair, Abdulrhman, and Taleb who have selflessly helped with so many aspects of life.

I would like to express my appreciation to all my friends and university colleagues, with particular thanks to the staff of my research faculty, the Institute for Risk and Disaster Reduction. Thank you all for patiently sharing your time and knowledge with me. I am incredibly grateful for your inspiring and insightful advice.

Finally, I want to thank my sponsor, the Royal Embassy of Saudi Arabia Cultural Bureau who have always been generous in offering their valuable time and resources in supporting my research.

Abstract

One of the most important factors in developing preventative measures is awareness of health risks among public authorities and the public themselves. The coronavirus pandemic of 2020-2023 has exposed significant weaknesses in public health systems that need to be addressed, although research has so far been limited with respect to studies that have explored the perceptions of both the public and authorities about the uptake of preventative health measures.

As it is the host of the annual Hajj pilgrimage, Saudi Arabia offers a good case study of the health management of one of the biggest mass gatherings in the world. Although the health strategy here usually involves an array of preventative measures, the uptake among pilgrims is extremely low.

As a case study exploring the factors that determine uptake, the Hajj pilgrimage is approached in this dissertation using a mixed methodology for the collection of data from the officials of the Hajj and the individuals who participate in it. Some 280 participants were canvassed in the quantitative study. The findings are that 94% considered the Hajj to be safe and limited themselves to taking pre-travel advice on health, while 70% of the respondents reported the diversity of the pilgrims to be the main factor threatening health outcomes. Overall, the study reported a significant shortfall in pilgrims' perception of the health risks associated with the Hajj pilgrimage. Qualitative research was then utilised to collect data from 17 Hajj officials, using semi-structured interviews followed by thematic analysis.

The key themes that emerged in the analysis include, first, the safety of the Hajj as perceived by Saudi officials; secondly, in the face of health risks, how the safety of pilgrims is maintained by Saudi officials; thirdly, avoiding the health risks of the Hajj pilgrimage; fourthly holding training sessions for the Hajj workers; fifthly, the pilgrims' awareness of health risks; sixthly, the education of pilgrims about health risk in their individual countries; and finally, the use of new technologies to raise the pilgrims' awareness about health instructions and measure their satisfaction regarding the outcomes.

Impact Statement

While achieving positive public health outcomes is one of the most important goals for all the nations in the world, mass gatherings pose serious health concerns and can result in substantial negative health outcomes in the local and national community. In line with the potential impact of mass gatherings on global security via the spread of disease, the international research community regards it as prudent to focus on the uptake of preventative health measures by the participants in events such as the Hajj pilgrimage. This research underlines the perceptions of health officials regarding the uptake of health precautions in the light of the measures imposed by the Saudi public authorities during the Hajj.

A mixed methods quantitative and qualitative approach was taken for the research, where a cross-sectional survey was conducted among internal and external pilgrims performing the Hajj. The main objective of this study was thus to investigate the role and perspectives of the Saudi authorities in raising awareness of health risks during the Hajj and the response of the pilgrims. One important parallel objective has been to understand the pilgrims' perspectives on pre-travel preparation and their precautions during the pilgrimage itself.

Infectious diseases are among the most prevalent health concern during the Hajj, while the recent coronavirus pandemic has provided justification for the role of mass-

gathering events and the spread of diseases. Previous studies have indicated that a significant number of persons are infected with influenza during mass gatherings. These notably occur in arid or semi-arid weather conditions which, alongside the diverse nature of the pilgrims, provides the best environment for the spread of diseases. The propagation of the coronavirus as a result of mass gatherings has been evidenced in several countries, including Italy, Malawi and Malaysia among others, which has had a greater impact as a factor than other socio-economic factors within the individual countries. The quantitative survey evaluated the general safety and preventative measures applied, the factors that influence public health safety at Hajj, the source of pre-travel health advice, recommended preventative health measures, and the effectiveness of preventative measures. Conducting semi-structured interviews with 17 research participants then gave us the opportunity to explore their opinions and experiences in the qualitative part of the research. It was deemed important to follow a triangulation approach to those directly involving in the hajj pilgrimage, which meant giving a voice to both the Saudi authorities and the hajj pilgrims themselves in order to understand in depth the strengths and weaknesses of the factors deemed most influential in impacting health risk awareness for the Hajj pilgrimage.

Among the key findings were that the demographics of the participants of these events precipitate transmission of these diseases, with key demographic factors including age, sex, education, employment and lifestyle among others. As such, the research sought to explore how different demographic factors come into play in terms of management attitudes towards the Hajj attendees and public perceptions themselves towards

preventative health initiatives imposed during the Hajj pilgrimage. The research also accounted for a number of stakeholders important to developing strategic policies and approaches to achieve greater positive public health goals. Among the key stakeholders included here were Saudi Arabia's public health officials, citizens, students, educators and global public health ambassadors.

The qualitative approach adopted in this study has rarely been used in research on Saudi Arabia's approach to the Hajj pilgrimage. Here our focus was on how public officials raise risk awareness among hajj pilgrimage. In this way, the study aimed to fill the current gaps in knowledge and contribute to the effective use of qualitative research in the domain of mass gathering. Our conclusion was that a deeper understanding of pilgrims' health needs during the Hajj would enable officials to restructure their method with regard to the gaps identified in the current system.

The hope is that the research outcomes of the qualitative study will greatly help Saudi officials in identifying possible weaknesses in the measures already imposed during Hajj. The conclusions and recommendations provided by an evaluation of the current preventive health system might assist officials in creating policies that drive positive public health goals. Lasting solutions from the research will then help the Saudi government to manage the variability of the uptake of preventive health measures during Hajj.

Another of the essential contributions of this study and its findings is to provide a realistic picture of Saudi authorities in Saudi Arabia based on the views and

experiences of the participants. In doing so, our study has also exposed a number of gaps which will prove important in promoting future research by other scholars. This project has also provided a database for future researchers interested in the field of mass gathering, enabling them to perform multiple studies on the most essential topics that emerged from the current findings. By building on the existing research literature, our study findings can enhance current understanding of the role of decision-makers in the field of mass gathering.

On an international level, evidence-based strategies drawn from our research will be of global significance with regard to the needs and tools required for management of mass gatherings in regard to public health concerns. Since the complexity of the management of mass gatherings relies upon different factors - such as location, weather conditions, types of diseases, number of persons attending and the effectiveness of the host country public health system - this research can provide a benchmark in the exploration of these themes with regard to the future achievement of positive public health goals in the individual countries and globally.

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List of abbreviations

RO - Reproduction Rate

SARS - Severe Acute Respiratory Syndrome

MERS-CoV - Middle East Respiratory Syndrome

WHO - World Health Organization

ECDC - European Centre for Disease Control

SFDRR - Sendai Framework for Disaster Risk Reduction

RSVs - Respiratory Syncytial Virus

NDM-1 - New Delhi metallo-beta-lactamase-1

HBM - Health Belief Model

TA - Thematic Analysis

KSA - Kingdom of Saudi Arabia

UCL - University College London

NCBE - National Committee of Bio-Ethics

KACST - King Abdulaziz City for Science and Technology

CHAPTER 1: INTRODUCTION

1.1 Background

Every year, approximately three million Muslims from all over the world journey to the Saudi city of Mecca to complete the Hajj pilgrimage. The pilgrimage has been strictly observed for centuries (Salamati & Rahimi-Movagher, 2016). It is one of the five pillars of the Islamic religion and should be observed at least once by every able Muslim (Salamati & Rahimi-Movagher, 2016). As the global Muslim population has grown over the centuries, the number of those willing and able to complete the annual pilgrimage has increased significantly, with the 2019 edition attracting approximately 2.5 million visitors (The National, 2019). With such a large number of pilgrims attending every year, the Hajj is marked by intense congestion, a hot climate, diverse hygiene standards and shared accommodation (Shujaa & Alhamid, 2015). These circumstances regrettably create a facilitative environment for health risks.

As the host of the most sacred sites in the Islamic world, the Saudi government has the noble responsibility of safeguarding the health of all pilgrims. As such, Saudi public health officials are constantly engaged in the process of managing the prevalent health risks associated with the Hajj. In addition, foreign governments and international health agencies are conscious of the mass gathering's health risks as there is a possibility of pilgrims importing infectious diseases to their countries of origin (Shujaa & Alhamid, 2015).

The magnitude of the potential health risks facing the Hajj became apparent in 2020 following the declaration of a global coronavirus pandemic. The novel coronavirus, Covid-19, emerged in China in late 2019 and quickly spread through the rest of the world. With a basic reproduction rate (R0) of between 2-2.5 and a high of 102.5 per 100,000 hospitalisation rate for the most vulnerable populations, Covid-19 has significantly outpaced other pandemics that threatened the Hajj such as SARS and MERS-CoV (CDC, 2020). Given the rapid spread of the disease, public health authorities have warned that its impacts will only worsen unless mitigation measures are taken. Most of the mitigation efforts around the world have targeted reduced social interactions, thus reducing the reproduction rate. However, several governments have also extended this preventative move to the Hajj, including some that account for the highest pilgrim numbers, such as Indonesia (Chappell, 2020).

Furthermore, the Kingdom of Saudi Arabia has intimated that it would be difficult to control social interactions in a mass gathering as large as the Hajj and has instead prepared for a much leaner pilgrimage. As of June 2020 then, the Ministry of Hajj decreed that only a small number of pilgrims residing in Saudi Arabia would be allowed to embark on the 2020 edition (Dadouch, 2020). While significantly scaling down Islam's defining pilgrimage may seem extreme, it is in line with Saudi Arabia's holy duty as the custodian of the Kaaba to safeguard and protect all pilgrims.

To address the health risks that face pilgrims while in Mecca, the Saudi Ministry of Health publishes a raft of preventative health measures before every Hajj cycle. In addition to these measures, pilgrims have a wide array of sources for health education

that they access before embarking on the Hajj. This is advantageous as studies have consistently shown that pre-travel health preparation, including seeking education, improves the health outcomes of international travellers (Wynberg et al., 2012). Sadly, however, the uptake of the recommended preventative health measures has been found to be lacking in certain pilgrim populations (Badahdah et al., 2018). The underlying reasons for this are still largely unclear as there has been very limited research into pilgrims' perceptions of the health risks that exist during the Hajj and the preventative health measures recommended by the Ministry of Health. Ultimately, the decisions by Hajj pilgrims on seeking pre-travel health advice and adopting recommended preventative health measures are greatly influenced by their beliefs and attitudes that have been shaped by years of cultural and social influences. As such, moving forward, aggressive public awareness and education are needed to sensitise pilgrims to the need for pre- Hajj health advice seeking behaviour and the validity of all recommended preventative health measures. Some of the key factors under consideration in the study are thus the perceptions of the pilgrims towards uptake of preventive health measures and, mostly importantly, the officials' attitudes to management of the events. Both of these two groups would provide great research contributions towards the management of events of the magnitude of Hajj and offer further strategies in increasing the uptake of preventive health measures among pilgrims.

1.2 Research problem

Mass gatherings have a substantial negative impact on community health outcomes in the event that they are not managed effectively. Critical elements that surround the effective management of these gatherings include health infrastructure, planning, global spread and public awareness (World Health Organization, 2011). Hence, the effects of these gatherings across the world have sparked numerous studies and debates in an attempt to manage them effectively. This research focuses on the management attitudes and the public perceptions towards preventative health initiatives.

As one of the largest mass religious gathering in the world, the Hajj has serious public health implications on an international level as advancements in transportation technology over the last century have resulted in human activity not being limited by geography. However, these advances have also meant that humans can more easily acquire and spread infections such as bacteria, viruses, mycoplasma and fungi (Niu & Xu, 2019). While environmental factors can influence the transmission of these infectious factors, social factors such as lifestyle habits and population density often have a greater mediating effect (Niu & Xu, 2019). For example, the Hajj's congested nature creates a conducive environment for the spread of infectious diseases. Furthermore, the tropical arid climate of Mecca during the Hajj does little to contain the spread of global infectious disease, while also increasing exhaustion among pilgrims (Niu & Xu, 2019). In view of the religious nature of Hajj, the Saudi authorities have little freedom to stop or postpone the annual event. Thus, they must instead strive

towards improving their public health capabilities to minimise its threat to international health security.

While the Hajj pilgrimage has occurred every year without fail for the last 14 centuries, it is only in the last century that it has grown to have the global representation that it enjoys today (Salamati, & Rahimi-Movaghar, 2016). The consequences for international public health of such a huge mass gathering are best seen in the events leading up to the 2009 Hajj cycle. A few months before the 2009 pilgrimage, a meeting was convened by representatives from WHO, the Saudi Ministry of Health, the European Centre for Disease Prevention (ECDC), the Centre for Disease Control and Prevention (CDC) in the United States and a series of other national and international public health agencies to discuss how to protect pilgrims against the developing H1N1 Influenza A pandemic (Sullivan et al., 2010).

It was believed that a pandemic could potentially be imported into the Hajj owing to the fact that some pilgrims were from regions where here had been outbreaks and also because many visiting pilgrims would be from low-income countries that lacked the resources to prevent or treat an H1N1 outbreak. With the Hajj being characterised by crowded, hot and humid conditions conducive for the spread of disease, the possibility was very real that pilgrims could become infected at the mass gathering to go on to transport the disease to their home countries (Sullivan et al., 2010). While no H1N1 case was ultimately reported at the Hajj, a more severe incident would recur in 2020. By June 2020, the novel coronavirus had infected over two million people and claimed the lives of over 160,000 people (Algaissi et al., 2020). By early

July, the figures in Saudi Arabia had grown to over 200,000 confirmed cases and close to 2,000 deaths (Algaissi et al., 2020).

At the beginning of the outbreak, most of the cases in the Kingdom were caused by individuals returning into the country. As a result, the country's primary response to the disease has been to limit movement to and within the country. This strategy has also limited the country's ability to hold an effective pilgrimage at full capacity. Given the potential impacts the Hajj could have on global health security, Saudi public health officials, international agencies and pilgrims needed to be on the same page. Regrettably , studies have found the uptake of certain recommended preventative health measures to be mixed among some of the pilgrims (Razavi et al, 2016) In addition, in many instances pilgrims do know about the existence of certain health risks or the importance of some preventative health measures (Barasheed et al., 2016). Unless these omissions are remedied quickly, there is a high likelihood that what was feared in 2009 with the H1N1 pandemic could occur in the future, with deadly consequences.

1.3 Purpose of the Study

The Hajj is affected by a wealth of public health issues. Infectious diseases are undoubtedly the most prevalent public health issue during the Hajj despite occurrences of stampedes that cause significant number of deaths (Shujaa & Alhamid, 2015). The congested conditions, hot climate and diverse medical backgrounds of the pilgrims

create a conducive environment for the spread of infectious diseases. For example, it is reported that as many as a third of all pilgrims that embark on the Hajj become infected with influenza during the mass gathering (Alfelali & Rashid, 2014). In fact, the high prevalence of influenza has led to the use of the phrase “Hajj cough” to refer to it. Regrettably , infectious diseases with higher mortality rates are also reported during the Hajj, with pneumonia being the leading cause of hospital admissions during several Hajj editions (Shujaa & Alhamid, 2015). Additionally, the emergence of a global coronavirus pandemic in 2020 has shown that the Hajj can not only impede global health security but also be impeded by it. Fortunately, however, there is a series of preventative health measures that can be applied to significantly reduce the risk of infectious diseases, even in a mass gathering as large as the Hajj. The Saudi Ministry of Health recommends some of the measures to pilgrims every year. Many of these measures, including vaccinations and hygiene standards, have been found to be effective in numerous studies (Razavi et al., 2016).

Regrettably, the uptake of these recommended health measures varies considerably among pilgrims. Understanding the perception of risk and beliefs held by pilgrims towards health risks and recommended preventative measures, respectively, could provide Saudi public health officials with the insight needed to implement effective and lasting solutions. The overall aim of this study will then be to determine the level of risk awareness among Hajj pilgrims. More specifically, the study will investigate the nature and prevalence of pre-travel advice-seeking behaviour among

pilgrims and the impact it consequently has on their uptake of the preventative health measures recommended by the Saudi Ministry of Health.

The realisation of the overall purpose of this study will be guided by the following goals and objectives:-

Goal 1: To obtain a deep understanding of pilgrim's health needs during the Hajj.

Objective 1: To determine which preventative health measures are commonly undertaken by pilgrims before travel, which information is accessed, and which sources are used.

Objective 2: To establish how seeking pretravel health information is linked to the uptake of preventative measures recommended by the Saudi Ministry of Health for Hajj pilgrims, such as vaccination.

Objective 3: To use data derived to reach the previous objectives to derive recommendations for encouraging the greater uptake of pre-travel health advice and preventative measures among pilgrims will reduce the risk of disease infection and transmission at the Hajj.

The first hypothesis (**HP 1**) is derived from Goal 1 and its three objectives:-

If the practice of seeking pre-travel health advice is inadequate among Hajj pilgrims, then the data will highlight low levels of preparation.

Sub-HP: There is a link between low levels of the preparedness and the origin of pilgrims in lower socio-economic conditions. In other words, this sub-HP aims to test a possible relation between low preparedness and the

lack of access to healthcare where access to healthcare is referred to in terms of human development indicators.

Goal 2: To understand the status of the current emergency management system during the Hajj.

Objective 1: to assess the risk perceptions and beliefs of Saudi authorities involved in Hajj toward health risks and recommended preventative measures

Objective 2: To assess measures already taken by Saudi authorities to encourage a greater number of pilgrims to seek pretravel health information and preventative measures prior to undertaking the Hajj.

Objective 3: To compare the merits of these measures against those implemented for mass gathering events in other countries.

Objective 4: To determine the current obstacles contributing to the pilgrims' poor awareness of health risk and failure to follow instructions.

The second hypothesis (**HP 2**) is as follows: If the emergency management system currently used by Saudi authorities to reduce the risk of infectious disease transmission during Hajj has not been adequate, then the data will show low levels of pre-travel health advice seeking-behaviour or low levels of the adoption of preventative measures.

Sub-HP: If the data highlights low levels of awareness of the benefits of seeking pre-travel health advice and adopting recommended preventative

measures, then a different communication strategy will be needed in order to ensure better pilgrim health and safety during Hajj.

Goal 3: To develop new strategies to encourage pilgrims to seek pre-travel health information and preventative measures.

Objective 1: To apply the information collected through Goal 1 and Goal 2 to derive actionable guideline recommendations that are grounded in the scientific evidence developed in this dissertation.

The third hypothesis (**HP 3**) is derived from this goal: There is significant potential to use scientific information to improve pre-travel health advice-seeking behaviour and the uptake of recommended preventative measures by Hajj pilgrims.

CHAPTER 2: A REVIEW OF THE LITERATURE

2.1 Introduction

Healthcare is one of the essential elements to consider in planning for mass gatherings. Even in events where everything is managed smoothly, it has been noted that approximately 1.5% of people will require medical assistance, associated both with a different kind of 'physical stress or 'pre-existing' medical conditions (Alexander, 2016). These include, for example, exposure to bad weather and injures from crowd stampedes.

However, planning for healthcare in mass gatherings is also becoming particular relevant as crowds may be a vector of possible pandemic diseases associated with virus mutation, for example, avian influenza (WHO, 2019). Crowded spaces, coupled with the stress and fatigue that characterise them, can create the environment for the spreading of infectious diseases (Atsi-Selmi et al., 2016). These issues present different challenges for the analysis conducted in this other studies. A large portion of the most state-of-the-art research explains how viruses spread and the physical dynamics of spreading, in the case of influenza or allergies (Otter et al., 2016 WHO, 2017), but until recently this has not been consistently translated to the academic literature on disaster risk reduction. (Al Rabeeah et al., 2012) point out that the creation of a specific area of research was only formalised in 2010, with the Jeddah declaration establishing "mass gathering medicine".

While the concept of mass gathering medicine is not new, it has become an special topic of discussion in recent years. According to Yezli and Alotaibi (2016), mass gathering medicine can be defined as a field of study within medicine that deals with the public and private health risks and health impact of mass-gathering events. In fact, mass-gathering medicine has been in effect for decades through the delivery of health services at mass gathering events. However, it was only formalised as a field of study within medicine by the 2010 Jeddah declaration. The World Health Assembly of Ministers of Health then lent greater legitimacy to field by adopting it as a formal discipline in 2014 (Al Rabeeah et al., 2012). Mass-gathering medicine deals with a wealth of health risks associated with these events. Some of these risks include infectious illnesses, non-infectious illnesses, injury, environmentally related illness and injury related to deliberate acts (Yezli & Alotaibi, 2016).

Given the variety of health risks, mass gathering medicine is described as being very diverse. Combined with its having only emerged as a formal medical discipline recently, this variety within a new sphere of medicine has highlighted numerous knowledge-gap areas that require further exploration. That said, a consensus has arisen that much of this knowledge can be gained by investigating the large and frequent religious mass gathering events, such as the Hajj and the Kumbh Mela that have been published in Multidisciplinary Digital Publishing Institute, healthcare (see appindex H).

According to Atsi-Selmi et al. (2016), disaster risk in mass gatherings events is typically caused by hazards that interact with existing individual vulnerabilities, where

much of the current research is concentrated on the transmission of travel-related infectious diseases. Moreover, (Alexander, 2016) highlights that planning for pandemics needs to consider both the medical and non-medical nature of the issue, taking into consideration the implications for a globalised society and global transportation networks in facilitating the spreading of the infection. Some significant steps for improving the situation have been undertaken within the Sendai Framework for Disaster Risk Reduction (SFDRR). The SFRR was adopted as a non-binding agreement by the United Nations member states in 2015. It attributes a great deal of importance to improving the resilience of public health care, including with respect to mass gatherings (UNSDR 2015).

A significant portion of the research into mass-gathering events has concentrated on global sporting events. Events such as the Olympics and the World Cup not only occur frequently and attract millions of visitors, but they also take place at different locations thus allowing for the collection of various insights. According to the CDC, the assessment of mass gathering events can effectively be done by looking at characteristics related to "location, venue, purpose, size, participants, duration, timing, activities, and capacity" (CDC, 2013). Their location is crucial as different countries have different levels of infrastructure development, health regulations, climates and security arrangements – all of which can affect the health risks posed to visitors. For example, in the lead up to the 2018 FIFA World Cup in Russia, visitors were advised to receive diphtheria vaccine shorts (European Centre for Disease Prevention and Control, 2018). This is a crucial recommendation considering the

location of the event, Russia, which in past years has had numerous incidents of diphtheria (Netesov & Conrad, 2001).

As the current literature continues to expand and its relevance increases, there is a strong need to define the existing gaps in research and the areas in need of strengthening to improve practices associated with the implementation of the SFDRR. In particular, there is a need to focus on the physical dynamics at mass gatherings and how they influence the spreading of contagious illnesses. Additionally, the role played by awareness, training and risk perception in the spreading of these illnesses also needs to be defined.

This comprehensive review focuses on a specific category of mass gatherings that are particularly extensive in terms of their participation, and are focused on specific geographical locations: religious events. In 2019 alone, the Hajj attracted over 2.5 million pilgrims, while the Kumbh Mela was attended by approximately 150 million people (The National 2019; Sridhar, Gautret & Brouqui, 2015). In addition to creating operational challenges, these large pilgrim numbers are linked with increased vulnerability to infectious diseases. These mass-gathering events concentrate vulnerable populations such as the elderly and individuals with pre-existing conditions, thus further increasing the risk for contagion.

The next section of this chapter hence aims to define the open questions and areas needed in in future researches. First, the methodology adopted for the review is developed. Secondly, the analysis explores the case study of the Hajj that is distinguished by a wide range of topics covered by the literature. Thirdly, the Kumbh

Mela will also be investigated and the Arba'een pilgrimage in a similar way to the Hajj. The discussion will then summarise the current insights and highlight the significant gaps that currently exist in health and safety approaches to mass gatherings.

2.2 Literature review methodology

The next sections develop a "traditional or narrative literature review" intended to be replicable in the future (Cronin et al., 2008). The first step of the review involves undertaking a preliminary search of keywords in several electronic databases such as the National Center for Biology Information, Jstor.org, Google Scholar, PubMed, ScienceDirect and ISI Web of Science. These were chosen because they access complementary datasets and use different research algorithms. The keywords used in this initial search were "mass gathering medicine," "mass gathering health risks" and "health risk." A further and more focused analysis was conducted by adding the name of the case studies to each of the keywords.

As a second step, the abstract sections of the sources identified were analysed to reveal other relevant keywords that could be associated with the same content. Several new keywords were also identified including "infectious disease risk" and "non-infectious disease risks." Again, a further and more focused analysis was conducted by adding the name of the case studies to each of the keywords. The focus of the literature was clearly concentrated on the three largest religious gatherings,

namely the Hajj, Arba'een and the Kumbh Mela, which are reported in the sections below.

The final step in conducting the review involved a cross-check of the bibliography in the papers including identifying possible recurrent citations. What emerged was a concentration of the literature on the Hajj event, which will be discussed more in details. This can be explained by more information being provided by Saudi authorities and the yearly recurrence of the event.

2.3 Mass gatherings

Mass gatherings are often associated with public health challenges. According to the WHO, mass gatherings are planned or spontaneous events that gather substantial numbers of attendees who may strain the health planning and response capacities of the hosting country. The public health threat posed by mass gatherings has led to the development of mass gathering medicine, as a specialty that emanated from the discourse on the 2009 Hajj. The 2009 Hajj was held during the H1N1 influenza pandemic, while the first ever International Conference on Mass Gatherings Medicine was held in Jeddah, Saudi Arabia in 2010 (World Health Organization, 2007). The conference led to a coalition of experts from around the world. Experts from various virtual WHO mass gathering collaboration centres and global academic and public health faculty provide important insights that guide development of optimal health and medical prevention at mass gatherings.

By 2014, mass-gathering medicine had been formalised as a new discipline. The discipline was highlighted at the World Health Assembly of Ministers of Health in Geneva in May 2014. Planning and surveillance systems were explored during the event. The systems were expected to help in the monitoring public health risks in line with the experience of healthcare providers.

Several risks and hazards are associated with mass gatherings. The first risk is the transmission of communicable diseases including the anti-biotic resistant bacterial infections (Rahman et al., 2017). These infections can escalate into deadly epidemics adversely impacting upon public health in the communities affected. Hence, it is always important to establish effective containment measures for communicable diseases, particularly in the context of mass gatherings (Petersen et al., 2016).

The third important health risk related to mass gatherings is water and sanitation related disorders. Essentially, hygiene is critical to disease prevention in mass gatherings. Water and sanitation problems can increase the risks of spreading such diseases as cholera and typhoid. As such, it is important to ensure that participants in mass gatherings get access to safe water.

Fourthly, mass gatherings can exacerbate such co-morbidities as hypertension, diabetes, and cardiovascular diseases. Thus, it is important to pay attention to the health needs of people with pre-existing health conditions during mass gatherings (Petersen et al., 2016). Mass gatherings can also increase the risk for mental health and psychological disorders. Additionally, thermal disorders such as heat stroke, heat

exhaustion and dehydration can contribute to ill-health among participants in mass gatherings.

Mass gatherings take many forms, including pilgrimages, sports events, music festivals, and regional and national commemorative events (Thackway et al., 2009). While some mass gatherings are short-lived, some span days and even weeks. The most striking of these mass gatherings are the Kumbh Mela and the Hajj, which attract millions of pilgrims. The spectacle involved in such mass gatherings normally engenders fascination., These mass gatherings are then notable for being associated with public health challenges because the behaviour of the participants often seems so different from the normal routine (Petersen et al., 2016). However, it is important to recognise that mass gatherings can deliver social, cultural, and psychological benefits to participants. As such, policy must be geared towards creating events where the benefits outweigh the dangers. It is also important to understand how large-scale collective events impact the health and well-being of the public.

2.4 Theoretical Framework: Social Capital in Mass Religious Gatherings

2.4.1 Introduction

This section delves into the theoretical framework that elucidates the relationship between social capital and mass religious gatherings. Informed by the extensive literature review conducted earlier, we aim to shed light on how social capital theory can provide valuable insights into the dynamics of mass religious gatherings, particularly in the context of health risks and the adherence to preventative measures.

Furthermore, this section will incorporate the perspectives of Hajj pilgrims and Saudi authorities.

2.4.2 Theoretical Foundations of Social Capital

2.4.2.1 Defining Social Capital

Social capital, rooted in sociology and economics, encompasses the intricate web of networks, relationships, and resources embedded within social structures, which individuals can access for mutual benefit (Putnam, 1995; Bourdieu, 1986). Social capital manifests in multiple forms, including bonding, bridging, and linking social capital (Szreter & Woolcock, 2004).

2.4.2.2 Social Capital and Health

Extensive research has explored the nexus between social capital and health outcomes (Berkman et al., 2000). This body of work acknowledges that social capital influences health through mechanisms such as social support, health behaviors, and access to healthcare services (Kawachi & Berkman, 2000).

2.4.2.3 Social Capital in Mass Religious Gatherings

2.4.2.4 The Role of Social Capital

In the context of mass religious gatherings, social capital assumes a central role in shaping participants' behaviors and responses to health risks. Drawing from the literature review on mass religious gatherings, we will elucidate how social capital can influence risk perception, risk awareness, and the adherence to preventative measures.

2.4.2.5 Factors Shaping Social Capital in Mass Religious Gatherings

Shared Religious Identity: The profound sense of shared religious identity among participants in mass religious gatherings can foster bonding social capital and cultivate a collective commitment to health and safety. Community Cohesion: The strength of social ties and community cohesion within these gatherings can facilitate the dissemination of health information and foster the adoption of recommended health measures. Trust and Norms: The presence of trust within the religious community and adherence to shared social norms can profoundly impact individuals' willingness to follow health guidelines. Communication Networks: The communication networks established within mass religious gatherings play a pivotal role in rapidly disseminating information concerning health risks and recommended preventative actions. Incorporating Perspectives: To provide a comprehensive understanding, this section will incorporate insights from Hajj pilgrims and Saudi authorities. These key stakeholders offer unique perspectives on the role of social capital in the Hajj pilgrimage and how it influences health-related decisions and behaviors."

2.4.3 Applying Social Capital Theory to Mass Religious Gathering Medicine

2.4.3.1 Implications for Preparedness

By integrating social capital theory into the framework of mass religious gathering medicine, event organizers and public health authorities can develop more effective strategies for risk communication, community engagement, and health promotion, thus enhancing overall preparedness.

2.4.3.2.Research Gaps and Future Directions

While research on social capital and health within the context of mass religious gatherings is expanding, there remain several critical research gaps and avenues for future exploration. These gaps will be delineated, emphasizing their significance in comprehending and enhancing public health outcomes during mass religious gatherings.

Conclusion

This section has illuminated the theoretical foundations of social capital and its relevance to mass religious gatherings, with a particular focus on health risks and preventative measures. Incorporating the perspectives of Hajj pilgrims and Saudi authorities enriches our understanding of the role of social capital in these sacred events, offering valuable insights for the improvement of public health interventions and the fortification of community resilience.

2.5 Social Capital and Risk Perception in Mass Religious Gatherings

In the context of mass religious gatherings, understanding risk perception is paramount, as it significantly influences individuals' adherence to health guidelines. Several factors contribute to risk perception within the context of mass religious gatherings. One crucial aspect is shared religious identity, which fosters bonding social capital among participants, cultivating a collective commitment to health and safety. This shared identity not only strengthens the sense of community but also plays a pivotal role in how individuals perceive health risks. Furthermore, the community cohesion within these gatherings, characterized by robust social ties, facilitates the dissemination of

health information and fosters the adoption of recommended health measures. The solidarity among participants contributes to a heightened sense of responsibility towards the well-being of fellow pilgrims.

In addition to shared identity and community cohesion, the presence of trust within the religious community and adherence to shared social norms profoundly impact individuals' willingness to follow health guidelines. Trust serves as a cornerstone in risk perception; when individuals trust the information and guidance provided by religious authorities and fellow pilgrims, they are more likely to perceive health risks accurately and act accordingly. Moreover, adherence to social norms within the religious context shapes risk perception. Pilgrims often look to the behavior of their peers and religious leaders as models, influencing their perception of what is considered safe and appropriate.

Effective communication networks are another crucial element that affects risk perception during mass religious gatherings. The communication networks established within these gatherings play a pivotal role in rapidly disseminating information concerning health risks and recommended preventative actions. These networks serve as conduits for sharing vital health-related updates, enabling pilgrims to stay informed and make informed decisions regarding their health.

It is imperative to incorporate diverse perspectives to comprehensively understand the role of social capital in risk perception. Thus, this section will integrate insights from Hajj pilgrims and Saudi authorities, key stakeholders offering unique viewpoints on how social capital shapes risk perception within the Hajj pilgrimage. Furthermore, it is worth noting that the literature on risk perception should also consider the influence of fatalism, a concept deeply rooted in religious contexts. Fatalism can affect risk perception, as individuals may attribute health outcomes to divine will, potentially impacting their willingness to take preventative measures. By examining the interplay of social capital, risk perception, and fatalism, we can gain a holistic understanding of the dynamics at play in mass religious gatherings and their implications for public health strategies.

2.6 Mass-gathering medicine and health

The main danger associated with mass gatherings is the potential for infectious disease transmission. Essentially, mass gatherings bring people into proximity and thus increase the chances of infection transmission (Karami et al., 2009). The rudimentary sanitation conditions may magnify the chances of disease transmission among participants. It is important to note that the first Asiatic cholera pandemic of 1817-1824 was a result of the infection transmission at the 1817 Kumbh Mela. The Indian pilgrims and British naval officers played a significant role in the spread of the disease across India and beyond. The Kumbh Mela mass gathering contributed to the spread of the

disease in the Asian country. Other health risks are also associated with mass gatherings. For instance, the pilgrims at Hajj are more vulnerable to heatstroke and suffocation.

Policymakers should focus on anticipating and mitigating some of the public health risks associated with mass gatherings (Thackway, et al., 2009). A specialised field of medicine should be set up to address mass gatherings specific public health strategies. Mass-gathering medicine can help in conducting pre-event risk assessments, conducting surveillance and reporting procedures for monitoring patient presentations and organising onsite medical facilities and services. The practical challenges that characterised the H1N1 influenza pandemic have informed some of the mass-gathering health strategies and practices. It is worth noting that social psychological evidence indicates that mass gatherings can benefit the psychological well-being of participants (Lombardo, et al., 2008). As such, focus should be on implementing mass gathering health practices instead of limiting mass gatherings.

2.7 Group processes and health

Social psychological discourses often focuses on group behaviour and its relationships with social identity (Lombardo et al., 2008). Arguably, a variety of identities then operates at different levels of abstraction. It is therefore important to establish some of the factors that make other individuals differ from others. People have multiple identities that vary in terms of their inclusiveness. It is important to

realise that mass gatherings influence people's identities because people define themselves in terms of a particular social identity. As such, people that share a particular social identity tend to see each other as fellows rather than others.

Shared identity results in increased anticipation of social support and increased confidence that once can cope with difficult circumstances (Ahmed & Memish, 2019). As such, shared identity is critical to increasing cohesiveness among people. Studies have shown that shared identities provided group members with a sense of meaning and purposes as well as the belief that social support is available should they need it. Thus, the construction of a shared identity is the basis of social benefits to society.

2.8 Mass gatherings as the basis of social benefits

The potential for a shared identity to develop in mass gatherings. Participants who have not met before are able to establish lasting relationships based on a shared identity. For instance, religious pilgrims, music festival attendees or sports fans are more likely to develop a lasting shared identity which may form a strong foundation for personal relationships (Memish & Al-Rabeeah, 2013). Essentially, mass gatherings turn an aggregation of strangers into a psychological group in which social relationships become more intimate, entailing that mass gatherings have the potential to bring the benefits likely to provide much needed social benefits.

Collective assembly is more than just people coming together to find a distraction from ordinary life. Instead, mass gatherings are an opportunity for the people to feel connected to something bigger than themselves. People enjoy the company of those

they share a common social identity. Shared identification is a key element of mass gatherings where people receive the social support they need when necessary (Memish & Al-Rabeeah, 2013). The identity-related processes at mass gatherings bring improvements that continue even after the event has ended. Several psychological outcomes are associated with mass gatherings which include empowerment, mood improvement and self-esteem. In turn, several processes are associated with mass gatherings which include share emotional experience and shared identity. Participation in group activities improves the wellbeing of members, while the connection between the participants helps to provide much needed social and psychological support.

2.9 Religious mass gatherings and health

Research has shown that individuals who are religious report better health outcomes because religious mass gatherings provide health relevant social capital (Memish & Al-Rabeeah, 2013). Religious gatherings are often characterised by the creation, enactment and maintenance of a community by the collective behaviour of members. For instance, the month-long Hindu Magh Mela has been associated with improved health and wellbeing among the participants (Memish & Al-Rabeeah, 2013). The pilgrims often report improvements in their health and wellbeing compared to non-attendees. The common social identity shared during the pilgrimage and the associated intimate social relations improve the social and psychological wellbeing of the

participants. The mutual social support enjoyed by participants plays a critical role in improving their overall wellbeing.

Therefore, it is important to celebrate the community identities often exhibited at mass gatherings. This is because the participants in mass gatherings experience greater levels of social integration and social connection (Steffen et al., 2012). Additionally, participants at mass gatherings experience increased empowerment and more positive social beliefs about the world and the people around them. As such, shared social identities are critical for maintaining harmony in communities. Emotional synchrony is another important aspect related to having a shared social identity among mass-gathering attendees. As more positive social beliefs about society are engendered among individuals, then people will experience increasingly strong positive emotional states.

It is important to realise that mass gatherings are more about establishing communities that offer social support for members (Walsh et al., 2021). For instance, young people dealing with various social challenges can receive the support they need when they join organisations. Individuals that participate in large-scale scouting events are more likely to improve their general wellbeing (Association, 2011). Some of these events feature a variety of communal activities that have a shared focus which can help in significantly establishing a joint emotional experience and a sense of shared identity. Having a sense of belonging is critical to improving one's social wellbeing. Shared emotions have the potential to improve the participants' self-esteem and pride, so enhancing their receptiveness to new experiences.

Mass gatherings can help people deal with trauma associated with death. The experience of losing a loved one can obviously be traumatic, but mutual support from people who have experienced the trauma of death can improve the psychological wellbeing of the bereaved. This is because the participants may provide opportunities for building a sense of community and social support. It is also important to realise that participating in mass gatherings can establish a welcome sense of solidarity and hope (Walsh et al., 2021).

2.10 The value of mass gatherings

Many researchers have argued that an exclusive emphasis on the public health risks of mass gatherings could overshadow their potential benefits to the society (Enderlein et al., 2018). For instance, there is a consensus on the importance of participants experiencing a strong sense of social connection at mass gatherings. The shared emotional experience among the participants can significantly contribute to positive social outcomes. These connections can give rise to powerful feelings of solidarity, leading to the development of a mutually supportive social unit. As such, socially beneficial mass gatherings should be encouraged rather than discouraging them. Policymakers can then leverage social gatherings to influence a sense of social integration and wellbeing of citizens.

Policymakers should also find ways to explore how social inclusion can be increased through mass gatherings (Enderlein et al., 2018). This can be achieved

through investigating the degree to which an inclusive social identity is possible at any event. The value represented by the respective events can help in determining their social value. For instance, mass gatherings can offer psychological benefits to the participants. Arguably, according to Hopkins (2021) mass gatherings provide individuals with shared identities and ideologies that usually foster social benefits, since they offer individuals purpose and meaning, helping them to appreciate the need for psychological social support.

2.11 Relational intimacy and mass gatherings

The relational intimacy associated with shared identity in mass gatherings can result in a number of risks (Hopkins & Reicher, 2017). For instance, the experience of crowding can be stressful for participants. Overcrowding can cause safety fears, as when people are brought close to other people's bodies. Coming into contact with other people's sweat and odour can be a disgusting experience for many. However, others may find considerable pleasure in crowding. For instance, participants who report a stronger identification with others at mass gatherings often experience a reduced sense of crowding.

The reduced sense of overcrowding often mediates the relationships between identification with the crowd and participants' positive emotion at a particular mass event. However, to some extent it increases the risks associated with overcrowding.

Individuals with a shared identity such as pilgrims often experience a reduced sense of crowding. This is because a shared identity attenuates certain feelings of disgust.

It is therefore debatable to believe that crowding is naturally stressful. Instead, stress depends on the degree to which participants view each other in terms of shared social identity (Hopkins & Reicher, 2017). The mutual connection that motivates proximity can be attributed to the great sense of solidarity found in mass gatherings. The relational intimacy associated with a shared social identity is often manifested in increased trust and empathy among the participants. Such trust and empathy may encourage all manner of more intimate interactions with other strangers sharing the same social identity. The sharing of such personal resources as water bottles, razor blades, eating utensils and lipstick are some of the intimate interactions associated with mass gatherings (Hopkins, 2021). While sharing water may result in health benefits including preventing dehydration, such acts may also bring risks, such as sharing bacteria. As a result, communicable diseases can spread significantly, leading to major public health problems. Participants that share toilet items are more vulnerable to infections (Hopkins, 2021).

Values and norms play a critical role in determining the behaviour of individuals in mass gatherings (Wood, 2018). People in mass gatherings no longer behave in terms of their individual beliefs and values but rather in terms of group-based beliefs and values. The behaviour of the individuals at mass gatherings is influenced by their understanding of their collective norms, values and beliefs. The cultural particularities of the event at hand influence the effectiveness of the risk mitigation and health

promotion strategies in place. Therefore, it is important to consider shared values and beliefs when using certain health promotion strategies to target mass gatherings. For instance, pilgrims at the Hindu Magh Mela often show respect to each other by putting their hands together. This implies that these values and norms can facilitate the spread of communicable diseases at mass gatherings because hand-to-hand infection transmission is common in places where people hold hands most often. As such, it is important to realise that identity-related values, beliefs and practices influence public health in a significant way. These social processes can combine to have a cumulative effect that can adversely impact the health of mass-gathering participants.

Essentially, identity related values and practices often encourage behaviours that have a direct impact on public health (Hopkins & Reicher, 2017). For instance, certain types of music festival are often characterised by alcohol consumption and unprotected sex. As a result, communicable diseases can be spread among the participants. In festivals where participants are drawn from all over the world, some dangerous pathogens can be globalised (Ahmed, 2019).

It is important, however, to note that other events actually encourage healthy behaviours. For instance, the pilgrims at the Hindu Magh Mela are required to follow a simple low salt, low fat, and vegetarian diet and must walk long distances to bathe (Shafi et al., 2008). The pilgrims are also required to refrain from smoking. Such identity-related norms associated with the Hindu Magh Mela provide health practitioners with opportunities to intervene and bring about longer-term change. For

instance, there may be billboards advising individuals from pilgrimage to continue with their new health practices back at home.

Meanwhile, other behaviours in mass gatherings that impact the participants health negatively (Steffen et al., 2012). For instance, Asian and African sports fans have the habit of blowing vuvuzelas which can facilitate the generation and dissemination of respiratory aerosols. As such, these practices can create favourable conditions for infection transmission. Moreover, some participants can share the vuvuzelas, significantly increasing the risk of infection transmission (Lai et al., 2011). It is therefore important to identify and address the various public health risks associated with identity-related practices. This is because it is important to be constantly aware of the potential for identity-related beliefs to have contradictory implications for the health and wellbeing of participants (Hopkins et al., 2017).

2.12 Scientific Contribution to Disaster Risk Reduction in Religious Mass Gatherings

This research significantly advances the field of Disaster Risk Reduction (DRR) by providing unique insights into risk perception and the role of social capital within religious mass gatherings. Rather than focusing solely on natural disasters and hazards, this study extends the scope of DRR research to address the distinct challenges presented by mass religious gatherings worldwide.

One noteworthy contribution lies in our enhanced understanding of risk perception during such gatherings. By examining how shared religious identity, community cohesion, trust, and adherence to social norms shape pilgrims' perceptions of health risks, this study illuminates the psychological and sociocultural factors that influence risk perception. This knowledge is vital for crafting tailored DRR strategies that cater to the specific dynamics of religious mass gatherings, where risk perception plays a pivotal role in decision-making.

Furthermore, this research highlights the significance of social capital as a determinant of risk perception and health-related behaviors within these gatherings. Social capital, characterized by shared values, trust, and interconnected networks, emerges as a potent force that influences risk awareness and the adoption of preventative measures. This study establishes a critical link between social capital and risk perception, offering a fresh perspective for enhancing DRR strategies. Recognizing the potential of social capital to promote health and safety measures within these gatherings carries profound implications for disaster preparedness and response.

Additionally, this research emphasizes the value of incorporating diverse perspectives into DRR efforts. By integrating insights from both Hajj pilgrims and Saudi authorities, this study bridges the gap between grassroots experiences and official decision-making processes. This holistic approach not only enriches our understanding of risk perception but also provides practical guidance for developing inclusive and culturally

sensitive DRR strategies. It underscores the importance of actively engaging with the religious community and authorities as partners in disaster risk reduction efforts.

Moreover, by addressing the role of fatalism within religious contexts, this research offers a nuanced perspective on risk perception. While DRR often assumes rational decision-making, the interplay of fatalistic beliefs with risk perception adds complexity to the equation. Understanding how fatalism can either hinder or facilitate the adoption of preventative measures is crucial for designing interventions that align with the religious and cultural values of participants.

In additional, this research makes a substantial contribution to the field of Disaster Risk Reduction by advancing our understanding of risk perception and social capital within the unique context of religious mass gatherings. It informs the development of tailored DRR strategies for these events and underscores the importance of culturally sensitive, community-driven approaches to disaster preparedness and response on a global scale. This research paves the way for more comprehensive and inclusive DRR practices in the realm of religious mass gatherings, benefiting both pilgrims and the broader community.

2.13 Vulnerability Analysis in the Context of Hajj Pilgrimage

Vulnerability in the state of art of this research refers to the susceptibility of individuals or groups to various risks and challenges within the context of religious mass

gatherings, specifically the Hajj pilgrimage. It encompasses physical, psychological, social, and economic aspects that may render individuals or groups more prone to adverse outcomes when exposed to hazards or disruptions during the pilgrimage. Vulnerability analysis in the context of Hajj aims to identify and understand the factors that make certain pilgrims, including those over 60 years old, more vulnerable to health risks and disruptions during the event.

In relation to this research, a vulnerability analysis conducted in the context of Hajj pilgrimage has yielded key findings that are relevant:

2.13.1 Age-Related Vulnerability: The analysis has identified that individuals over 60 years old are considered vulnerable due to age-related health concerns. Older individuals may have underlying health conditions, reduced physical resilience, and increased susceptibility to infectious diseases, making them more at risk during mass gatherings like Hajj.

2.13.3 Healthcare Access: The vulnerability analysis underscores the importance of access to healthcare services for pilgrims. It highlights challenges in providing adequate healthcare to a large and diverse population during Hajj and how this can exacerbate vulnerabilities, especially among older pilgrims who may require more medical attention.

2.13.4 Crowd-Related Risks: The analysis reveals that overcrowding and congestion during Hajj can pose significant risks, particularly for vulnerable individuals. Older pilgrims may struggle to navigate through crowded areas, increasing their exposure to potential health hazards and making evacuation during emergencies more challenging.

Logistical Challenges: Vulnerability analysis has identified logistical challenges in ensuring the safety and well-being of all pilgrims, especially the elderly. These challenges include transportation, accommodation, and access to essential services, all of which can disproportionately affect older individuals.

2.13.4 Policy Implications: The ban on individuals over 60 years old from attending Hajj, as mentioned in the analysis, reflects a policy response to mitigate vulnerabilities. While this policy aims to protect older pilgrims from health risks, it also raises questions about potential consequences, such as the exclusion of elderly individuals from a significant religious obligation and the impact on their spiritual well-being.

2.14 The Hajj

As noted in the introduction, the Hajj is a yearly event that attracts approximately three million Muslims from all over the world. It represents more than a mere physical journey. The annual mass gathering is one of the five pillars of Islam and is mentioned in both the Quran and the Sunnah (Salamati & Rahimi-Movagher, 2016). The primary site that Muslims visit while on the Hajj is the Kaaba. The Kaaba is the most sacred site in Islam and is widely described as the House of God. In fact, Muslims from all over the world are face the Kaaba while performing their daily Islamic prayers, Salah (Peters, 1996).

In addition to the spiritual significance of bringing people closer with God, the Hajj also carries a social significance. This mass gathering allows Muslims from all over the world to commune with each other on an equal level. Furthermore, as the procedures and rites involved in the Hajj have remained unchanged for centuries, the pilgrimage also helps pilgrims feel connected with those that came before them. Given these spiritual and social factors, it is easy to comprehend why millions of people embark on this mass pilgrimage every year. In fact, with the global Muslim population growing every year, the pressure on Saudi Arabia to accommodate more pilgrims during the Hajj will only increase further.

The origins of the Hajj can be traced back to Prophet Ibrahim. This prophet also features heavily in the other Abrahamic religions, being known as Prophet Abraham in both Christianity and Judaism. Many Islamic scholars believe that Prophet Ibrahim built the Kaaba, which would become the ultimate destination of the pilgrimage, under the explicit instruction of God (Peters, 1996). The current format of the Hajj was first undertaken by Prophet Muhammad in the 7th century (Peters, 1996). The exact dates of the Hajj pilgrimage are determined using the Islamic Lunar calendar, Hijr. Previously, pilgrims had very few reliable transportation options and would, consequently, commence their journey to Mecca months in advance. However, following the considerable advancements made in both globalisation and mass transportation over the course of the last century, millions can now journey to Mecca within only a short duration of time (Gatrad & Sheikh, 2005). Today, nearly all pilgrims use air travel to access Hajj, with only a few based in Saudi Arabia preferring road travel.

With the religion of Islam having the second largest global population, millions of pilgrims wish to embark on the Hajj every year. However, the Kingdom of Saudi Arabia can only accommodate between two and three million at a time (Salamati & Rahimi-Movagher, 2016). Consequently, the government controls the inflow of pilgrims using the Hajj visa (Gatrad & Sheikh, 2005). That is, it is impossible for one to enter Mecca for the Hajj without a Hajj visa issued solely by the Saudi Ministry of Hajj. These visas are distributed to countries all around the world depending on the proportion of the global Muslim population living in every country. The Hajj visa is also one of the primary tools to guarantee public health safety during the mass gathering. All those that are issued with the visa are expected to have first fulfilled a series of preventative health requirements issued by the Saudi Ministry of Health (Ministry of Heath, 2018). These requirements are issued before every Hajj cycle and are consequently subject to change depending on the prevailing nature of public health risk in Mecca. For convenience purposes, travel to Mecca during the Hajj is typically facilitated using travel agencies. This also allows for the easy management of pilgrims as groups rather than as individuals once they arrive at Mecca.

While it is among the largest mass gatherings in the world, the Hajj only covers a total of five days. This consequently means that millions of pilgrims have to complete the same Hajj rites over the course of only a short window of time. There is, therefore, great pressure on Saudi authorities to create an effective and efficient schedule, and for the pilgrims to stringently observe the schedule. The first ritual completed by pilgrims once they arrive for the Hajj is called Ihram (Peters, 1996). This is an exercise where

pilgrims don a simple white garment, also known as an Ihram, before entering Mecca. Wearing this garment is meant to signify purity, not only physically, but also spiritually. Pilgrims are also expected to show a greater commitment towards spiritual purity by desisting from "impure" behaviours and acts, such as smoking, drinking, engaging in intercourse and committing crimes. The Ihram also has a social significance as it makes all Muslims, regardless of their background or culture, appear the same. As such, the Ihram can also be interpreted as an assertion that none of the pilgrims is a better Muslim than the other (Peters, 1996).

Pilgrims also visit the holiest site in Islam, the Kaaba, on the first day of the Hajj. Since the Kaaba is located inside the Great Mosque of Mecca (Masjid al-Haram), pilgrims often say their prayers before commencing the ritual of circling around the Kaaba (tawaf) (Peters, 1996). Pilgrims are expected to circle around the Kaaba for a total of seven circumambulations while moving in a counter-clockwise manner (Gatrad & Sheikh, 2005). There are a few organisational challenges that present themselves during the circumambulation ritual. The first is that many pilgrims decide to circulate around the Kaaba for more circumambulations than the recommended seven, thus creating congestion. Additionally, since embarking on the Hajj is a once-in-a-lifetime opportunity, all pilgrims will attempt to complete this ritual regardless of their prevailing health conditions, including those with special needs. Given the fact that completing the seven rotations around the Kaaba comes to a total between 1.4 and 3.5 kilometres depending on the degree of congestion, this can be a taxing undertaking, even for those that are physically able (Hajj & Umrah Planner, 2018).

During their pilgrimage to Mecca, most pilgrims sleep in tent cities located in Mina. Mina is a large valley located approximately six kilometres from Mecca (Peters, 1996). While incidences have reduced significantly in recent years, tent cities have previously been the site of deadly fire outbreaks. After spending their first night in Mina, pilgrims on the second day then embark on the third ritual, *wuquf*. This ritual occurs on the plain of Arafat, where pilgrims say prayers while facing Mecca.

On the very same day, pilgrims begin collecting stones in the Muzdalifa area close to the Hajj. These stones are used for the "stoning of the devil" ritual that takes part on the third day of the pilgrimage (Image 1). This ritual, also known as Jamaraat al-Aqaba, involves stoning large pillars. It is done to imitate the resilience shown by Prophet Muhammad when he threw stones at the Devil after he attempted and failed to tempt him (Peters, 1996). The stoning ritual is undertaken at Jamaraat, which has regrettably been the site of several deadly human stampede disasters in recent years (Shujaa & Alhamid, 2015). Over the course of the remaining days, pilgrims will repeat some of the Hajj rituals, including circling around the Kaaba and stoning the devil. At the end of the fifth day, once all the Hajj rituals have been completed as stipulated by the official schedule, the pilgrimage is then considered complete (Peters, 1996).

Image 1: Pilgrims undertaking the stoning of the devil ritual (Aljazeera, 2009).

Even while the Hajj's social and spiritual importance have largely remained the same, the accessibility and management of the Hajj has changed considerably over the course of the last few centuries. While the Hajj was only completed by a few people for centuries, the number has increased considerably in recent times. Today, there are between two and three million pilgrims that make the journey to Mecca every year (Salamati & Rahimi-Movaghar, 2016). Naturally , the sudden and significant growth in pilgrim numbers has created several challenges. The situation is further complicated by the fact that the Hajj can only be completed within a relatively short period of time (five days) and they must strictly follow a set schedule of rites and rituals (Shujaa & Alhamid, 2015). Additionally, when compounded with congestion the terrain and climate of Mecca can also lead to fatigue among pilgrims. That said, despite these

complications, adherents of the Islamic faith consider the Hajj to be a God-given obligation and would consequently welcome the opportunity make the physical and spiritual journey to Mecca. Furthermore, with the global Muslim population growing faster than that of any other global religion, it is highly likely that the number of Hajj pilgrims will significantly increase in the coming years (Arab News, 2019). Owing to the fact that it hosts all Hajj sites, the Kingdom of Saudi Arabia is tasked with protecting the health of pilgrims while they affirm their commitment to Islam.

2.14.1 Health risks during the Hajj

The Hajj is regrettably faced by a number of high-profile risks. This stems from the fact that this mass gathering has several unique characteristics that creates a conducive environment for health risks. The first of these characteristics is the size of the pilgrim crowds. Every year, approximately three million people converge on the holy city of Mecca to complete the same sequence of rites and rituals, at approximately the same time (Salamati & Rahimi-Movaghar, 2016). In fact, elevated population densities of up to nine people per square metre have previously been recorded during the mass gathering (Shujaa & Alhamid, 2015). Such congestion is not only scary, but also considerably increases the risk of pilgrims contaminating each other with infections and causing physical harm to each other through stampedes.

Regrettably , the size of the gathering is further complicated by the fact that Mecca covers a relatively small area (Salamati & Rahimi-Movaghar, 2016). The sheer

size of the crowds greatly stretches the limited public health resources available during the Hajj. It is important to note that the Saudi government devotes a substantial number of public health resources to the mass gathering (Leggio et al., 2016). In addition to tens of thousands qualified healthcare professionals and volunteers, dozens of health centres and hospitals are made available during the pilgrimage. For example, during the 2012 pilgrimage there were a total of 25 hospitals in Mecca and nearby regions, supported by over 140 health centres, used to provide healthcare services to Hajj pilgrims (Shujaa & Alhamid, 2015). While these public health resources may seem significant, they are quite meagre compared to the millions of pilgrims they are meant to serve. As such, in the event of a catastrophic public health incident, available health resources would do very little to reduce the risk of harm to pilgrims.

Another factor that increases the degree of health risk during the Hajj is the climate of Mecca. Saudi Arabia is well known to be a desert nation. As such, it is not surprising that Mecca, one of the country's interior cities, largely has a semi-arid climate. Even during the winter, temperature levels rarely become significantly low, while in the summer they can hit highs of up to 45ºC (Abdelmoety et al., 2018). As such, even when the event that Hajj falls on the winter months, the climate is not particularly kind to pilgrims. (Kang, 2019) used projections to assert the likelihood that climatic conditions will worsen during the next decade, with increasing intensity and frequency of meteorological events. In addition to the ever-present risk of heatstroke, a hot climate during the Hajj increases the likelihood of fatigue, compromising the health of those pilgrims who have weak immune systems (Abdelmoety et al., 2018).

Lastly, the diversity of the pilgrim population during the Hajj also increases the level of health risk during the mass gathering. Hajj pilgrims are drawn from all over the world. While this is a fact to be celebrated from a religious standpoint, it creates a number of complexities from the public health standpoint. Naturally , these pilgrims have widely unique and diverse medical backgrounds. Some originate from regions where certain disease strains are not found in other parts of the world (Cobbin et al., 2017). Additionally, some pilgrims, and particularly those from low-income countries, have typically had little-to-no exposure to effective medical care before embarking on the pilgrimage. Given the fact that pilgrims can travel to Mecca within a relatively short period of time, infectious disease that are only unique to certain regions of the world can easily spread at a mass gathering. Furthermore, cultural and linguistic barriers also prevent some of the pilgrims from accessing immediate and effective care (Shujaa & Alhamid, 2015).

2.14.2 Infectious-related health risk

Regrettably , infectious-related health risks are quite common during the Hajj. Their spread and dissemination is highly reliant on close contact and interaction (Rahman et al., 2017). Owing to its huge crowds, the Hajj provides multiple avenues for the transmission of diseases. In fact, several airborne infections such as tuberculosis and meningitis have been recorded at the annual mass pilgrimage (Memish et al., 2011). Furthermore, poor hygiene behaviour among some of the pilgrims, coupled with

inadequate adherence to recommended preventative measures, facilitates the easy spread of infectious diseases.

Undoubtedly, the most common infectious diseases during the Hajj are respiratory infections, particularly upper respiratory tract infections. For example, it is reported that up to a third of all pilgrims that embark on the Hajj experience respiratory symptoms associated with the influenza virus (Balkhy et al., 2004). This has consequently led the influenza infection during the mass pilgrimage to be informally referred to as the "Hajj cough". In addition to influenza, adenoviruses and respiratory syncytial virus (RSVs) are also quite common at the mass pilgrimage. Sadly, there is very little existing research on the epidemiology of upper respiratory tract infections during the Hajj. That said, a 2007 study found that pilgrims that spent a longer time in the Grand Mosque of Mecca had an elevated risk of contracting an acute upper respiratory tract infection (Alzeer, 2009). This indicates that the religious gatherings pose a significant health risks for the participants.

The ease with which upper respiratory tract infections spread during the Hajj has led to the fear that viral pandemic could occur at the mass gathering. In fact, in the last few years Saudi public health authorities have been forced to implement strict infectious control measures in response to SARS, H1N1 and the MERS Coronavirus (Shujaa & Alhamid, 2015). The Hajj first had to deal with the threat of a global respiratory pandemic following the emergence of the SARS-CoV virus in China. Before the virus was adequately brought under control, at least 8,000 people were infected globally, with over 800 losing their lives (Algaissi et al., 2020). While there

were no infections or death reported at the Hajj, Saudi authorities had again to deal with the threat of a global coronavirus pandemic in 2012 after several cases of the MERS-CoV were recorded in Saudi Arabia. Ultimately, the virus spread from the Kingdom to more than two-dozen countries, resulting in over 2,500 infections and approximately 860 deaths (Algaissi et al., 2020). The Saudi authorities were praised for their handling of the MERS-COV pandemic threat as none of the exported cases was directly linked to the Hajj.

That said, arguably the greatest threat of a viral pandemic impeding the Hajj was observed in 2020 following the emergence of Covid-19. As with SARS and MERS-CoV, Covid-19 is a respiratory disease that can be characterized as a zoonotic coronavirus. Despite being traced to a small wet market in Wuhan, China, the novel coronavirus spread to over 200 countries in less than six months (Algaissi et al., 2020). Such is the severity of Covid-19's spread and impacts, the WHO declared it a public health emergency of international concern in January 2020. That said, the acute respiratory disease was only declared a global pandemic in March 2020 (Algaissi et al., 2020). The health burden of the pandemic has especially been significant on a few countries such as the United States, China and Iran. In response, these countries have restricted social movement and interaction, increased testing protocols and have implemented stringent case tracing protocols (Algaissi et al., 2020). As one of the earliest countries to implement unprecedented precautionary and preventative measures, Saudi Arabia has only adopted some of these extreme measures.

While the Saudi response to the global COVID-19 pandemic is targeted as safeguarding public health, it has also reduced the country's capacity to hold a large mass gathering event. Compared to other countries, Saudi Arabia's standing as one of the leading authorities on mass gathering medicine left the country better prepared to combat a potential coronavirus pandemic. Additionally, as a signatory to WHO's International Health Regulation, the Kingdom has regularly been monitoring and reporting on its pandemic preparedness (Algaissi et al., 2020). The country set up a national committee to prepare for the pandemic more than two months before its first case was reported. Only two days later it was announced that not only would the Umrah be suspended, the holy mosques in Mecca and Medina would also be closed (Algaissi et al., 2020). Additionally, the Saudi government halted air travel into and out of the country. As the global pandemic worsened, completing the five daily prayers at mosques was also banned. These preventative measures culminated in the June 2020 announcement that the Kingdom would not allow more than 10,000 people to embark on the 2020 Hajj (Dadouch, 2020). However, this figure included both foreign and local pilgrims residing in Saudi Arabia.

While they are not as prevalent as upper respiratory tract infections, lower respiratory tract infections account for a significant portion of hospital admissions during the Hajj. In fact, as highlighted earlier, pneumonia has been the leading cause of hospital admission for pilgrims during several Hajj editions. In 2003, for example, approximately 39% of the pilgrims admitted during the mass gathering were suffering from pneumonia (Al-Ghamdi et al., 2003). Additionally, tuberculosis, another lower

respiratory tract infection, is often quite common among elderly pilgrims. According to Alzeer (2009), in addition to the fact that some pilgrims from tuberculosis endemic countries arrive with the infection while it is in active state, its spread is heavily facilitated by reduced immunity among vulnerable pilgrims owing to fatigue and exhaustion. It has also been theorised that the spread of lower respiratory tract infectious disease, particularly tuberculosis, is partly facilitated by the fact that most of the pilgrims travel to Saudi Arabia by air (Alzeer, 2009). Long, crowded flights provide a good avenue for the spread of infections.

Infectious gastrointestinal diseases often are often also reported during the Hajj. However, these infections do not have particularly high mortality and morbidity rates. Many of the pilgrims that embark on the Hajj in fact experience traveller's diarrhoea (Memish, 2010). The occurrence of these and other gastrointestinal infections has largely been attributed to poor hygiene standards and food handling. In more serious cases, some pilgrims have been infected by the vibrio cholerae bacteria, leading to a cholera infection. While reported cholera incidents have become quite few in recent years, outbreaks were a common feature at the Hajj before the 1990s (Shujaa & Alhamid, 2015). To control the spread of cholera, diarrhoea and other gastrointestinal infections, the Ministry of Health has strict regulations on the importation and handling of food products (Ministry of Health, 2018). Additionally, the ministry also encourages pilgrims to maintain high standards of hygiene throughout their entire visit to Mecca.

Regrettably , meningococcal disease has also been an infectious health concern historically during the Hajj. The infectious nature of this disease is typically at an

elevated level during the Hajj owing to overcrowding, elevated carrier rates and high humidity (Shujaa & Alhamid, 2015). As a result, there have been several meningococcal disease outbreaks during the Hajj. An outbreak of meningococcal serogroup A was last reported in 1989 (Memish, 2010). Since then, however, there have been two high profile outbreaks attributed to the serogroup W135. The first occurred in 2000 and affected approximately 1300 pilgrims, while the second occurred in the following year and is estimated to have affected slightly more than 1,100 people (Memish et al., 2013). Given the high risk to public health associated to meningococcal disease by the Ministry of Health, all pilgrims are required to receive a vaccination before entering Saudi Arabia.

Some of the rituals associated with the Hajj can expose pilgrims to the risk of contracting infectious blood-borne disease. At the end of every Hajj cycle, male pilgrims will typically shave their heads to signify a successfully completed pilgrimage (Memish, 2010). Regrettably , however, these haircuts are not always provided in the safest manner. For some of the pilgrims, getting a haircut typically means visiting roadside barbers. These barbers may sometimes use unsterilised blades to cut the hair of multiple people, thus creating an avenue for the possible spread of blood-borne diseases such as HIV and hepatitis (Memish, 2010). The Ministry of Health recognises the potential health risks caused by this behaviour and consequently encourages pilgrims to receive a hepatitis B vaccination before embarking on the Hajj. Additionally, pilgrims are also advised to be very careful of where and how they receive their haircuts, with only licenced barbers being preferred (Memish, 2010).

More recently, public health officials inside and outside Saudi Arabia have become aware of the potential risk for the global spread of antibiotic-resistant bacteria through mass gatherings such as the Hajj. According to the Al-Tawfiq and Memish (2015), antimicrobial resistance develops when microbial organisms such as bacteria survive exposure to an antimicrobial drug such as an antibiotic by changing. While gradual resistance to antimicrobial drugs is expected as a result of genetic changes, microbes are becoming increasingly resistant as a result of drug misuse. Antimicrobial resistance is considered a significant global health concern as it effectively makes certain medicines ineffective and increases the risk of infectious diseases being transmitted among people. As such, the concern that the globalisation of drug resistance could be achieved through the Hajj is valid. In fact, several studies have already proven that antibiotic-resistant bacteria can be transferred and spread by travellers. For example, a study by (Struelens et al., 2010), found that a section of travellers returning to the United Kingdom from India acquired New Delhi metallo-beta-lactamase-1 (NDM-1), which has shown significant resistance to almost all beta-lactam antibiotics. Given the fact that the Hajj is not only the largest human mass gathering in the world, but also that it is a recurring event, it creates multiple avenues for the spread of drug-resistant infections through close contact and interaction. Sadly, however, the literature available on the patterns of antibiotic use among Hajj-goers and the actual role they play in the dissemination of antibiotic resistance is still very limited (Al-Tawfiq & Memish, 2015).

2.14.3 Non-infectious-related health risks

While infectious diseases are by far the most prevalent health risks during the Hajj, they regrettably are not the only ones. Non-infectious-related health risks occur far less frequently but account for a significantly greater proportion of the mortality during the annual pilgrimage (Shujaa & Alhamid, 2015). Sadly, much of the mortality and morbidity associated with non-infectious-related risks are in fact avoidable. As such, it is not surprising that some of the preventative health measures recommended to pilgrims before embarking on the Hajj touch on non-infectious health risks.

Given the hot climate in Mecca, it is not surprising that heat-related diseases are a significant health risk during the Hajj. The congestion, difficult terrain and hot climate experienced during the pilgrimage can sometimes lead to fatigue among pilgrims (Shujaa & Alhamid, 2015). However, in extreme cases high temperatures can also causes heat stroke. For example, a highly deadly mass heatstroke incident was recorded during the 1985 Hajj, in which more than 1,000 pilgrims lost their lives (Shujaa & Alhamid, 2015). Regrettably , the sick and the elderly are typically at a higher risk of being affected by heat stroke. Simple recommendations such as using an umbrella, drinking water and applying sunscreen can go a long way in effectively preventing the occurrence of heat-related diseases.

Additionally, Crowd crushes have been some of the deadliest health risks reported at the Hajj in recent years. Human mass stampedes typically happen when panic occurs within a large crowd leading to uncontrolled mass movement that

ultimately cause injury or death (Salamati & Rahimi-Movaghar, 2016). Many of those killed in mass stampedes die as a result of traumatic asphyxiation (Salamati & Rahimi-Movaghar, 2016). Sadly, given the large crowd densities that are prevalent during the Hajj, scheduling and logistical errors can sometimes result in deadly human stampedes. This was regrettably the case during the 2015 Hajj pilgrimage, where over 2,000 pilgrims lost their lives (Salamati & Rahimi-Movaghar, 2016). Furthermore, before this incident, there had been several other deadly stampede incidents at the Hajj, going as far back as 1990.

Though not as prevalent as stampede incidents, pilgrims during the Hajj are also faced by the public health risk of fire incidents. In 1997, a fire incident occurred in the tent city of Mina that claimed the lives of 343 pilgrims and injured thousands more (Shujaa & Alhamid, 2015). The congestion of tents coupled with the strong winds that blow across the Mina valley, greatly facilitated the spread of the fire. Fortunately, in the years since strict fire regulations have been introduced that have prevented the recurrence of a similar incident. In addition to tents now being constructed of fire-resistant material, pilgrims are not allowed to cook in their tents.

2.14.4 Mass casualty incidents at Hajj

The threat of mass casualty incidents have significantly increased of the years. Mass casualty incidents can come in the form of stampedes, crash injuries, fires, and accidents. The occurrence of mass casualty incidents is always unpredictable. It is

important to realise that several mass casualty incidences have occurred in the recent years.

The Hajj mass casualty incident in 2015 is among one of the deadliest such occurrences in recent history. Two major disasters occurred during the 2015 Hajj, resulting in the death of pilgrims. The first major mass-casualty incident occurred on 15 September 2015 when a crane used to expand the area around the Grand Mosque in Mecca toppled over, killing 107 people and injuring more than 394 (Hopkins & Reicher, 2017). The victims came from 12 countries. The second mass casualty incident took place on 24 September 2015 when a major stampede occurred in Mina at the intersection leading to the Jamaraat Bridge. This mass casualty incident resulted in the death of 769 pilgrims and injuries to 934 pilgrims. The deaths were a result of traumatic injuries sustained and suffocation.

It is important to take measures to prevent the occurrence of mass casualty incidents in mass gatherings (Karami et al., 2019). Mass casualty incidents pose a significant challenge to health services. Essentially, preparations for mass casualty incidents are mandated by the WHO and should be followed by the organising authorities. When mass casualty incidents occur, local investigations and reviews should be done in order to assess the underlying factors leading to the incidents. It is also important to assess the effectiveness of the response plan as well as identify lessons for inclusion. For instance, simulations exercises and training of health workers is critical to mitigating mass casualty incidents, particularly in mass gatherings.

2.14.5 Health risk perception among Hajj pilgrims

Several studies have been conducted that have indirectly highlighted the state of health risk perception among Hajj pilgrims (Tashani et al., 2016). It has been shown that the perceptions and misperceptions that pilgrims have towards health risks and preventative measures greatly influence the uptake of these measures (Tashani et al., 2016). For example, in a study investigating barriers to vaccination uptake among Australian Hajj pilgrims, (Tashani et al., 2016) found that perceptions about vaccines being unsafe to be one of the biggest barriers. Equally, a study by (Alqahtani, Althimiri and BinDhim., 2019) reported that only 44% of pilgrim participants though the health risks at Hajj to be significant enough to seek pre-travel health advice. (Badahdah et al., 2019) also found the lack of awareness regarding Hajj's pandemic risk was one of the main causes of low influenza-A vaccines during the 2009 H1N1 influenza pandemic. Regrettably , however, the number of published studies that investigate health risk perception among Hajj pilgrims is too low to draw substantive conclusions. Examples of these studies include a study by (Gautret et al., 2013) investigating camel-milk-associated infection risk perception and knowledge in French Hajj pilgrims, while a study by (Alqahtani et al., 2019) investigated Saudi Hajj pilgrims' preparation and uptake of health preventive measures during Hajj 2017, and a study by (Al Shimemeri, 2012) also investigated cardiovascular diseases amoung Hajj pilgrims.

2.14.6 Preventative health measures recommended by the Ministry of Health

Cognisant of the various health risks that exist at the Hajj, the Saudi Ministry of Health every year publishes an updated list of preventative health guidelines and recommendations that pilgrims are expected to adhere to. The most recently published update was in readiness for the 1439H (2018) Hajj season. Among the diseases of special importance highlighted in the update was yellow fever. The Ministry instructed that all pilgrims from yellow fever-endemic countries in Africa and the Americas should show a valid yellow fever vaccination certificate (Ministry of Heath, 2018). Additionally, all pilgrims arriving in Saudi Arabia were required to show a valid meningococcal meningitis vaccination certificate. The ministry accepted either the trivalent ACYW135 polysaccharide vaccine or the trivalent ACYW135 conjugate vaccine (Ministry of Heath, 2018). For both yellow fever and meningococcal meningitis, the pilgrims were required to have received their vaccination shots no longer than ten days before travelling to the Kingdom. Equally also, pilgrims from countries at high risk of polio reintroduction were required to show a poliomyelitis vaccination certificate (Ministry of Heath, 2018). The at-risk countries were Afghanistan, Ethiopia, Myanmar, Nigeria, Pakistan, South Sudan, Syria and Yemen (Ministry of Heath, 2018).

Furthermore, with regards to seasonal influenza, the Ministry did not require all pilgrims to be vaccinated, but rather recommended that they did. It especially advised persons with compromised immune systems to receive the vaccine, and that it

also be given to young children, pregnant women and the elderly. Lastly, pilgrims from countries affected by the Zika virus disease or dengue fever were required to show certification that they had completed disinfection measures (Ministry of Heath, 2018).

A major concern going into the 2018 Hajj cycle was the growing threat of MERS-CoV and other similar respiratory infections. The Ministry set out a series of hygiene recommendations to prevent easy transmission (Ministry of Heath, 2018). All pilgrims were advised to wash their hands with soap or a disinfectant after sneezing (Ministry of Heath, 2018). This was also advised after using toilets or before handling food so as to reduce the risk of contracting a gastrointestinal infection. They were also advised to wear mask and use disposable tissues when coughing or sneezing in crowded areas. Further, pilgrims were warned against consuming any improperly stored or cooked foods, especially meat and milk.

Lastly the Ministry of Health encourages pilgrims to be in good physical condition and also actively seek out health education. As stated on numerous occasions, the Hajj can be a very tiring journey, especially considering the hot climate in Mecca. The Ministry encourages fellow governments only to grant those pilgrims in the correct physical condition to complete the pilgrimage the permission to embark on Hajj (Ministry of Heath, 2018). Those with serious health conditions such as advanced chronic illnesses are exempt from undertaking the Hajj under Islamic law (Ministry of Heath, 2018). Equally, once at the Hajj, pilgrims are encouraged stay out of direct contact with the sun and to drink a large amount of water so as to avoid heat exhaustion.

Foreign governments are encouraged to provide pilgrims with basic health education in preparation for the annual mass gathering.

In addition to these preventative measures provided by the Saudi Ministry of Health, several international organisations and governments also provide recommendations for pilgrims. For example, in order to prepare American pilgrims, the Centre for Disease Control and Prevention (CDC) has published a detailed overview of the Hajj pilgrimage on its website, including the various health issues involved (Guatret et al., 2013). Equally, the WHO regularly issues updates on health issues at the Hajj that pilgrims should be aware of, and the potential measures they can take to safeguard their health (Guatret et al., 2013). As such, there are multiple sources through which pilgrims can access information on effective preventative health measures to apply while in Mecca.

2.14.7 Adherence to recommended preventative health measures

The socio-medical model of interaction shows that pilgrims' behaviour also plays a major role in the mitigation of health risks at the Hajj (Figure 2). A significant portion of the studies investigating adherence preventative health measures during the Hajj have concentrated on the uptake of the influenza vaccine. The WHO and numerous national health bodies report vaccination as the most effective mitigation strategy against seasonal influenza (Alfelali & Rashid, 2014). There has, however, been little consensus on the exact rate of uptake among Hajj pilgrims, with results from various

studies varying considerably. According to a study carried out on Australian pilgrims by Barasheed et al. (2016), 65% and later 89% of the respondents reported receiving the seasonal influenza vaccine before travelling to Mecca. A study of Malaysian pilgrims reported that approximately 73% of them had received an influenza vaccine (Deris et al., 2016). The uptake rate is, however, considerably lower in other studies.

A 2013 study of French pilgrims found that none of the 129 respondents had received the seasonal influenza vaccine before embarking on the pilgrimage (Benkouiten et al., 2014). Additionally, the uptake of the vaccine was found to be equally varied among healthcare professionals working during the Hajj. (Madani and Ghabrah, 2007) reported that only 5.9% the respondents had received the vaccine. Even a study investigating the uptake of the influenza H1N1 vaccine before the 2009 Hajj found that only 30% of the pilgrims had received it despite the widely publicised concerns about a global pandemic (Memish et al., 2011). Awareness of other preventative measures targeting infectious respiratory diseases, such as good hygiene and face masks, was also limited to only 50% of the respondents (Memish et al., 2011). Studies have found that the use of face masks among pilgrims has been found to be equally varied, ranging from 0.02% to 98% (Barasheed et al., 2016). However, the reported average uptake is about 50% (Barasheed et al., 2016).

Arguably the greatest success achieved in adherence to recommended preventative health measures has been with the uptake of the meningococcal disease vaccine. According to Memish et al. (2014), the compliance rate for the Ministry of Health directive on meningococcal disease stands at a respectable 98.2%. Equally, the

uptake rate for Hajj healthcare workers was reported as 82.4%, specifically for the quadrivalent (ACYW135) vaccine (Madani & Ghabrah, 2007). This high uptake rate perhaps explains why there have been no reported meningococcal disease outbreaks in recent years, even though the reported incidence of some other infectious diseases has remained high. For example, the uptake of the pneumococcal vaccine has consistently been reported as below 30% despite pneumonia being one of the leading causes of hospital admissions and intensive care unit visits during the Hajj (Razavi, Saeednejad & Salamati, 2016). As such, the religious pilgrimage increases the risk of contracting respiratory diseases.

2.15 Kumbh Mela

The Kumbh Mela is a mass gathering held in India. As with the Hajj, the Kumbh Mela is a religious mass gathering. However, it is based on Hindu mythology as opposed to Islam (Sridhar, Gautret & Brouqui, 2015). Its mythological background stems from belief that nectar with the ability to create immortality was poured at four different locations within India. Every three years, the Kumbh Mela draws Hindu pilgrims from all over the world to one of these four locations. These four locations are on the banks of the River Ganges, the River Godavari, the River Kshipra and at Triveni Sangam (Sridhar, Gautret & Brouqui, 2015; Image 2). Unlike the Hajj, the exact duration of the Kumbh Mela and the exact number of rituals can differ significant from

edition to edition. For example, during the 2013 edition, the mass gathering lasted for close to two months (Sridhar et al., 2015), with a total of six specified bathing days. However, participants in the Kumbh Mela are not required to stay for the entirety of the mass gathering, and neither are they required to take a dip in the river.

The Kumbh Mela event attracts close to 100 million participants and is also faced by a wealth of health challenges (Sridhar et al., 2015). However, owing to the strong commitment of public health authorities in India, the Kumbh Mela has so far had not had significant health disaster events. One major reason for this is the fact that a greater portion of the event's budget has been put towards health, with an increase from 20% in 1966 to 45% in 2013 (David & Roy, 2016). There has also been an increased reliance on the collection and analysis of health data to inform relevant preventative measures. Equally, telemedicine and teleconsultation services have been introduced to enable the treatment of complex conditions and cases in the Kumbh Mela from tertiary hospitals located hundreds of miles away. Furthermore, in recent years at Kumbh Mela there has been a move away from compulsory inoculation towards improved sanitation and water services and increasing access to quality medical services.

Image two: Pilgrim's congregated on a river's bank for the Kumbh Mela (Nichetech Solutions, 2021)

2.15.1 Health risks during the Kumbh Mela

Several factors in the Kumbh Mela make the mass gathering susceptible to health risks. Arguably the greatest vulnerability is the large number of participants. At approximately 100 million participants, the Kumbh Mela is about 30 times larger than the Hajj (Mehta et al., 2014). Additionally, many of those who attend the Kumbh Mela are from low socio-economic backgrounds with unknown medical histories. For example, it is estimated that up to 56% of all children in India aged between one and two years old are not sufficiently immunised (Sridhar et al., 2015). Furthermore, as noted above, the mass gathering is held at four different locations, all of which are on the banks of rivers. This has complicated the creation of permanent facilitative

infrastructure. Instead, a Mela city is constructed at one of the chosen sites several weeks before the commencement of the mass gathering. However, some of the infrastructure in each city is not always sufficient to support the tens of millions of visitors. Equally, unlike the Hajj where almost all the pilgrims arrive by aeroplane, Kumbh Mela participants arrive by train, road, and on foot (David & Roy, 2016). This diversity of entry methods makes it difficult for the authorities not only to track visitors' movements but also to undertake effective health surveillance. Furthermore, depending on the duration of the Kumbh Mela, it can sometimes take place in winter months, thus exposing millions of people to extremely low temperatures.

2.15.2 Infectious disease risk

Cholera is the most prevalent infectious disease risk at the Kumbh Mela. During this mass gathering event, millions repeatedly and concurrently take holy baths in the river. Some of the participants also relieve themselves in the water, while others drink the same river waters. As such, should the water be contaminated, millions can easily become infected. According to Sridhar et al. (2015), a high number of bathers coupled with hot weather facilitates the growth of *Vibrio cholerae.* Additionally, the situation is further complicated by the fact that cooking is neither regulated nor supervised. Rather than prepare their own food, many pilgrims instead purchase cheap meals from the surrounding communities (Sridhar et al., 2015). Further, negative sanitation practicesmore such as open defecation are still widely practiced at the mass gathering

event. As such, there are multiple avenues through which visitors can come in contact with the cholera pathogen.

Other infectious diseases that are spread through contaminated water are also prevalent at the Kumbh Mela. While deadly cholera outbreaks were common even before the mid-20th century, no outbreaks have been reported since (David & Roy, 2016). However, the event has not experienced similar success with diarrhoea. According to Balsari et al. (2016), the incidence rate of diarrhoea at the Kumbh Mela stands at 5%. The same study found that most diarrhoea cases were reported approximately 48 hours after the designated bathing date. As such, the drinking of river waters can be inferred as the main vector for the spread of diarrhoea at the mass gathering event.

While infectious respiratory diseases are not linked with significant mortality at the Kumbh Mela, they are still very prevalent. Overcrowding, stress and exhaustion facilitate the spread of upper respiratory tract infections such as influenza. Additionally, the use of wood fuel and cow dung to create fires has caused many to seek treatment for persistent coughs. In fact, approximately 23% of the 15,000 patients treated during the event have received treatment for cough-related respiratory infections during the 2013 Kumbh Mela edition (Iyer, 2013). Furthermore, owing to the fact that tuberculosis is endemic to India, there is always a risk of the disease being spread at the annual mass gathering.

Some of the rituals undertaken at the Kumbh Mela expose visitors to blood-borne diseases. Some visitors undergo initiation to become *sadhus* (monks) at the mass

gathering. While many of the rituals involved in this initiation are not shown openly, the initiates are required to shave their heads (Sridhar et al., 2015). Given that this clean shave is often with a knife or blade, as opposed to sterilised equipment, it creates a risk of the spread of blood-borne diseases. Some of these diseases may include hepatitis and HIV/AIDS. That said, there has been little research into the spread of these diseases at Kumbh Mela rituals (Sridhar et al., 2015).

2.15.3 Non-infectious disease risk

As with the Hajj, the Kumbh Mela also involves a significant risk of human crowd crushes While this mass gathering does not occur within a fixed structural boundary, the movement of pilgrim is mainly limited to the banks of rivers (Balsari et al., 2016). As such, overcrowding is common on these river banks, and in extreme cases it has resulted in deadly crowd crushes. For example, in 1954 a mass crowd crushes occurred that killed 500 people and injured thousands more (Balsari et al., 2016). While there have not been other significant deadly mass crowd crushes at Kumbh Mela sites, several have occurred at facilitative venues and sites. For example, in 2013 36 people lost their lives at a railway station as visitors struggled to board trains headed to the Kumbh Mela (Sridhar et al., 2015).

The occurrence of sectoral conflict at the Kumbh Mela has also been directly and indirectly linked with injuries and deaths. As intimated earlier, this mass gathering attracts people from all walks of life. Some of the visitors belong to different religious

sects. As some of these sects are not cordial with each other, the Indian government has in the past tried to schedule different bath times for these groups. However, several clashes have still been reported between rival sects. For example, in 2010 an attempt by one sect to flex its might by driving into a crowd created a crowd crushes that injured several persons (Sridhar et al., 2015).

2.15.4 Preventative health measures recommended by the Ministry of Health

In recent years, there has been a strong commitment on the part of the public health authorities in India. The Kumbh Hela has not had significant accident (Sridhar et al., 2015) while there have been different reasons for this, not least the fact that a greater portion of the event's budget has been put towards health with an increase from 20% in 1966 to 45% in 2013 (David & Roy, 2016). There has also been an increased reliance on the collection and analysis of health data to inform relevant preventative measures. Equally, telemedicine and teleconsultation services have been introduced to enable the treatment of complex conditions and cases in Kumbh Mela from tertiary hospitals located hundreds of miles away. Furthermore, there has been a move away from compulsory inoculation in support of improved sanitation and water services and increasing access to quality medical services. Visitors are advised not to drink river waters, but instead consume the piped water provided by the government in the temporary Mela city (Balsari et al., 2016). Equally, they are also advised on how to handle and store food in a hygienic manner.

2.15.5 Adherence to recommended preventative health measures

The current literature includes very little research into the adherence to recommended preventative health measures at mass gatherings. That said, some studies have shown that despite government insistence against it, many pilgrims continue to drink water from the rivers as they consider it holy (Sridhar et al., 2015). Additionally, many insist on drinking due to superstitious beliefs about alternative water sources such as wells. Furthermore, the lack of adequate enforcement means that many pilgrims do not adhere to food-related preventative measures (Sridhar et al., 2015).

2.16 Arba'een pilgrimage

The third largest mass religious gathering is the annual Arba'een pilgrimage is held every year in Karbala, Iraq and challenges the Hajj in size (Karampourian et al., 2017). The mass gathering attracts approximately 20 million Shia Muslim pilgrims annually (Image 3). This large number has thus far not only created logistical challenge, but also public health challenges. However, this event is distinguished by limited literature available and focused on the direct healthcare impacts.

Image 3: Large number of congregants at the Arba'een pilgrimage (IQNA, 2019).

These challenges at the annual mass gathering event are partially caused by the defects of the health infrastructure in Iraq. Years of war have left large sections of the country devastated, including many that touch on the healthcare system (Karampourian et al., 2018). Additionally, organisers cannot adequately rely on the health infrastructure in the country when preparing for the annual event.

Despite the lack of significant research evidence, the Arba'een pilgrimage is believed to have significant infectious disease risk. According to Karampourian et al. (2018), this largely stems from the fact there have been very few efforts to address the underlying factors that have determined the prevalence of infectious diseases. In addition to insufficient public health facilities, the Arba'een pilgrimage is also characterised by insufficient sanitation facilities. Additionally, little regard is given to the diversity and density of the population that embarks upon the pilgrimage. Owing

to these complications in the control of underlying factors in the prevalence of infectious diseases, a wealth of infectious diseases could affect pilgrims at the annual mass-gathering event.

Research has also shown the level of risk perception among Arba'een pilgrims to be worryingly low. Many of those who embark on the pilgrimage do not have sufficient knowledge of public and private health conditions. As a result, many continue to engage in risky health behaviours such as unhygienic practices and refusal to take medication (Karampourian et al., 2018). This low awareness among pilgrims propagates the false idea that they will not be exposed to any health risks during the annual mass-gathering event. Consequently, disregarding health advice and requirements is seen as a harmless act.

2.17 Mashhad, Iran

As one of the largest cities in the northern part of Iran, Mashhad is regarded as one of the holiest sites for pilgrimage in the Arab world. As part a large and significant country in the Middle East, Mashhad is also known as a massive trade hub (Akhavi, 2020). This commercial importance translates into a sizeable population, which is the second largest in Iran after Tehran while it is also the home of many refugees from other countries. Owing to the pilgrimage, the Ali al-Rida shrine is one of the greatest tourist attraction for the city and it is estimated that more than 10 million people visits the city every year (Akhavi, 2020).

Several concerns have raised by a number of scholars regarding the preparedness of the Iranian government in managing the pilgrimage in Mashhad city (Ziabari, 2022). There have been reports that this year's pilgrimage has been met with a number of incidents, including crowd crushes and deaths from heat strokes as well as general disorganisation, all attributed to the health conditions of the pilgrims as they suffer from accidents and old age. Other complaints coming from pilgrims include problems with access to good quality drinking water, unreliable transport, poor hygiene and sleeping places, as well as general issues with safety and lack of security.

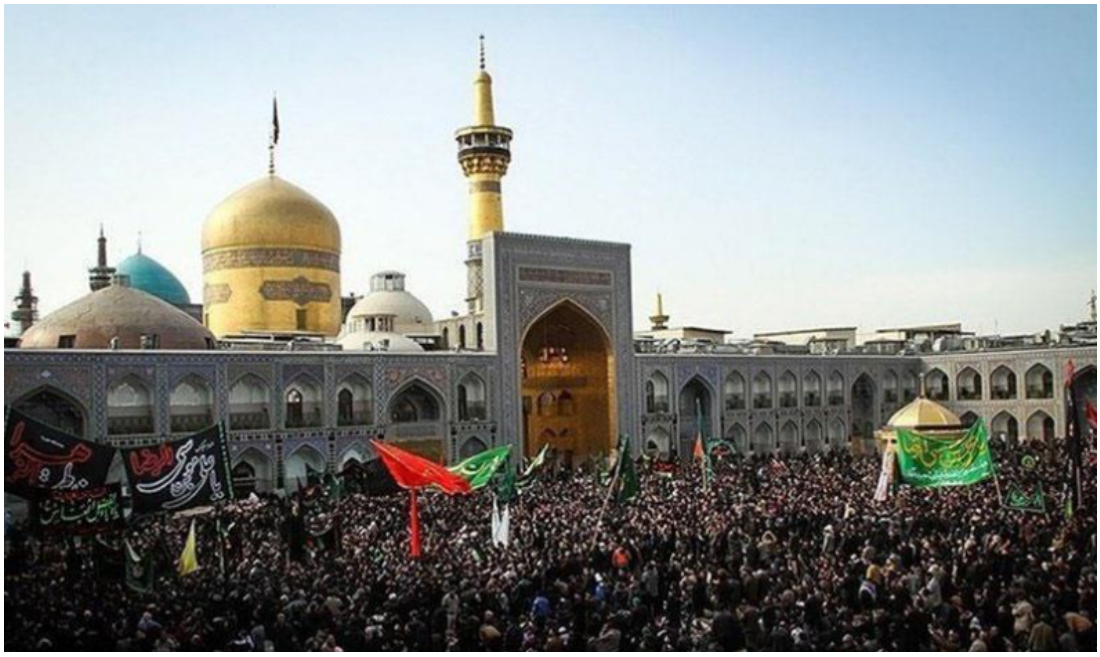


Image 4: (Millions commemorate the anniversary of the martyrdom of Imam Redha in the holy city of Mashhad, 2019)

One researcher (Razavizadeh et al., 2022) attributed the recent problems of the Mashdad pilgrimage to the world having experienced a widespread outbreak of the coronavirus, enduring pandemic conditions for the better part of the last two years. The

control or management of the pandemic heavily relied on strict preventative measures, such as social distancing and a ban on gatherings. Religious gatherings have not been exceptions to these measures, although such bans have been met with widespread criticism from religious leaders, who have claimed that more people than ever needed to express their religious faith in response to the difficult conditions created by the disease. The closure of the *Shi'ite Shrines* to impose a temporary ban on the pilgrimage thus sparked mixed feelings throughout the Muslim world, with religious leaders issuing harsh remarks about the pandemic measures.

One important study (Razavizadeh et al., 2022) looking specifically at religious devotees has revealed that consideration of this cultural aspect has a greater impact on the uptake of preventative health measures. In this sense, research (Fouladiyan et al., 2021) has reported that a significant percentage of the population were surprised and shocked by the authorities' decision to shut down the Mashdad shrine, with a majority of the respondents linking the closure to their theological notion of evil. This period has also been characterised by restrictions on religious activities and government interventions to maintain hygienic conditions being key in reducing prevalence of the virus. However, it could be argued that a majority of people involved in the pilgrimage have been in a state of denial or cognitive dissonance with regard to the restrictive measures employed by the Iranian government to manage the Covid-19 pandemic (Fouladiyan et al., 2021)

An earlier study (Ghezeldasht et al., 2013) has proven invaluable in expounding upon the relationship between mass movements of people and the spread of diseases,

utilising Mashhad city as a case study and with findings affirming the high prevalence of another virus, hepatitis E, during peak visitation in the city. The spread of hepatitis here could be attributed to conditions of overcrowding and the systems providing the country's water supply, although the Ghezeldasht et, al (2013) study also noted that the foreign visitors responsible for the temporary mixed population was the main concern in creating crowding tendencies rather than general population density.

This study (Ghezeldasht et al., 2013) further acknowledged the importance of state's preparing for mass gathering events in order to alleviate the damage that might be caused, citing densely populated areas being responsible for the high prevalence of hepatitis E, and so recommending that prevention and mitigation strategies be put in place before the pilgrimage occurs. Ghezeldasht's (2013) study has proven invaluable in outlining key areas, such as the drainage systems and water systems to be the key contributors to the high prevalence of the virus.

Another interesting study (Sharifi-Tehrani & Esfandiar, 2018) found that perceived health risks frequently have a negative association with the following factors: loyalty to the same destination; the quality of past visits; and an experience of non-victimisation. Here Sharifi-Tehrani & Esfandiar (2018) argued that, in view of the corresponding health risks across different areas associated with significant mass events such as the Hajj pilgrimage, planners and officials have an obligation to put in place effective prevention and mitigation strategies to counter the high prevalence of accident and disease. The final study that might be considered here (Abdollahzadeh et al., 2021) focused on the role that socio-economic factors play in determining a varying

range of perspectives on disease, with economic issues and health awareness being significant drivers in the spread of disease. Such research is invaluable in establishing as a basis for exploring the uptake of preventative measures by pilgrims resident alongside the regular population during the Hajj period.

2.18 The Festival of Pacific Arts and Micronesian Games

The Festival of Pacific Arts and the Micronesian Games draws participants and spectators from several countries (Rahman et al., 2017). This mass gathering presents significant health risks to the participants and spectators. The influx of people increases pressure on the fragile local health infrastructure. In 2014, the Eight Micronesian Games took place in the Pohnpei State, Federated States of Micronesia. Essentially, Pohnpei is a small island state of approximately 36,000 people in the western Pacific. The Micronesian Games attracted over 1700 athletes and officials from several Micronesian countries and territories. In June 2014, Pohnpei reported a major measles outbreak that spanned the duration of the games, resulting in a total of 251 cases. Following the incident, the UN's Third Conference on Small Developing States was held in Apia, Samoa in September 2014. The conference attracted over 3000 delegates from 115 countries. It was the largest event ever hosted by Samoa.

The 12th Festival of Pacific Arts was hosted by Guam, a Micronesian island of 163,000 people, in 2016 (Petersen et al., 2016). The festival was large and attracted over 2500 artists and performers from over 27 countries and territories across the

Micronesia. The island communities would have been greatly affected by the introduction of a novel disease. Notably, the event went on during a time when dengue, Zika, chikungunya and measles had been reported in the participating countries.

Fortunately, surveillance of mass gatherings has been given significant importance in the Pacific. The hosting countries in the region have hence been able to implement comprehensive and intensive mass gathering surveillance (Hopkins & Reicher, 2017). However, it is important to continue identifying opportunities for improvements in the various mass gathering surveillance programmes.

2.19 Cross-continental collaborations on mass gatherings

Several country-specific religious mass-gathering events attract pilgrims from other countries (Petersen et al., 2016). For instance, the Arbaeen pilgrimage attracts millions of pilgrims from around the Middle East. This event takes place in the Iraqi city of Karbala and poses significant public health risks. In West Africa, the Grand Magal religious pilgrimage in Sengal attracts millions of Muslim pilgrims from Senegal and the surrounding countries. It is the largest religious mass gathering in West Africa. Notably, the Grand Magal religious pilgrimage attracts individuals from outside Africa, increasing the potential for the globalisation of local endemic infectious diseases. As such, it is important to develop effective strategies for addressing the associated public health challenges (Hopkins & Reicher, 2017). The Africa CDC has

played a critical role in improving coordination and public health capacity building initiatives in partnership with event organisers.

Essentially, mass gatherings provide unique opportunities for cross-continental multidisciplinary collaborations on public health and basic science research. These allow for the development of strong evidence-based strategies for public health planning. Global health experts should share information from various mass gatherings around the globe. This collaboration will help in the creation of effective mass gathering medicine specialist society or formal network that will enhance international collaborations on mass gathering medicine.

There are several needs and opportunities for cross-continental multidisciplinary research and training in this field. For instance, there is a need for the development of a stronger evidence base for public health planning and health services for mass gatherings (Hopkins & Reicher, 2017). It is important to realise that the coordination of experiences of the organisers of various mass gatherings on a range of communicable and non-communicable diseases can offer ideal platforms for the formal discipline of mass-gathering medicine. These partnerships will help in obtaining strong evidence base along with updated mass gathering specific and individual guidelines. Moreover, cross-continental multidisciplinary research and training will provide opportunities for high quality studies designed to provide data that stands up to rigorous scientific review and so move the public health and health promotion agendas forwards across the globe.

The cross-continental efforts will help in the determination of causes of mass casualty incidences including crush injuries, crowd crushes, fires, crowd management, pilgrim psychology and behaviour, as well as implementation of measures for reducing public health risks. Additionally, there is need for effective and purpose driven surveillance of diseases with epidemic potential as well as determination of prevalence and prevention of transmission C. It is also important to carry out surveillance of antibiotic-resistant bacteria in order to prevent the globalisation of such pathogens.

2.20 Guidance for health risk assessment at mass gatherings

The World Health Organization has developed the Health Emergency and Disaster Risk Management framework for strengthening preparedness, response, and recovery from health emergencies in mass gatherings (Memish & Al-Rabeeah, 2013). The framework presents an all-hazards mass-gathering risk assessment tool that provides a benchmark for monitoring progress made in capacity strengthening over a given period. The framework also introduces a reputational risk assessment domain aimed at complementing the vulnerability and capacity assessment matrices. The tool is comprised of four key elements: hazard identification and prioritisation; vulnerability assessment matrix; capacity assessment matrix; and reputational risk.

The Health Emergency and Disaster Risk Management framework categorises hazards into four groups alongside their potential data sources. They include endemic diseases, current local or international disease outbreaks, historical data from similar

events, and threats arising from changing hazard characteristics. The classification allows for the identification of the most potential hazards for prioritization. Notably, the hazard prioritisation score is often defined by the product of frequency and magnitude and exposure based on the hazard prioritisation matrix. The prioritisation scores for all the hazards identified are then assessed and those with the highest scores are selected for further assessment. The number of selected hazards included in the risk assessment framework is a trade-off between the availability of risk assessment resources including the time and the risk management objectives of the various mass gatherings.

The vulnerability assessment matrix is another important element of the Health Emergency and Disaster Risk Management framework (Steffen et al., 2012). Essentially, vulnerability refers to the circumstances of people that make them susceptible to the damaging effects of a hazard. The initial step in the vulnerability assessment is to develop a set of scientifically based indicators from hazard and population characteristics and the predisposing factors. There are then two distinct of standardised indicators that incorporate hazard magnitude and vulnerability that should be developed to address infectious hazards and non-infectious hazards. With regard to infectious hazards, several indicator areas should be considered while dealing with infectious diseases. These various indicators include case fatality rate, endemicity and severe illness ratio, route of transmission, vulnerable population, vaccine effectiveness, and effective treatment. On the other hand, the non-infectious hazard vulnerability indicators include the morbidity rate, complications, mortality rate, vulnerable

population, types of risk factors and prevalence of risk factors. The risk areas are defined and ranked from one to five, in order of increasing vulnerability. Each indicator is assigned a weight which is ranked quantitatively from one to five. The weight score is obtained from the product of the indicator score and the weight.

The capacity assessment matrix involves the evaluation of the strengths, attributes, and resources available within a community that could be harnessed to minimize the adverse effects of hazards. The capacity indicators include governance, infection prevention and control, risk communication, surveillance of diseases, rapid response team, laboratory capacity, and case management. The main indicator areas for non-communicable diseases include screening for chronic diseases, number of core healthcare workers, and access to health services, inpatient bed density, referral system, and health promotion. With regards to external causes of morbidity and mortality, the relevant indicator areas include incident command and coordination, pre-hospital triage management, communication, and emergency response time. It is important to estimate the risk of each hazard in order to develop the most effective public health intervention strategies.

2.21 Discussion

This review has shown that public health risks during religious and mass gatherings have been investigated extensively, but there are still some evident gaps in the state of art. It can be noted that much of the current research has focused on the

Hajj and some insights from other mass gatherings have been overlooked. For example, while infectious disease risk at the Hajj has been covered extensively, commensurate academic and research attention has not been provided towards pandemic risk at this and other religious mass gatherings.

A common gap in all the case studies analysed is the limited evidence associated with risk perceptions, which makes it hard to understand why pilgrims choose to adopt or ignore preventative actions before and during these mass gathering events. Indeed, the literature on disaster reduction consider this element as a critical component to address vulnerabilities in emergency planning (Alexander, 2016). In other words, it can be noted that in all case studies the uptake of preventative measures is not always the same for all travellers (Razavi et al., 2016), although this is not supported by the discussion on the extent to which pilgrims are aware of health risks

Mass gatherings often increase the risk of public health challenges across the globe. Experts from various virtual WHO mass gathering collaboration centres and global academic and public health faculty provide important insights that guide development of optimal health and medical prevention at mass gatherings (Memish & Al-Rabeeah, 2013). By 2014, mass-gathering medicine had been formalised as a new discipline. There are several risks and hazards associated with mass gatherings. The first risk is the transmission of communicable diseases, including antibiotic-resistant bacterial infections. These infections can escalate into deadly epidemics that can adversely impact public health among the affected communities. It is always important to establish effective containment measures for communicable diseases, particularly in

the context of mass gatherings. The third important health risk related to mass gatherings is water and sanitation-related disorders Mass gatherings take many forms, including pilgrimages, sports events, music festivals, and regional and national commemorative events. While some mass gatherings are short-lived, some span days and even weeks.

It is important to realise that the main danger associated with mass gatherings is the potential for infectious disease transmission (Walsh et al., 2021). Essentially, mass gatherings bring people into proximity and thus increase the chances of infection transmission. Thus, policy makers should focus on anticipating and mitigating some of the public health risks associated with mass gatherings. A specialised field of medicine should be set up to address mass gatherings specific public health strategies. Mass gathering medicine can help in conducting pre-event risk assessments, conducting surveillance, and reporting procedures for monitoring patient presentations and organizing onsite medical facilities and services. The practical challenges that characterized the H1N1 influenza pandemic have informed some of the mass gathering health strategies and practices.

Around the world, social psychological discourses often focus on group behaviour and its relationships with social identity. Arguably, a variety of identities operate at different levels of abstraction (Memish & Al-Rabeeah, 2013). It is therefore important to establish some of the factors that that make other individuals to differ from others. People have multiple identities that vary in terms of their inclusiveness. It is important to realise that mass gatherings influence people's identities. This is because people

define themselves in terms of a particular social identity. As such, people that share a particular social identity tend to see each other as fellows rather than others. Research has shown that individuals who are religious report better health outcomes because religious mass gatherings provide health-relevant social capital. Religious gatherings are often characterised by the creation, enactment and maintenance of a community by the collective behaviour of members. For instance, the month-long Hindu Magh Mela has been associated with improved health and well-being among the participants. The pilgrims often report improvements in their health and well-being compared to non-attendees.

A variety of scholars have argued that an exclusive emphasis on the public health risks of mass gatherings could overshadow their potential benefits to the society. For instance, there is a consensus on the importance of participants experiencing a strong sense of social connection at mass gatherings (Shafi et al., 2008). The shared emotional experience among the participants can significantly contribute to positive social outcomes. These connections can give rise to powerful feelings of solidarity, leading to the development of a mutually supportive social unit. As such, mass gatherings should be encouraged rather than discouraging them. Policy makers can leverage social gatherings to influence a sense of social integration and well-being of citizens.

Meanwhile, several behaviours in mass gatherings impact the health of others negatively. For instance, Asian and African sports fans have the habit of blowing vuvuzelas which can facilitate the generation and dissemination of respiratory aerosols.

As such, these practices can create favourable conditions for infection transmission. Notably, some participants can share their vuvuzelas, significantly increasing the risk of infection transmission.

The Hajj is one of the most popular Muslim mass gatherings in the world. The primary site that Muslims visit while on the Hajj is the Kaaba. The Kaaba is the most sacred site in Islam and is widely described as the House of God. In fact, Muslims from all over the world are face the Kaaba while performing their daily Islamic prayers, Salah (Peters, 1996). In addition to the spiritual significance of bringing people closer with God, the Hajj also carries a social significance. This mass gathering allows Muslims from all over the world to commune with each other on an equal level. Furthermore, as the procedures and rites involved in the Hajj have remained unchanged for centuries, the pilgrimage also helps pilgrims feel connected with those that came before them.

Even for the Hajj, much of the research has concentrated on the causes and consequences of infectious disease risks (Sridhar et al., 2015). Much less evidence has not been a commensurate look into how pilgrims perceive health risks at mass gatherings and specifically the Hajj. For example, while there are numerous studies assessing the prevalence of infectious diseases at the Hajj, only a few have investigated the perceptions and attitudes pilgrims have towards them and the containment strategies used to prevent their spread. This trend is common with the analysis conducted on the Kumbh Mela, where numerous inferences have been made about the behaviours of pilgrims without a commensurate look into how they perceive health

risks (Sridhar et al., 2015). As highlighted above, in this case people's decisions on the adoption of preventative health measures are greatly dependent on how they perceive the underlying health risks (Skinner et al., 2015).

Finally, in all cases the literature overlooked the demographics and cultural drivers that could influence risk perception, risk awareness and the adoption of preventative measures. On the other hand, Kumbh Mela is a mass gathering held in India. As with the *Hajj,* the Kumbh Mela is a religious mass gathering. However, it is based on Hindu mythology as opposed to Islam (Sridhar et al., 2015).The third largest mass religious gathering is the annual Arba'een pilgrimage is held every year in Karbala, Iraq and challenges the Hajj in size (Karampourian et al., 2017). The mass gathering attracts approximately 20 million Shia Muslim pilgrims annually. This large number has thus far not only created logistical challenges, but also public health challenges.

Mass gatherings not only increase the risk of infectious disease transmission, but they may also lead to the globalisation of pathogens, including antibiotic-resistant bacteria. For instance, the most common infectious diseases during the Hajj are respiratory infections, particularly upper respiratory tract infections. For example, it is reported that up to a third of all pilgrims that embark on the Hajj experience respiratory symptoms associated with the influenza virus (Balkhy et al., 2004). This has consequently led to the influenza infection during the mass pilgrimage being informally referred to as the Hajj cough. While the Saudi response to the global Covid-19 pandemic is targeted as safeguarding public health, it has also reduced the country's

capacity to hold a large mass-gathering event. Compared to other countries, Saudi Arabia's standing as one of the leading authorities on mass gathering medicine left the country better prepared to combat a potential coronavirus pandemic. Additionally, as a signatory to WHO's International Health Regulation, the Kingdom has regularly been monitoring and reporting on its pandemic preparedness (Algaissi et al., 2020). The country set up a national committee to prepare for the pandemic more than two months before its first case was reported. While infectious diseases are by far the most prevalent health risks during the Hajj, they regrettably are not the only ones. Non-infectious-related health risks occur far less frequently but account for a significantly greater proportion of the mortality during the annual pilgrimage (Shujaa & Alhamid, 2015). Sadly, much of the mortality and morbidity associated with non-infectious-related risks are in fact avoidable. As such, it is not surprising that some of the preventative health measures recommended to pilgrims before embarking on the Hajj touch upon non-infectious health risks.

A significant portion of the studies investigating adherence preventative health measures during the Hajj have concentrated on the uptake of the influenza vaccine. The WHO and numerous national health bodies report vaccination as the most effective mitigation strategy against seasonal influenza (Alfelali & Rashid, 2014). As with the Hajj, the Kumbh Mela is also faced by a significant risk of human crowd craches. While this mass gathering does not occur within a fixed structural boundary, the movement of pilgrim is mainly limited to the banks of rivers (Balsari et al., 2016). As such, overcrowding is common on these river banks, and in extreme cases has resulted in

deadly stampede events. For example, in 1954, a mass crowd crushes occurred at the mass gathering killing 500 people and injuring thousands more (Balsari et al., 2016). While there have not been other significant deadly mass crowd crushes at Kumbh Mela sites, several have occurred at facilitative venues and sites. Essentially, mass gatherings provide unique opportunities for cross-continental multidisciplinary collaborations on public health and basic science research. This will allow for the development of strong evidence-based strategies for public health planning. Global health experts should share information from various mass gatherings around the globe. This will help in the creation of effective mass gathering medicine specialist society or formal network that will enhance international collaborations on mass gathering medicine.

In addition, there are several needs and opportunities for cross-continental multidisciplinary research and training. For instance, there is a need for a stronger evidence base to be developed for public health planning and health services for mass gatherings. It is important to realise that the coordination and coalition of experiences of the various mass gatherings organisers on a range of communicable and non-communicable diseases can offer ideal platforms to take the formal discipline of mass-gathering medicine forwards. This will help in obtaining strong evidence base along with updated mass gathering specific and individual guidelines. The World Health Organization has developed the Health Emergency and Disaster Risk Management framework for strengthening preparedness, response, and recovery from health emergencies in mass gathering (World Health Organization, 2019). he framework presents an all-hazard mass gathering risk assessment tool that provides a benchmark

for monitoring progress made in capacity strengthening over a given period. The framework also introduces a reputational risk assessment domain aimed at complementing the vulnerability and capacity assessment matrices. The tool is comprised of four key elements: hazard identification and prioritisation; vulnerability assessment matrix; capacity assessment matrix; and reputational risk.

These gaps suggest a focus on the current state of art on the hazard, exposure and physical vulnerability components of disaster risk. Instead, it is missing an understanding of vulnerability as a process where environmental, social and economic factors interact dynamically (Figure 1). In our case studies, for example, the physical vulnerabilities could manifest itself in the lack of adequate sanitation infrastructure (Sridhar et al., 2015). However, the inability to communicate with health professional at a mass gathering due to cultural or linguistic differences, as well as in policies and practices, can be seen as a barrier that increase disaster risk a social barrier by increasing the vulnerability of pilgrims. In other words, lack of communication or negligence in addressing underlying factors of vulnerability can act as amplifying factor of risk, which could be counteracted by developing and emergency planning process supported by positive factors, such as governance (Alexander, 2000).

While there are numerous models attempting to explain the differential use of preventive behaviour, one of the most consistently and widely used is the health belief model (HBM; Joseph et al., 2009; Skinner et al., 2015). This model holds that individuals base their decisions on preventative behaviours based on two key elements. The first element is their believed susceptibility to the health risk at hand (Skinner et

al., 2015). For example, a healthy young pilgrim may feel that their chances of contracting influenza while on the pilgrimage are quite low. The second element is the perceived severity of the health risk at hand (Skinner et al., 2015). For example, the same pilgrim may feel like even in the event that they contract seasonal influenza, the disease is not too serious. Therefore, based on the combination of these two trains of thought, the pilgrim may decide to forego seeking additional health information on influenza and taking up the preventative behaviours recommended by the Saudi Ministry of Health. However, the HBM goes on to clarify that these two elements are greatly influenced by information. Information can create an increased level of threat perception, but that alone is typically not sufficient to pressure an individual into adopting preventative behaviour.

Instead, decisions on whether or not to act are determined by a further two factors. The first is the overall perceived benefit of the proposed preventative behaviour. Secondly, the individual will typically assess the barriers associated with the preventative behaviour at hand, such as cost or embarrassment (Skinner et al., 2015). The eventual balance between the perceived benefits of a preventative action compared to its costs, ultimately determine whether an individual adopts it or not (Joseph et al., 2009). Just as with the HBM, pilgrims at the Hajj typically make decisions subjectively, thus explaining why despite factual evidence for the need of preventative health measures, some still choose not to adopt them. Understanding how people perceive health risks is a necessary ingredient in also understanding the preventative health measures people choose. Equally, how Hajj pilgrims perceive

health risks at Mecca plays a central role in informing whether or not they undertake pre-travel health advice-seeking behaviour and/or adopt the preventative health measures recommended by the Ministry of Health.

In conclusion, the findings of this review highlighting the differences between factors that have been investigated, partially investigated and leave open questions for future research

2.22 Conclusion

The literature on mass-gathering medicine has evolved substantially in recent years and has concentrated on analysing different ways of mitigating health risks. Many studies have focused on the epidemiological and physical conditions influencing these health risks, such as the infectious disease risk (Tavan et al., 2019). This review has emphasised that there is inadequate evidence on how pilgrims perceive risk, the factors affecting information dissemination and ultimately how these elements affect preparedness and training (Tavan et al., 2019). Despite the recommendations of documents such as the Sendai Framework for Disaster Risk Reduction (2015), socio-ecological drivers associated with health risks are not understood in their implications for vulnerability mitigation and risk reduction at large. In other words, future research would benefit from better contextualisation in the existing framework for disaster reduction, in order to address possible drivers and root causes.

This review of the state of current research presents some limitations although these do not invalidate the solidity of the outcome. For example, little data is available from other religious mass gathering events to compare with those analysed from the Hajj. This could point to the existence of linguistic and cultural barriers in the study and reporting of religious mass gatherings.

2.23 Chapter summery

This chapter reviewed previous research on the following topics: mass gatherings around the world, The Hajj, Kumbh Mela, Arba'een pilgrimage, Mashhad Iran, and sports events, with an emphasis on infectious and non-infectious health risks, recommended preventative health measures, and adherence to these measures.

So, it was necessary to have an intellectual background to comprehend the present research's findings. Quantitative and qualitative approaches were utilised to collect data for this investigation, as described in the next chapter, which discusses the methodology used in this study. I examine the perspectives of a number of international and national hajj pilgrims and Saudi authorities (decision makers) about the reality and function of raising awareness in mass gatherings. The next chapter will also explain the rationale for selecting a technique that has hardly been used to the mass collection of data during the hajj pilgrimage in Saudi Arabia, as well as demonstrate how the data was collected, analysed, and verified.

CHAPTER 3: METHODOLOGY

3.1 Introduction

The purpose of the chapter is to present the tools used in collecting the data and describe the analytical methods used in this study. It is hoped that this study will investigate health risk awareness of Saudi officials and perceptions in approaching mass gatherings, such as pilgrimages in Saudi Arabia. Moreover, it is hoped that the research will also reveal the appropriate methods and measures employed by the Ministry of Pilgrimage to reduce the risks associated with performing pilgrimage.

As has already been stated, a mixed qualitative and qualitative research approach has been utilised to collect the essential research data. This chapter is hence divided into various sections, each of which discusses a different aspect of the research methodology: descriptions of the methodology of qualitative and quantitative research and its application in this study; the research tools; the research participants; the research setting; data collecting processes ; the factors considered when implementing thematic analysis (TA) techniques for the pilot study; and finally, ethical considerations.

Despite persistent government efforts, significant gaps still remain in the adoption of preventative health actions by some of the pilgrims. My literature review has outlined that that many health risks continue to exist during the Hajj. Guided by the research questions, this study has hence set out to answer the relevant research

questions using a cross-sectional design method. The mixed research methodology employed has provided an overall picture of health risk perception among pilgrims despite the lower attendance of the Hajj over the past few years due to the coronavirus pandemic.

3.2 Methodological Framework

The methodological framework underpinning this research study is grounded in a pragmatic approach, combining elements of both positivism and constructivism. This framework was chosen based on the nature of the research questions and the need to balance objectivity with a nuanced understanding of human experiences and perceptions related to health risk during mass gatherings, particularly the Hajj pilgrimage in Saudi Arabia. Pragmatism is an overarching philosophy that emphasizes the practicality of research methods and the utility of findings. Pragmatism allows researchers to select and adapt research methods that are most suitable for addressing specific research questions and objectives. In this study, the pragmatic approach provides flexibility in combining quantitative and qualitative methods to gain a comprehensive understanding of health risk awareness and perception.Positivism is reflected in the quantitative component of the research, where empirical data is collected through structured surveys and analyzed using statistical techniques. This positivist aspect seeks to quantify and measure the extent of health risk perception, safety measures, and other variables among pilgrims. The quantitative data obtained through surveys allows for generalizability and statistical inference, providing a broad

perspective on the research questions. Constructivism, on the other hand, informs the qualitative component of the research. This approach recognizes that individuals construct their own understanding of reality, and it seeks to explore the meaning-making process. Qualitative methods such as interviews, observations, and thematic analysis are employed to delve into the subjective experiences, beliefs, and attitudes of pilgrims. This constructivist aspect aims to uncover the nuances, complexities, and cultural contexts that shape health risk perception and decision-making among pilgrims.

3.3 Rationale for the Selected Methodological Framework

Holistic Understanding: The mixed-method approach within a pragmatic framework allows for a holistic understanding of the research topic. By combining quantitative and qualitative methods, the research can capture both the breadth and depth of health risk perception during mass gatherings. Complementarity: Positivist and constructivist approaches complement each other. The quantitative data provide a quantitative baseline and identify patterns, while the qualitative data offer in-depth insights and explanations. Together, they create a richer and more nuanced picture. Applicability: Pragmatism aligns with the practical objectives of this research. It acknowledges that the findings should not only contribute to academic knowledge but also inform practical measures and policies related to health risk management during mass gatherings.Cultural Sensitivity: Given the cultural and contextual variations in the Hajj pilgrimage, a constructivist approach is essential for understanding the unique

perspectives of different pilgrim groups.Flexibility: Pragmatism allows for flexibility in adapting research methods to the dynamic and evolving context of mass gatherings, including unforeseen challenges such as the COVID-19 pandemic.Additionally, the chosen methodological framework of pragmatism integrates positivist and constructivist elements to provide a comprehensive and practical approach to studying health risk awareness and perception during mass gatherings. This approach aligns with the research's objectives and the need to balance quantitative data with qualitative insights to inform effective public health interventions and policies.

3.4 Sampling Design

The sampling design for this study involved both qualitative and quantitative methods. For the quantitative method, a cross-sectional survey was conducted among internal and external pilgrims performing the Hajj pilgrimage. The survey used a convenience sampling technique, where participants were selected based on their availability and willingness to participate. The survey was distributed to pilgrims at various locations, including airports, hotels, and Hajj camps. For the qualitative method, a purposive sampling technique was used to select participants who had experience with the Hajj pilgrimage. The participants were selected based on their age, gender, nationality, and health status to ensure diversity in the sample. The sampling tools used for identifying research participants included flyers, social media, and personal contacts. The rationale behind using these sampling tools was to reach a diverse group of participants who had experience with the Hajj pilgrimage .The survey used in this study was designed to

provide quantitative data on risk perceptions based on the research questions extracted from the literature. The survey consisted of two sections: the first section collected demographic information, while the second section assessed pre-travel advice-seeking behavior of pilgrims and their uptake of preventative health measures. The survey was designed to be completed in approximately 10-15 minutes. The qualitative data were collected through interviews and focus group discussions. The interviews and focus group discussions were conducted in Arabic and were audio-recorded with the participants' consent. The interviews and focus group discussions were semi-structured and covered topics such as health risks, preventative measures, and experiences during the Hajj pilgrimage.

3.5 Participant Selection Criteria

The participant selection criteria for this study were based on the diversity of experiences of pilgrims during the Hajj pilgrimage. The study aimed to include participants of different ages, genders, nationalities, and health statuses to ensure a diverse sample. The participants were selected using a purposive sampling technique, which allowed for the selection of participants who had experience with the Hajj pilgrimage. The sampling criteria were designed to ensure that the study captured a range of experiences and perspectives related to health risks during the Hajj pilgrimage.

3.6 Design of Survey and Interview Questions

The survey questions were designed to provide quantitative data on risk perceptions based on the research questions extracted from the literature. The survey consisted of

two sections: the first section collected demographic information, while the second section assessed pre-travel advice-seeking behavior of pilgrims and their uptake of preventative health measures. The survey questions were designed to be clear and concise, with closed-ended questions that allowed for easy analysis of the data.

The interview questions were designed to provide qualitative data on the experiences and perspectives of pilgrims and Saudi authorities related to health risks during the Hajj pilgrimage. The interview questions were semi-structured and covered topics such as health risks, preventative measures, and experiences during the Hajj pilgrimage. The questions were designed to be open-ended, allowing participants to share their experiences and perspectives in their own words. The questions were also designed to be flexible, allowing for follow-up questions based on the participants' responses.

The interview questions were based on the research questions extracted from the literature and were designed to be closely related to the research issues. The questions focused on issues such as the fundamental experiences of those involved in decision-making when it comes to making choices that benefit and increase the safety of pilgrims by increasing their understanding of the risks involved in doing the Hajj. The questions also focused on the authorities' understanding of current risks, their definition, and their mention to pilgrims in order to avoid them in the future. The participant selection criteria for this study were based on the diversity of experiences of pilgrims during the Hajj pilgrimage, and the survey and interview questions were designed to provide

quantitative and qualitative data on risk perceptions and experiences related to health risks during the Hajj pilgrimage. The questions were designed to be clear, concise, and flexible, allowing for easy analysis of the data and capturing a range

3.7 Quantitative research in a mixed-method approach

The mixed quantitative and qualitative research methodology used here has involved conducting a cross-sectional survey among internal and external pilgrims performing the Hajj. This survey evaluated the general safety and preventative measures applied, the factors that influence public health safety at Hajj, the source of pre-travel health advice, recommended preventative health measures and the effectiveness of preventative measures. I will now outline the planning and evolution of the study below.

3.7.1 Survey development:

I started by designing a survey (Appendix A) to provide quantitative data on risk perceptions based on the research questions extracted the literature. Using the limited time available, a cross-sectional design (7) was chosen to provide an overall picture of the perception of the health risk by pilgrims. The first section of the survey involved collecting demographic information. The second section assessed pre-travel advice-seeking behaviour of pilgrims and their uptake of preventative health measures. This section also enquired about pilgrims' attitudes towards various health risks and preventative measures recommended by the Saudi Ministry of Health.

The questions in the survey questionnaire were created by the researcher and tested for face and content validity with a panel of experts. The survey was then translated from English into six languages: Arabic, Urdu, Indonesian, Malay, Turkish and Persian. The translation was conducted by an official language translation agency and tested by official translators in the Consulate General of each of the countries.

3.7.2 Administration of the Survey

To identify all the external and internal pilgrims, I contacted the Institute of Hajj and Umrah Research in Mecca. I received approval to access all the holy places in Mecca during Hajj 2019. A first quantitative data collection was carried out from August 4th to August 25th, 2019, in Mecca, with the aim to gather as much quantitative data as possible within that time frame. I proceeded to approach 294 pilgrims randomly in different places in Mecca.

3.7.3 Participant Withdrawal

It's important to note that since the survey was designed to be completed anonymously, participants could not withdraw their responses once the survey was submitted. Anonymity was maintained to ensure the privacy and confidentiality of participants' responses. Therefore, participants did not have the option to withdraw their data after completing the survey.

3.7.4 Statistical analysis

Descriptive statistics using SPSS version 24 was used to analyse the collected responses. A P value ≤ 0.05 was accepted as the threshold of significance.

3.7.5 Ethical considerations:

Permission was sought from the Saudi Ministry of Health to conduct a public health study at the Hajj. Ethical approval was not required here as this survey was voluntary not requiring the involvement of any patients under treatment. In addition, each participant was provided with a consent form that they had to sign before participating in the study.

3.8 Qualitative research methods

When identifying the most appropriate methodology for the research approach, Corbin & Strauss (2008) emphasise that the complexity of comprehending social happenings, events, people's behaviour and experiences must be examined. To serve the purpose of this study, a qualitative approach was hence employed in a mixed research methodology.

According to Mack (2005), the ability of qualitative research to produce nuanced textual descriptions of how people experience a given research subject is one of its strengths. Such an approach offers insights about the "human" aspect of a problem, which is often characterised by the contradictory behaviours, ideas, views, emotions and relationships of individuals.

Qualitative methods have been used for many decades in the social sciences, communication, psychology, and education, among other fields, to study human issues. (Denzin & Lincoln, 2000). This research method offers a variety of interpretive and

naturalistic research techniques, drawing upon case studies, personal experiences, life stories, observations and interviews, all of which help to examine the issues involved with an overall goal of draw meaning from the events researched (ibid). Hoepfl (1997) highlights the following characteristics of qualitative or naturalistic research: qualitative method collects data from the natural environment, where the researcher makes an attempt to observe, describe and interpret settings in their natural state, so retaining what Patton (2002) refers to as "empathic neutrality". The researcher hence serves as the "human instrument" for data collection. Qualitative researchers primarily employ inductive data analysis, while qualitative research reports are descriptive, incorporating expressive language and the "presence of voice in the text" (Patton, 2002).

Moreover, qualitative research has an interpretive bent that aims to uncover hidden realities. Qualitative researchers hence give attention to both the particular and the universal, exploring the uniqueness of each situation. Qualitative research also employs an emergent rather than predefined design, where researchers concentrate on both the emerging process and the study's conclusions or output. Finally, qualitative research is evaluated using a unique criterion of trustworthiness (Devers, 1999).

Table 4. 1 Comparison between quantitative and qualitative methods (adapted from Castellan (2010, p. 7).

Research Method Components	**Qualitative**	**Quantitative**
Assumptions that are philosophical	The researcher interacts with the subject of the study from a post-positivist perspective, which is naturalistic, social, multifaceted, and subjective.	Positivist viewpoint, objective reality, researcher's independence from the subject of study.
Methodologies	Case study, ethnography, grounded theory, cultural studies, phenomenology.	Experiments, quasi-experiments, single-subject studies, descriptive studies, comparative studies, correlational studies, and ex post facto studies.
Aim and objective of the research	Interpretation, insight, understanding and contextualisation.	Prediction, explanation and generalisability.
Hypotheses or questions	The question is changing, broad and open-ended.	A hypothesis is based on evidence; a guess or a prediction.
Researched aspects	A modest number of non-representative examples are usually included.	A proportionally representative sample of the population was chosen at random.
The researchers who carried out the research	Personal participation and partiality; emic (from an insider's point of view).	Objective, unbiased, distant and impartial (from an outsider's perspective).
Data Collection	Written field notes, interviews, photographs,	Tests in the form

	observations, and artefacts.	of numbers and statistics, surveys, and questionnaires.
Data Analysis	Theoretical induction: codes, themes, and patterns.	Statistical procedures, deductive processes.

Source: Castellan (2010, p. 7)

It is my belief as the researcher here that a qualitative approach is suitable for understanding the feeling, perspectives and experiences of the participants concerning health risk awareness and perceptions of mass gatherings in a case study of pilgrimage in the Kingdom of Saudi Arabia. Such a study addresses in depth the risks that are associated with a pilgrimage in the KSA. A quantitative approach would not have provided the same deep insights into such a topic as, in contrast, quantitative surveys require that the researcher have a thorough understanding of the issue in order to establish useful variables to address the research questions.

Moreover, the issues and concepts that arise from this qualitative study can then be investigated further, creating variables for exploration in future investigations. The numerous opinions expressed, and the questions raised by the participants in this study (the Deputy Directors and other officials of Hajj and Umrah Department) can then be analysed using a quantitative method in future research using interviews and questionnaires. For the moment, the section below goes into greater depth about why the qualitative technique was chosen to provide detailed and nuanced information on the research questions tackled.

3.9 Justification for utilising qualitative research methods

This study has used a qualitative research technique as part of a mixed-method approach to investigate the risk perceptions and other health considerations around mass gatherings from the viewpoint of the Saudi authorities i.e., the state's senior decision-makers). This method was chosen with a particular emphasis on pilgrimage to the Hajj because it allowed for the examination of the participants' experiences as well as their concerns about health and non-health-related risk factors that occurred throughout the trip.

Corbin & Strauss (2008) asserted that a qualitative method may be used to gain fresh insights into phenomena that we do not comprehend. In addition, a qualitative approach is well-suited to the investigation of inexplicable occurrences and circumstances, as well as unusual situations. It is helpful when prior theories are deficient or insufficient (Patton, 2002). A qualitative approach is also appropriate for studies whose aims and objectives may be readily understood via a long narrative (Creswell & Creswell, 2017). According to Johnson & Christensen (2008), a qualitative approach enables the researcher to collect comprehensive and insightful information about ordinary life events that may be readily understood via a narrative approach. This research fits all of these requirements as it tries to understand the deputy directors' and officials' perspectives on mass gatherings and the health risks linked with the pilgrimage.

Given that the study examines the perspectives of officials and deputy directors in the Hajj and Umrah department, another reason why a qualitative study approach was selected is that the complexity of the experiences and perceptions of Saudi officials (as high-level decision-makers) cannot be represented adequately by quantitative data alone. As Labuschagne (2003) pointed out, human feelings and experiences cannot be investigated in laboratories or through scientific testing. As a result, a qualitative approach is seen as valuable for recalling everyday recollections, as it incorporates several strategies to help subjects recall matters that are easily forgotten.

3.10 Research instruments

The purpose of the interviews was to obtain replies from participants about their perceptions of pilgrims' health risks during mass gatherings. As such, the survey corrected assessed the influence of large groups on illness transmission and the preventative measures taken by the Ministry of Pilgrimage to minimise such occurrences.

The research questions originally selected directly influence the chosen research technique and, as a result, the research instruments used to gather data. For this study, interviews were used as the key method of data collection. According to Kumar (2018), the interview is a helpful research tool because it captures the interaction between two or more people with predetermined objectives and goals. Interviews are hence one of the key data collection techniques used by researchers to

analyse human behaviour (Cohen et al., 2007). Moreover, interviews are a standard qualitative research tool used by researchers to gain a deeper grasp of particular subjects under inquiry (Seidman, 2013), especially when dealing with human experiences.

Stake (1995) stated that interviews are the main route to engaging with different realities. Owing to the qualitative nature of interviewing, Fontana & Frey (2000) suggested that interviews can provide a more substantial breadth of data than can other techniques. Moreover, they added that interview participants should be treated as associates rather than as tasks to be completed to meet the researcher's goals. The interviews themselves should be warm and enjoyable if a researcher has established a good relationship with the participants, allowing the researcher to acquire a transparent and honest image of their interviewees.

3.11 Participants

The researcher conducted interviews with seventeen Saudi officials (senior decision-makers) in the Ministry of the Hajj, Ministry of Health, the Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research, the Royal Commission for Makkah City and Holy Sites, the Doyof al Rahman Programme, and the Emergency, Disasters and Ambulatory Transportation General Department. All the respondents were within the age range of 40-60 years all of them male and There were no women working as decision-makers among Saudi authorities in the Hajj pilgrimage. During the interviews,

the participants were allowed ample time to consider the level of health risk awareness during the Hajj pilgrimage.

The characteristics of the sample are shown in Table 4.2.

Table 4.2. The participants' age, gender, position, specialisation and years of experience.

No.	code	Age	Gender	Years of Experience
1-	R1	57	Male	37
2-	R2	47	Male	20
3-	R3	50	Male	30
4-	R4	45	male	9
5-	R5	43	Male	15
6-	R6	45	Male	29
7-	R7	52	Male	10
8-	R8	50	Male	30
9-	R9	57	Male	27
10-	R10	42	Male	20
11-	R11	45	Male	16
12-	R12	60	Male	48
13-	R13	50	Male	20
14-	R14	48	Male	20
15-	R15	58	Male	39
16-	R16	60	Male	40
17-	R17	47	Male	22

3.11 Research setting

This study was conducted in Makkah and Jeddah, cities which house the Ministry of the Hajj, Ministry of Health, the Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research, the Royal Commission for Makkah City and Holy Sites, the Doyof Al Rahman Programme, and the Emergency, Disasters and Ambulatory Transportation General Department, which is under government supervision and responsible to the Ministry of Health. As a researcher, I had no plans to pick a specific ministry or organisation. However, I sought to find a specialised

department that supports external and internal Hajj pilgrims, especially in raising health risk awareness among them.

3.12 Procedures for collecting data

The research data was obtained in the steps outlined below.

3.12.1 Ethical approval from the Ministry of Health

Prior to the data collecting phase, I obtained ethical approval from the Ministry of Health and UCL. In addition, I acquired official authority to gather data for the present research in accordance with the Kingdom of Saudi Arabia's higher education policy. The following government authorities granted approval: London's Cultural Attaché (represented by the Ministry of Higher Education). I submitted an official written request to the Ministry of Pilgrimage in January 2021 seeking permission to conduct interviews with all partner institutions that function during the Hajj expedition in order to gather data for the research (Appendix B). Prior to beginning my interviews, I was required to obtain a Certificate of Completion from The National Committee of BioEthics (NCBE) at King Abdulaziz City for Science and Technology (KACST), which verifies my eligibility to work in Saudi Arabian research (see Appendix C). In addition, I collaborated with the Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research as a supervisory institution. (For further information, Appendix D).

I also developed an action plan to organise my visit to the research site (Appendix E), which included meeting with management and defining the study's overall goal. This approach included calling and emailing their office managers to confirm their acceptance of the interview. Additionally, this procedure required that an interview schedule be established based on the participants' personal schedules and taking into consideration the most convenient periods throughout the official working hours (08:00 am to 04:00 pm). Organising the interview schedule for participants was rather problematic due to the fact that I was doing the interviews during the Covid-19 epidemic, which required me to undergo medical testing to assure safety.

3.12.2 The interview process

When interviewing subjects, it is critical to choose a peaceful location where they will feel safe, then securing discussion topics that are close to their hearts (McCosker et al., 2004). Interviewees also need to be allowed uninterrupted time to communicate or express thoughts, and to be free of other pressures. The workplace created a pleasant and peaceful setting for the interviews and enabled me to conduct myself professionally while facilitating the work and safeguarding the participants' privacy. At the start of each interview, I made a point of introducing myself and establishing a cordial and trusting connection with all participants by greeting them, reassuring them of their safety, and assuring them that all their personal information would remain confidential. I described the basic purpose of the research to every respondent, as well as their moral

rights. I then requested their written agreement to participate in the interview and sanction the audio recording of the conversation. They were requested to sign the English and Arabic versions of the permission form (see Appendices E and F, respectively).

All of the interviews were mostly performed in the Arabic language, face-to-face with the respondents, extending from one hour to an hour and a half. Due to the general benefits outlined above, I chose semi-structured interviews. Given the exploratory character of the research, the interview questions were wide and flexible so as not to influence the participants towards any specific point of view. In addition, I took care to put the interview questions in a side page so that they were addressed to all the participants which allowed for the review and balanced presentation of the general questions to the participants. Other questions to be asked were based on the nature of the replies from the participants, as long as they fitted within the overall framework of the study's objectives.

I took care to craft interview questions that were closely related to the research issues, hence deriving information for the questions from the previously reviewed literature. These questions focused on the following issues:

- The fundamental experiences of those involved in decision-making when it comes to making choices that benefit and increase the safety of pilgrims by increasing their understanding of the risks involved in doing the Hajj

- The authorities' understanding of current risks, their definition and their mention to pilgrims in order to avoid them in the future
- The officials' knowledge of future plans to improve pilgrims' awareness of risks from their places of origin prior to performing Hajj and developing the processes for training employees to service pilgrims.

Overall, it was important to understand the challenges and obstacles that decision-makers will have in adopting and improving them in the future. (Appendix F) contains the interview questions administered to the study's participants. In addition, I wanted to use the simple vocabulary of conversation and communication, which is different from the language utilised in academic discourse. I attempted to give uninterrupted attention to what the interviewees said, both orally and non-verbally, in order to encourage them to speak and be open and comfortable. Finally, all the interviews were audio recorded. In order to avoid instilling worry, eliciting hesitancy, or creating distractions, no notes were made throughout the conversation.

3.13 The pilot study

A pilot study is a preliminary test of the methodology undertaken before the major research in order to guarantee that the techniques or concepts used in the main study will work in reality (Kim, 2011). Here, (Jariath et al., 2000) clarify that a pilot study is

correctly organised from the start of the research proposal, helping the researcher to identify concerns and making required modifications and revisions to the main study. According to Kim (2011), a pilot study has the following advantages: (a) it identifies ethical issues, such as sampling, and provides an opportunity to resolve some of the issues that may impede the main research; (b) it seeks to reveal issues through real-world research experience, enabling qualitative researchers to concentrate on the topics of the proposed research that need to be expanded or narrowed, as well as gaining a clear perception of the main study's focus; (c) it assists qualitative beginner researchers in assessing and planning interviewing and observation techniques; (d) it may be used by individuals to self-assess their preparation, aptitude and motivation as a qualitative researcher; and (e) it adds to credibility of a qualitative study.

All the benefits outlined above have motivated the selection of a pilot study for use in the present research. The pilot study has helped to improve the primary study by providing a realistic image of the research prior to the beginning of the main study. I conducted my pilot study at the Custodian of the Two Holy Mosques Institute for Hajj and Umrah Research where its objectives were: (a) to review and develop the technique; (b) to determine whether the questions were understood by the interviewees, with the possibility of rewriting them if necessary; and (c) to determine whether the questions would provide sufficient data to conduct the main research. The pilot study took place in December 2020 and was addressed to academics who specialise in mass gatherings at the Custodian of the Two Holy Mosques Institute for Hajj and Umrah

Research. The data were gathered using semi-structured interviews that extended between 60 and 120 minutes and were conducted in a conversational manner.

I began by addressing the participants individually. Confidentiality, anonymity and consent issues were clarified and guaranteed. Face-to-face interviews occurred, which allowed for a free-and-easy flow of dialogue. Once I had posed the questions, I then waited for the interviewees to respond, sometimes interrupting to explain what had been stated. I followed with "Would you want to offer any further information to this subject?" as the last question.

I then transcribed all the participants' audio recordings. In addition, the interviews were prioritised for transcribing. I hired a transcriber who specialised in audio transcription and worked at 'Printing Undergraduates Services' to transcribe the audio content of the interviews. They highlighted stops, hesitations and any other quirks that happened throughout the interview to depict the conversation's genuine character accurately. As a consequence of the pilot study, the questions were modified and the original questions were slightly altered. The findings indicated that the questions needed to be tailored to the level of high decision-makers. In addition to obtaining significant estimates, I found that indirect inquiries should be utilised whenever possible, which is really important in obtaining as much information as without exposing the privacy of the participants.

3.14. Positionality in Research

Positionality refers to the researcher's social, cultural, and personal background, which can influence their perspectives, biases, and interactions with participants and data. In this section, I will discuss my own positionality in conducting this research and how my background may have impacted the study. Additionally, I will draw insights from relevant literature on positionality.

3.14.1 Researcher Positionality

I am a Saudi researcher who has had direct experiences with the Hajj pilgrimage. During my youth, I participated in the pilgrimage with my family, gaining firsthand knowledge of the pilgrimage process and the challenges faced by pilgrims. This personal experience has given me a unique perspective and understanding of the Hajj pilgrimage, including the risks and the importance of following the recommendations of the Ministry of Hajj.

3.14.2 Literature on Positionality

Positionality is a concept widely discussed in the social sciences and qualitative research literature. Researchers such as Donna Haraway (1988) and Sandra Harding (1993) have emphasized the significance of acknowledging one's standpoint and its potential impact on research. Reflexivity, as advocated by Norman Denzin and Yvonna

Lincoln (1998), involves recognizing the researcher's role in shaping research outcomes and being transparent about one's perspective.

3.14.3 Impact of My Positionality

My personal background and experiences may have influenced the research in several ways:Insider Perspective: My intimate familiarity with the Hajj pilgrimage as a Saudi who has participated in the event and worked during it provides an insider's perspective. This can be valuable in understanding the nuances of the pilgrimage experience, cultural context, and the specific challenges faced by pilgrims.

Bias and Preconceptions: There is a possibility that my personal experiences and beliefs regarding the Ministry of Hajj recommendations may introduce bias. It's important to acknowledge that my positive view of these recommendations, based on my experiences, could influence data collection and interpretation.

Empathetic Understanding: On the positive side, my personal experiences may enhance my ability to empathize with the participants and establish rapport during interviews or interactions. This can contribute to richer qualitative data.

3.14.4 Mitigating the Impact of Positionality:

To mitigate the potential impact of my positionality on the research, I have taken the following measures:Reflexivity: I have engaged in continuous reflection throughout

the research process, being aware of how my background and experiences may influence my interactions with participants and my interpretation of data.External Perspectives: I have sought external feedback from peers and mentors who may have different perspectives and experiences to balance my insider viewpoint.Methodological Pluralism: Utilizing both quantitative and qualitative methods allow for a more comprehensive and balanced exploration of the research questions, reducing the potential for bias.

3.15 Data analysis

Thematic analysis was selected as the method to analyse the interview data. According to Braun & Clarke (2014), this technique can be used to analyse qualitative data as it helps to identify patterns across a dataset in order to pinpoint, analyse and report the key themes repeated throughout them (Kiger & Varpio, 2020). I analysed the interview transcripts to determine the themes, sub-themes and generating themes that were key to the research questions and goals to ensure the reliability of the study (Prayag & Ryan, 2011).

The data were coded, identified, and analysed qualitatively and quantitatively. The researcher identified raw data including the perspectives of the Saudi authorities (the high-level decision-makers) regarding the pilgrimage and the strategies used by the Ministry of Pilgrimage to mitigate the risks associated with it. I then interpreted and discussed the findings. I analysed and interpreted the data qualitatively. As stated by (Braun and Clarke, 2006), the researcher himself is the key instrument of qualitative

research. Since the main focus of this study is qualitative, I used (Braun and Clarke's, 2006) qualitative approach in order to analyse the data. Moreover, (Guba & Lincoln, 1994) stated that the best instrument for qualitative naturalistic inquiry is the human being. Therefore, the researchers in this study played a role in every phase of the process, starting with organising the research, collecting data, analysing the data, and finally reporting the results.

Thematic analysis was able to lay out the participants' perspectives on health care awareness and their perceptions of mass gatherings. The procedures for data analysis in this research were as follows (Braun and Clarke, 2006). I identified the raw data that illustrated the risks and non-health-related risks of the pilgrimage and the measures employed by the Ministry of Pilgrimage to reduce these risks. I then interpreted and discussed the findings.

Table 4. 3 Thematic Analysis Stages

stage		Explanation of the process
1	Understanding yourself with your data	Data transcription (if required), data reading and rereading, and jotting down first remarks.
2	Creating primary codes	The systematic coding of data important characteristics throughout the complete data set, followed by the collection of data related to each code.
3	Attempting to locate themes	Assembling codes into prospective themes and collecting all significant data for each possible theme.
4	Considering themes	Checking if the themes operate in connection to the coded extracts (Level 1) and the complete data set (Level 2), and constructing a "map" of the analysis based on the themes.
5	Identifying and defining themes	Consistent analysis to develop the particulars of each topic and the overall narrative the analysis conveys, resulting in the

		generation of specific definitions and descriptions for each theme.
6	Creating the report	The last possibility for analysis. Selection of vivid, persuasive extract examples, final analysis of chosen extracts, linking the analysis back to the research objective and literature, and development of a scholarly report of the analysis.

Source: Braun & Clarke (2006, p. 87)

3.16 Thematic analysis factors to take into consideration

Using data collection to guarantee the clarity and direction of the analysis, I took numerous considerations into account while using thematic analysis (TA) in this study. (Braun and Clarke, 2006) state that when a researcher uses TA, he or she has two alternatives prior to collecting data: (a) a complete description of the data set, or (b) a detailed account of a specific element. Given that the purpose of this research is to investigate the perspectives of Saudi officials (i.e., senior decision-makers) on the Hajj pilgrimage, their experiences, their thoughts and their viewpoints, I determined the first option (a) to be the most appropriate.

The second consideration was about how to identify the recurring themes that emerged from the data. Two approaches are possible: a theoretical deductive 'top-down' approach or an inductive 'bottom-up' one. According to Creswell and Plano (2007), the deductive researcher works from the 'top down', beginning with a theory and progressing through the hypotheses and facts that support or refute the theory. Inductive researchers, on the other hand, operate from the bottom-up, employing participants' perspectives to generate bigger themes and a theory linking the topics.

The approach used in this study was not based on a single theory prescribed from the start, but rather on the discovery of topics emerging from participants' responses and their organisation and coding. The mixed-method approach has hence culminated in the development of a theoretical framework that is appropriate to the context of this study by highlighting the role of Saudi officials (senior decision makers) in increasing risk aversion among Hajj pilgrims. An inductive technique was then found to be more suitable for a subject that had not previously been examined before in the Saudi setting.

The third factor to evaluate is the 'level' at which the themes in TA should be recognised. Two categories of level exist in qualitative research: the explicit/semantic and latent/interpretive. (Braun & Clarke, 2006) describe these stages as follows. With a semantic method, themes are recognised within the data's explicit or surface meanings, where the analyst is not seeking anything beyond what a participant said or wrote. In an ideal world, the analytic process would go beyond description, where facts are merely organised and summarised to interpretation, and where an effort is made to theorise the importance of the patterns and their larger meanings and consequences. As a result, the present research relies on a semantic and explicit level of analysis of the themes discovered, examining participants' ideas and experiences in order to identify, evaluate and debate just what has been said without delving deeper into participants' minds. The sections that follow will now describe how (Braun and Clarke's, 2006) stages of thematic analysis have been used to this research.

3.17 The six stages of thematic analysis in this study

3.17.1 Stage One: Understanding yourself with your data

According to Braun and Clarke (2006), transcribing is an excellent method for researchers to get familiar with data in preparation for doing a theme analysis. This is especially true when working with verbal data such as interviews, television programmes, and political speeches.Additionally, some scholars (e.g., Bird, 2005) think that it should be considered as a critical stage of data processing within a qualitative, interpretive approach.

For the purposes of this research, all the interviews were transcribed to guarantee that enough understanding of the material gathered during the interview was obtained. A specialist from Undergraduate Printing Services was charged with transcribing the audio material of the interviews, including pauses, hesitations, and any other quirks that happened throughout the process of the interviews, in order to correctly depict the genuine nature of the discussions. The specialist was chosen to ensure impartiality in recording all the responses and to eliminate any potential bias that may have occurred. I transcribed the recordings. If I were the one transcribing, for instance, I may have been influenced by my perceptions of the participants during the interviews, summarising what I heard and therefore missing a plethora of data and possible codes and themes that emerged from the data. My isolation from the data transcription helped ensure the fairness of the process. As a researcher, it was my

mission to carefully compare the audio recording with the written notes to verify that no words or phrases were omitted.For the purposes of this research then, the codes and themes derived from the participants' replies could be regarded as more trustworthy. Moreover, I identified the raw data that pertained to the main objectives and questions of the study; namely, the health risks that existed during the pilgrimage, the role of the mass gathering in transmitting illnesses, and the preventive measures that are employed by the government to reduce the health risks. I then omitted the statements that did contained metaphorical expressions as they did not serve the main purpose of the study. I was hence able to immerse myself completely in the data, reading the texts again and beginning with the first stages of qualitative analysis in exploring the initial codes that provided a specific targeted response from a particular respondent before classification. This transcription process took two months, while the analysis itself took five months.

3.17.2 Stage Two: Creating primary codes.

Brown and Clark (2006) define inductive analysis as the categorization of data without consideration to preexisting coding frameworks or the researcher's analytical beliefs. The themes were therefore produced inductively as opposed to deductively. This stage included the development of the first data codes. I started manually coding (using open codes) by reading the transcripts extensively and, for analytical reasons, writing notes alongside the texts using highlighters and coloured pens to indicate the relevant and useful codes before documenting all observations in the text margins.

I then established preliminary codes for the data of each participant. After then, the codes were organised in tables. I collected the all descriptive codes, arranged them in a list, assigned them names, and defined them. Following that process, I created a checklist for each participant to confirm that they had stated the codes.

3.17.3 Stage three: Attempting to locate themes.

In this step, I made use of a mind map to classify and arrange the codes that had been generated in the previous phase (see Figure 4.1). This process aided in the organisation and composition of a number of significant themes and sub-themes critical to the findings of the study.

3.17.4 Stage four: Considering themes

This step involving refining themes and incorporating some into others. As a consequence, we went back and examined all the data fragments that seemed to fit a theme to make sure they really did follow a consistent logic.Additionally, the entire concepts pertinent to this research were ordered, while those of marginal significance were omitted.

3.17.5 Stage five: Identifying and defining themes

After compiling, organising and reviewing thre entire of the codes, a list of themes and sub-themes that were relevant to the study. In this way, I ensured that

themes and sub-categories were identified and labelled, and that each sub-category selected was most suitable and related to the primary topics. Additionally, I simplified the labels to ensure that they expressed the whole subject succinctly, while also using those that were well recognised in the area of risk and disaster management.

3.17.6 Stage six: Creating the report.

This last stage of the thematic analysis involved generating, presenting and discussing the findings. This process served as the foundation for the work completed in chapter 5.

3.18 Ethical Considerations

According to Robson (2002), doing research ethically entails adhering to a code of conduct to protect the interests and concerns of individuals participating in research or potentially impacted by it. Additionally, (Blaxter et al., 2006) contend that any social research raises a variety of ethical concerns, including privacy, informed permission, anonymity, secrecy, honesty and the usefulness of the study. As a researcher, I was motivated to address various ethical concerns throughout the creation of this academic work in accordance with University College London's focus on the relevance of ethics in research and assistance to its researchers during the conduct of their studies. As stated above, I obtained formal consent from the appropriate organisations and authorities, while extra attention was paid to the research

participants. The upshot was that I applied research ethics at three fundamental points over the course of this academic work in terms of the following: (a) factors considered before to the interview; (b) factors considered during the interview; and (c) factors considered after the interview.

3.18.1 Factors to consider before the interviews

The participants in this research were all at least 20 years old and competent enough to provide their informed permission. They were high-ranking officials from a variety of organisations who had a long history of involvement with the pilgrimage mission. It was my job as a researcher to explain to their office managers why it was so important that our interviewees understood what we were doing before they agreed to participate in the study. Obtaining their approval before the interview was essential.

Decision-makers may be reluctant to participate in research at first, but once they do, they tend to stick to their decision. Moreover, it is impossible to renege on a decision to deny study participation. Respecting the customs and preferences of Saudi society's top decision-makers was critical to me as a Saudi researcher, so I made a particular request to their office managers for permission to conduct interviews over the telephone.

Second, before to doing the interview, I went over the overall purpose of the study as well as the scope of the research with the participants. Additionally, I assured

them that no confidential information would be released. I also stated that I would not publish any material that they did not want to be publicised. In light of these criteria, it was made quite apparent that no one was obligated to answer any questions. In addition, they were allowed to leave the interview at any time without providing an explanation if they were feeling uncomfortable.

The purpose of confirming these rights was foster confidence between participants and myself. Notably, participants were required to sign two separate informed consent forms; one was retained by them and the other was retained by myself. As noted previously, I also translated the permiton form into Arabic (Appendix D) to ensure that they were aware of their rights as participants in this research. Finally, I obtained their permission by obtaining their signatures. In additional, They provided me their contact information, including phone and email, in case I needed to communicate with them again.

3.18 .2 Factors to consider during the interview

I worked together with their office managers to arrange a specific location for the actual interviews. As indicated before, it was critical to instil a feeling of security and privacy in participants while speaking with me, and even more so given that senior officials have their own set of norms for those who meet with them. Their official offices were chosen, being that this was easy and a pleasant option. As the researcher,

it was important for me to establish a polite and comfortable connection with the subjects via casual conversations and good humour.

I then stated to the participants that the interview would be audio-recorded and afterwards transcribed. I also advised them that they might request that the audio recording cease for personal reasons or if they did not want the information recorded. Indeed, this was a common occurrence when individuals talked really confidential personal matters. I paused the registration and listened to them privately at certain moments. To elicit comfort from the respondents, I demonstrated interest via nonverbal gestures, attentive listening and the absence of side remarks. I aimed to ensure that my participants comfortable at ease and were able to share their opinions - favourable or bad - with complete candour and openness. All the interviewees expressed enthusiasm for the interviews and consented to their data being published for scholarly reasons in order to improve the area of risk and disaster reduction. During the discussion with the Saudi senior authorities, they also agreed that they sould to contact with researchers through interviews and hear their perspectives and experiences on any issue relevent to Hajj pilgrimage safety.

3.18.3 Factors to Consider post the Interview

After completing the interviews and compiling the data, I took care to disguise the participants' identities and substitute them for generic codes, such as R1, as previously indicated. I also omitted any official documents with the Institute's name or

participant data. This guaranteed that, in accordance with research ethics, anonymity and privacy were maintained. The participants in this study mentioned some significant questions. Before finalising the sound recordings then, I spoke to the participants about the prospect of addressing certain explicit and delicate themes of Hajj pilgrimage safety. The participants believed that it was important to have candid talks regarding delicate subjects in order to promote understanding about the nature of their profession regarding the Hajj pilgrims.

Additionally, the participants encouraged me to communicate my results and the problems they highlighted to the government of Saudi Arabia and all relevant agencies for them to take appropriate action. In additional, requested expressly that I present an accurate picture of the status of Saudi authorities overseeing the Hajj pilgrimage operation, emphasising the need of openness and trustworthiness. To protect the material, I stored and saved the interviews using high-quality recording equipment. Only my supervisor and I had access to the tapes. This research only analysed the data that to the subject. The data set has been stored securely and will be destroyed at the end of the study.

3.19 General Data Protection Regulation (GDPR) Compliance

Ensuring compliance with the General Data Protection Regulation (GDPR) is crucial when conducting research that involves the collection and processing of personal data, particularly in studies that gather information from individuals within the European

Union (EU) or involve EU citizens. This section outlines how this research ensured GDPR compliance throughout the data collection and handling processes.

3.19.1 Informed Consent:

Participants were provided with clear and comprehensive information about the research, including its purpose, the data collection methods, and the use of their data. Consent forms were used to obtain explicit consent from participants before their participation in the research. Participants were informed of their right to withdraw their consent at any time without facing any adverse consequences.

3.19.2 Data Anonymization:

Personal identifiers such as names, addresses, and contact details were not collected during the research process. Survey responses and qualitative data were collected anonymously to ensure that individual participants could not be identified.

3.19.2.1 Data Storage and Security:

Any digital data collected were stored securely using encryption and password protection. Physical research materials, such as consent forms or printed surveys, were kept in locked storage to prevent unauthorized access.

3.19.2.2 Data Retention and Deletion:

Data were retained only for the duration necessary to complete the research objectives. After the research was completed, any identifiable data were securely deleted, and any remaining data were aggregated and anonymized for analysis.

3.19.2.3 Data Transfer:

If any data were transferred across borders, appropriate measures were taken to ensure that data protection standards were maintained during the transfer.

3.19.2.4 Data Access and Transparency:

Participants were informed of their right to access their data and were provided with contact information for any inquiries or data access requests.

3.19.2.5 Ethical Review:

Ethical approval, including GDPR compliance, was obtained from the relevant institutional review board (IRB) or ethics committee, ensuring that the research design and data handling processes adhered to legal and ethical standards.

3.19.2.6 Privacy by Design:

Data protection principles were integrated into the research design from the outset, emphasizing privacy by design as a fundamental aspect of the study.

3.19.2.7 Data Protection Officer (DPO):

A designated Data Protection Officer, if required by applicable regulations, oversaw the research's data protection measures and ensured ongoing compliance.By following these GDPR compliance measures, this research aimed to protect the privacy and data rights of participants, ensuring that the research was conducted in an ethical and legally compliant manner.

3.20. Validity

(Kvale, 2007) underlines that the concept validity refers to the truth, accuracy and strength of a proposition in regular language. A legitimate argument is then one that is sound, well-founded, defensible, persuasive and forceful. In the social sciences, validity refers to the question of whether a technique really studies what it claims to be a subject of research. Furthermore, (Guba and Lincoln, 1989) emphasised that validity is contingent upon whether the findings have genuine consequences for the participants' perceptions and descriptions. A researcher may ensure authenticity by conducting "member validation" refers to the process of returning complete data to participants in order to verify its accuracy. According to Chioncel et al. (2003), this suggests that the

transcribed data should properly represent the participants' responses. According to Kvale, "communicative validity entails determining the validity of knowledge assertions throughout a discourse. What constitutes a genuine observation or interpretation is determined by the relevant community's discourse" (Kvale, 2007, p. 125) Additionally, Kvale identified three types of communicative validation: peer validation, audience validation and member validation.

Three criteria were used to determine the validity of this investigation. To begin with, I conducted "member validation" by sending all participants the interview transcripts. I requested that they examine the contents. Without exception, all participants regarded the transcripts to be satisfactory, and the data were determined to be free of errors and additions. I then performed a search for "peer validation." Here, I was concerned about protecting the study's anonymity as required by the ethics of scientific enquiry.As a result, peer validation was confined to appropriate individuals, including my supervisor. He tracked the development of the study from beginning to end and offered critical input that shaped this research. The thoughts and perspectives of a dircter academic are critical in ensuring that the task is carried out in a clear and credible way.

Finally, for "audience validation," I contacted PhD students and many professors from the Institute for Risk and Disaster Reduction about their thoughts on the research before, during, and after the application process, the experiment, and the

final write-up. Taking part in academic conferences hosted by the institution and abroad, as well as participating in workshops on qualitative analysis and publishing the findings, all provided clear benefits to the completion of the thesis.

3.21 Reliability

According to Lutzhoft et al. (2010) reliability in qualitative study describes to the degree tthat a result is independent of the study's incidental conditions, which is contingent on clearly defined observational methodologies. According to Leung (2015), the essence of reliability in qualitative study is consistency: "A margin of error is acceptable for finding in qualitative study if the methodology and epistemological logistics consistently produce data that are ontologically similar but may differ in richness and ambience within similar dimensions." Additionally, (Yin, 2009) believes that operationalising the study stages is a strategy to assure dependability. In the other words, the structure of the methodology, and the data collection, analysis, and conclusions should all be well-documented in order to enable other reserchers to replicate the findings. (Eisner, 2017) also emphasises the need for a “excellent qualitative investigation” in aiding in the comprehension of an otherwise ambiguous or complex scenario. This statement says that when researchers present the data they obtained, they should clarify how they acquired and analysed them. Additionally, such an approach will benefit other scholars working on comparable topics.

To make sure that the consistency of the processes used in this study, I carefully described the methods required to collecct the research meticulously, including obtaining formal approvals and ethics approvals for this study. I also employed a solid method of participant selection, which was conducted with the help of the participants' office managers, thereby eliminating any potential of bias on my part. Additionally, all of the interviews were recorded and transcribed in the participants' native language (Arabic) by a person who works with university students. Transcription by another individual assured that I was not biased in my written recording of the participants' viewpoints and facts. The raw data was not modified or altered in any way to facilitate the creation of themes. This method is consistent with that of (Robson, 2002), who emphasised the significance of two approaches audiotaping and complete transcription To assure the accuracy of qualitative research data. I adopted this method for all of the interviews in this research to assure the management of complete data and to prevent any modification or alteration of the structure's fundamental content.

Also, the data analysis was done in Arabic to make sure that no meaning was lost in translation and to make sure that "codes" stayed unchanged in their original form. Indeed, (Twinn, 1997) advocated the use of the participants' native language throughout the data analysis phase in order to assure the development of robust findings. As a consequence, I ensured that the analysis data of all data in this study was conducted in Arabic and that only the eventual findings were translated into English. In this way, I was certain that the translation factor had not transformed the data, which

could have caused the loss of initial codes. In consideration of the primary data gathering instrument in this research was the interview, duplicating the study will not always generate the same findings. Similarly, the time and venue of the interview, the manner of the interview, and the perspectives of the participants may all have an effect on the conclusions.

According to Seal (1999), "the credibility of a study report is at the core of concerns such as validity and dependability". To establish credibility, this study attempted to explore the facts of the role of risk awareness among eternal and foreign pilgrims as understood by Saudi authorities operating on the Hajj pilgrimage missions. Their involvement and interpretation were critical in ensuring that the findings were credible and legitimate in the Saudi Arabian context. As the researcher, I was recognized that although the results of this research cannot be applicable to all circumstances, the underlying reasoning can. In addition, I realised that the research provides current data on the function of risk awareness among those pilgrims who would go on the Hajj in the future, which will contribute to increasing understanding among people interested in and working on these themes. A full explanation of the pilot study's techniques and data analysis will enable other researchers to perform comparable investigations and apply to their own work some of the processes covered in this thesis.

3.22 Chapter Summary

This chapter discussed the most fundamental methodological frameworks used in this research. In addition, the methods of data collection, the processes for data analysis, concerns of validity and credibility and ethics were considered. The data-gathering techniques employed here have resulted in a wealth of information, which is discussed in detail in the next chapter.

The next chapter will further pursue the mixed research methodology adopted by this study, presenting the quantitative data collected and various statistical tools used in their analysis and discussion. The aim again is that this data should provide actionable recommendations based on the different research gaps and relationship between variables identified throughout the study.

CHAPTER 4: Quantitative Analysis of Health Risk Awareness Among Hajj Pilgrims: Findings and Discussion

4.1 Introduction

Quantitative data are widely used by researchers seeking to understand the different aspects of the social world through results providing an interconnection between different events and variables. The fact that quantitative data are by nature of an objective character is one of the key reasons why the method is widely used in research. Such data may hence be used to find patterns, make predictions, test relationships and draw generalisations from research.

In line with the mixed methodology combining quantitative and qualitative approach, this study has utilised quantitative data to determine the level of risk awareness among external and internal Hajj pilgrims. The focus in particular is on pre-travel advice seeking behaviour and how the pilgrims influence the preventive health measures recommended by the Saudi health authorities. This chapter hence presents the data quantitative collected and various statistical tools used in their analysis and discussion that have been published in African Journal of Respiratory Medicine (see appindex G).

The quantitative findings analysed in this chapter will be crucial to testing the hypothesis that if the emergency management system currently used by Saudi authorities to reduce the risk of infectious disease transmission during Hajj has not been adequate, then the data collected here will show low levels of pre-travel health advice

seeking-behaviour or low levels of the adoption of preventive measures. Furthermore, this data should provide an opportunity to derive actionable recommendations based on the different relations of variables explored here and the research gaps identified throughout the study.

4.2 Results of the quantitative data survey

I randomly approached 280 pilgrims, 233 of them from 28 different countries who responded with a 83% response rate. Most respondents were from Malaysia, 26 (11.1%), and Pakistan, 21 (9%). The mean age (± standard deviation) was 42.88±12.15 while 130 (55.8%) of them were male. Of the respondents, 90 (38.6%) had an undergraduate degree and only 29 (12.4%) had not attended high school. The intended duration of stay in Mecca for the whole sample was 23.25±11.02 (Table 1). Then 219 respondents, translating into (94%), considered Hajj to be safe while 205 (88.0%) had sought pre-travel health advice before embarking on the Hajj. Some 121 (52%) did not think there was a risk of a global infectious disease outbreaks starting at the Hajj although 189 (81.1%) were satisfied with the current enforcement level of preventative health measures at the Hajj (see Table 2).

In the context of this research, the terms "educated" and "not educated" can be defined with reference to the demographic characteristics of the Hajj pilgrims:

Educated: For the purposes of this research, an individual can be considered "educated" if they have completed a formal education beyond a certain level, typically measured

by the attainment of a high school diploma or higher. This may also encompass individuals with vocational or technical training that equips them with skills and knowledge beyond basic literacy.

Not Educated: Conversely, "not educated" refers to individuals who have not completed a formal education beyond a basic level, typically lacking a high school diploma or its equivalent. This group may include individuals with limited literacy and numeracy skills, and they may not have received substantial formal training or education.

Table 2. 1 Demographic data on the pilgrims

Demographics (n=233)	**Mean ± SD N (%)**
Nationality	
Afghanistan	8 (3.4%)
Algeria	16 (6.8%
Australia	4 (1.7%)
Egypt	16 (6.8%)
France	5 (2.1%)
German	5 (2.1%)
India	10 (4.3%)
Indonesia	8 (3.4%)

Iran	1 (0.4%)
Iraq	5 (2.1%)
Jordan	10 (4.3%)
Kuwait	4 (1.7%)
Lebanon	11 (4.7%)
Libya	10 (4.3%)
Malaysia	26 (11.1%)
Morocco	8 (3.4%)
Nigeria	4 (1.7%)
Pakistan	21 (9%)
Palestine	3 (1.3%)
Philippines	14 (6%)
Saudi Arabia	12 (5.1%)
Sudan	3 (1.3%)
Sweden	1 (0.4%)
Syria	5 (2.1%)
Tunisia	4 (1.7%)
Turkey	15 (6.4%)
UAE	2 (0.9%)
United Kingdom	2 (0.9%)

Age	42.88±12.15
Gender	
Male	130 (55.8%)
Female	103 (44.2%)
Intended duration of stay in Mecca	23.25±11.02
Number of times the pilgrim has embarked on the Hajj	1.97±3.18
Level of education	
Did not attend high school	29 (12.4%)
High school diploma	50 (21.5%)
Postgraduate	64 (27.5%)
Undergraduate	90 (38.6%)

Table 2. 2 General questions about safety and applied measures

	N (%)
Do you consider the Hajj safe?	
Yes	219 (94%)
No	14 (6%)
Have you sought pre-travel health advice before embarking on the Hajj?	
Yes	205 (88.0%)
No	28 (12.0%)
How would you describe your experience of seeking pre-travel advice?	
Negative	4 (2%)
Positive	201 (98%)
Do you think there is a risk of a global infectious	

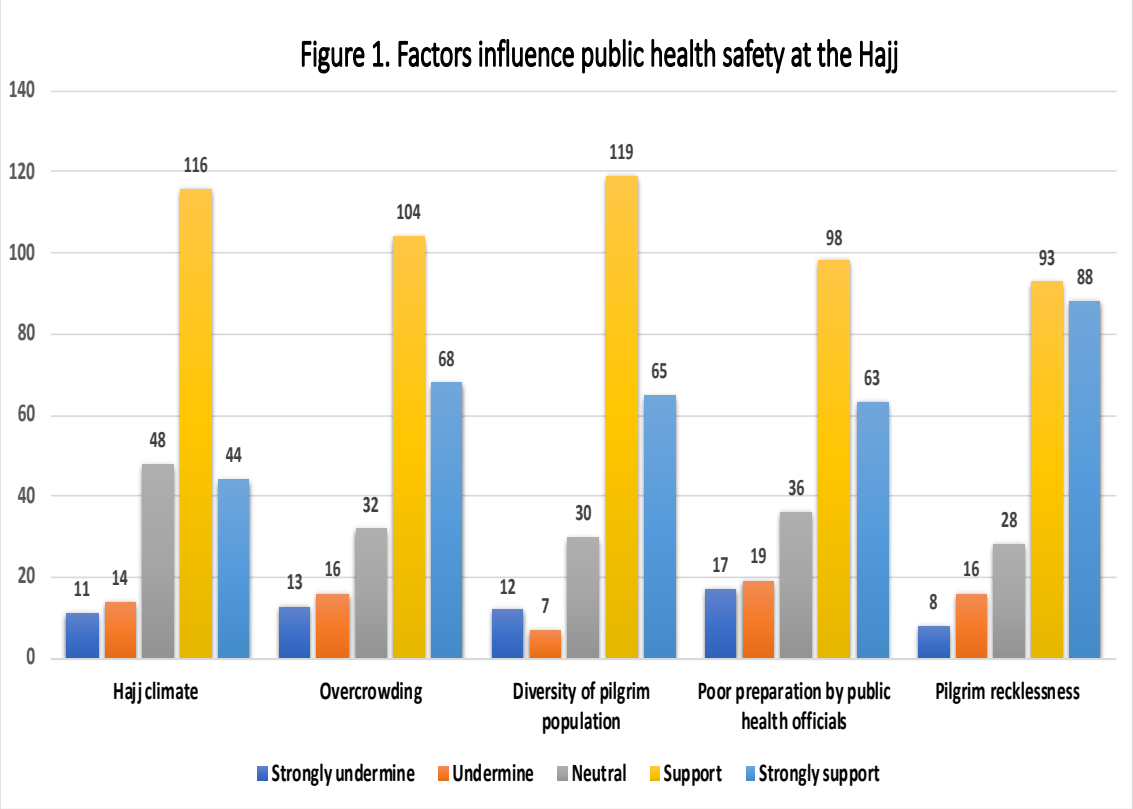
disease outbreak starting at the Hajj?	
Yes	112 (48%)
No	121 (52%)
Do you think the weather at Hajj poses a risk to your health?	
Yes	104 (44.6%)
No	129 (55.4%)
Are you satisfied with the current enforcement level of preventative health measures at the Hajj?	
Yes	189 (81.1%)
No	44 (18.9%)

4.2.1 Factors influencing public health and safety at the Hajj

Respectively, 184 (79%) and 181 (78%) of the respondents believed that the diversity of the pilgrim population, in the first place, and carelessness in the second place were the two factors that most influenced health security at the Hajj. Overcrowding at the Hajj, poor preparation by public health officials and the Hajj climate were ranked third,

fourth and fifth respectively (Figure 1). Some 36 (15.5%) of the respondents then gave their opinion that poor preparation by public health officials was not an important factor affecting affects public health and safety at the Hajj. In terms of their response selection, there appeared to be no major difference here between those who were educated (204) and not educated (29), except that the more educated tended to believe more readily that poor preparation by public health officials is not an influencing factor. Those who were not educated believed there is no significant relationship between preparation by public health officials and public health safety at the Hajj.

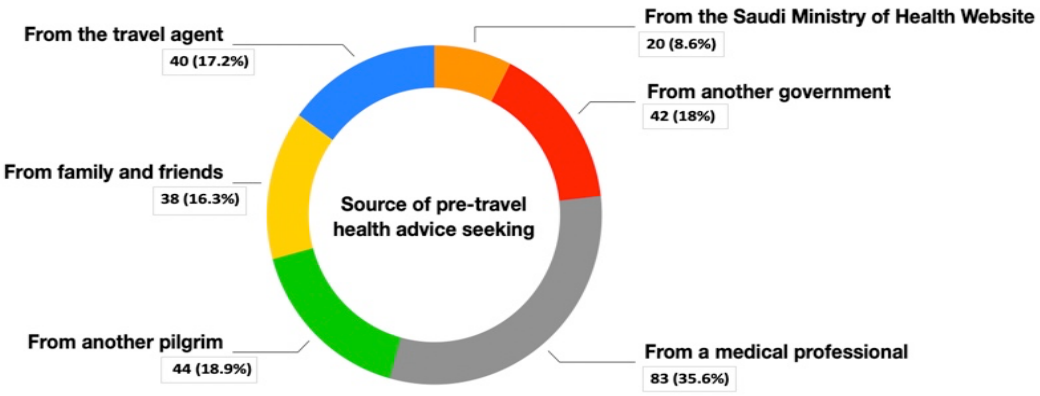
Figure 2. 1Factors influencing public health safety at the Hajj



4.2.2 External and internal Hajj pilgrims seeking pre-travel health advice

In total, 83 (35.6%) and 44 (18.9%) of the respondents sought pre-travel health advice from medical professionals and from other pilgrims respectively. Out of the 205 (88.0%) respondents who sought pre-travel health advice before embarking on the Hajj, 20 (8.6%) were found to seek it from the Saudi Ministry of Health website (Figure 2). No differences were then found between educated and less-educated pilgrims regarding their propensity to seek pre-travel advice.

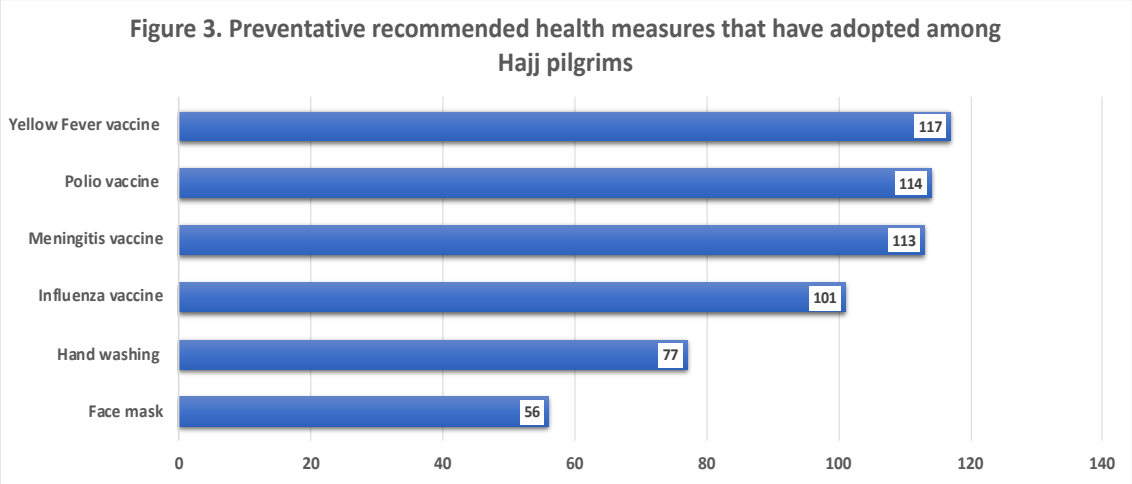
Figure 2.2 Seeking pre-travel health advice among external and internal Hajj pilgrims



4.2.3 Recommended preventative health measures adopted by Hajj pilgrims

Figure 3 shows the breakdown of the six preventive health measures adopted by the pilgrims. Here, yellow fever vaccine was the most popular preventative health measure, adopted by 177 of the pilgrims. This was closely followed by polio vaccine (114) and meningitis vaccine (113). Hand-washing and face masks were found not to be measures used frequently by pilgrims. There were no differences between educated and non-educated pilgrims regarding the preventative health measures adopted.

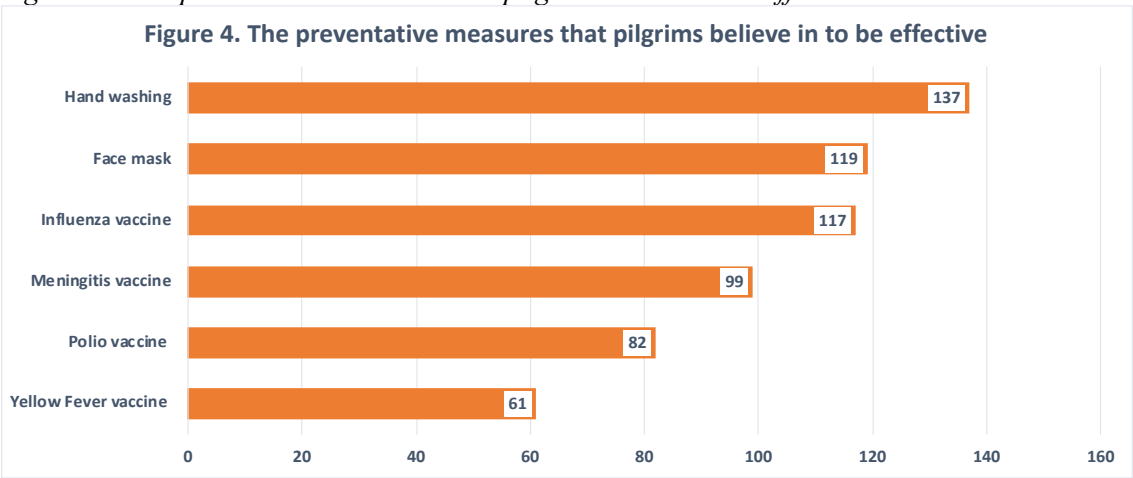
Figure 2.3 Preventative recommended health measures that have adopted among Hajj pilgrims



4.2.4 The preventative measures that have been effective among Hajj pilgrims

Most pilgrims believed that hand-washing and the wearing of face mask were effective (Figure 4) even though they were the least adopted preventative health measures (Figure 3). A minority of participants indicated that vaccines in general were effective compared to other preventive health measures. Regarding the preventative health measures believed to be effective, there was no observable difference in the selection of educated and non-educated pilgrims.

Figure 2.4 The preventative measures that pilgrims believe to be effective



4.3 Discussion

This section is the first opportunity to present the perception of the Hajj pilgrims on the health risks associated with pilgrimage to the holy city. As mentioned, the focus here is on the use and source of pre-travel health advice and the adoption of preventative health measures. This study hence draws upon quantitative data to report the factors that influence public health safety at the Hajj.

According to 79% of the respondents, the main factor influencing public health safety is the diversity of the pilgrim population. Considering the religious significance of the Hajj, it is little surprise that at any point in time the pilgrim population can be made up of pilgrims of diverse race, age, gender and medical background, to mention but a few factors among many (Ahmed et al., 2006).This diversity presents a public and global health challenge and has attracted the attention of global health players such as the World Health Organisation in the past regarding the design and implementation of prevention measures against public health risks posed by mass gatherings(Memish,

Assiri, et al., 2012). Diversity may be manifest, for instance, in the form of reduced perception of health risks by pilgrims coming from parts of the world with less developed health systems. This may affect how public health advice, recommendations and regulations are received and followed by the pilgrims.

Aside from diversity, 78% of the study participants also believed that the carelessness of pilgrims is another main factor that influences public health and safety at the Hajj. Other factors reported by the respondents include overcrowding, poor preparedness by public health officials and the climate. With over two million people converging every year upon Mecca, overcrowding is a specific feature of the holy pilgrimage, and this often results in an increased risk of both the spread of communicable diseases and stampedes producing crowd-crushes. This overcrowding also puts significant pressure on the medical facilities available during the Hajj, especially as the number of pilgrims varies from year to year (Shafi et al., 2008).

Owing to the geographical location of Mecca, one of the main public health issues has been hot weather conditions. With temperatures that exceed 40^{o}C in summer, heatstroke, heat exhaustion, sunburn and dehydration are a common occurrences during the Hajj (Shafi et al., 2008). Several preventative measures have been implemented by the Saudi government over the years to prevent heat-related casualties. These include increased awareness campaigns, the installation of cooling units along the route of the pilgrimage and provision of facilities to prevent heatstroke. However, despite these measures, the problem persists (Ghaznawi & Ibrahim, 1987). This suggest the need for improvements in how these problems are tackled.

In total, 205 out of 233 (88%) of the participants in this study sought pre-travel health advice. This finding corroborates previous studies that looked at Saudi Arabian and Australian pilgrims to the Hajj (Alqahtani et al., 2016). Furthermore, it was found that the major source of health advice remained medical professionals, which is in agreement with previous studies finding that two-thirds of Hajj pilgrims were reported to have sought health advices from medical professionals, including family doctors and travel clinics (Alqahtani et al., 2019). The Saudi Ministry of Health (MoH) remained the last source of Hajj-related health advice in this study with only 8.6% of pilgrims consulting the Ministry for health advice. This finding also agrees with the study conducted by (Alqahtani et al., 2019) where only 4% of Saudi Hajj pilgrims reported the Saudi MoH as their source of health advice (Alqahtani et al., 2019). In response to these findings, I would recommend a complete overhaul of the Saudi MoH information system to improve accessibility, especially by prospective Hajj pilgrims. This should help boost awareness of Hajj-related health risks and the preventative health measures available. Indeed, the importance of awareness campaign about the benefits of seeking travel health advice before the Hajj pilgrimage cannot be overemphasised and have been found to be associated with improved health consciousness and behaviour in Hajj pilgrims (Turkestani et al., 1995). In this study, I report the recommended preventative health measures adopted by Hajj pilgrims. In all respondents, yellow fever vaccine was the most popular preventative health measure, with 117 adopters. Polio, meningitis and influenza vaccines were then adopted by 114 (48.9%), 113 (48.5%) and 101 (43.4%) respondents, respectively. The coverage of influenza vaccine among Hajj pilgrims in

this study (43.4%) varies considerably compared to other studies where higher (Alqahtani et al., 2019) and lower (Memish, Stephens, et al., 2012) coverages have been reported. This difference is especially noteworthy, as respiratory tract infections, especially from influenza viruses, are very contagious and have been reported as the main cause of outpatient department visit during the Hajj pilgrimage (Aldossari et al., 2019).

A high and rapid rate of genetic mutation makes the influenza virus strains a global public health concern and this is exacerbated by the continuous close contact and overcrowding intrinsic to the Hajj pilgrimage (Hussain et al., 2017). Various measures have been recommended by the Saudi MoH including wearing of face masks, hand-washing and reasonable distancing; all of which have been reported to reduce the spread of respiratory tract infections (RTI) (Al-Asmary et al., 2007).

In future, the Saudi MoH should also consider the possibility of introducing and enforcing further preventative public health measures, including making vaccination against the various strains of influenza and other RTI viruses a prerequisite for performing the Hajj pilgrimage, in order to prevent disease outbreaks (Alqahtani, Mendes, et al., 2020). This is especially important in the face of the recent global outbreak of the SARS-CoV-2 virus which has been shown to be more prevalent and severe in people with co-morbidities (Alqahtani, Oyelade, et al., 2020).

In this study, the least adopted measures reported by the research participants were the wearing face-masks and washing hands. The preventative health measures believed to be effective by the respondents were also reported. Respectively, 137 and

119 participants believed that hand-washing and facemask wearing are effective preventative health measure, followed in order by vaccination for influenza, meningitis, polio and yellow fever. This is interesting, as hand washing and the wearing of facemask are also the least adopted preventative health measures, even though most pilgrims believe they are efficient. Accordingly, the respondents cited measures to deal with yellow fever, polio, meningitis and influenza vaccines as the most highly adopted preventative health measures. The findings of this study are consistent with previous research reporting that majority of pilgrims believed hand washing is the most effective preventative health measure against respiratory infections (Alqahtani et al., 2016).

Some limitations associated with this study include the small sample size which has the potential to reduce the statistical weight of the findings and limit the extension of the conclusions and recommendations to a wider, larger global population. Moreover, the heterogeneity of the study population presents a challenge when trying to control for pilgrims' medical history and country of origin, both of which may affect the perception of health risk and the adoption of preventative health measures. Nonetheless, our research shows that there is significant scope for improving the perception of public health risk associated with Hajj among pilgrims. We have emphasised the need to revamp how Hajj-related preventative health measures are communicated and enforced by the Saudi MoH in particular, with special consideration given to the diversity of pilgrims.

4.4 Conclusion

The quantitative data extracted by our research shows that there is a lapse in the pilgrims' perception of the health risks associated with the Hajj pilgrimage. The quantitative findings thus demonstrate a significant difference in the perception of risk and adherence to preventative health measures among the pilgrimages, illustrating the lack of a centralised and a unified information source working for their benefit.

Although most pilgrims understand the effective preventative health measures in question, the degree to which they adhere or apply these measures does not align at the same level with their understanding. The level of observation of these measures could hence be improved by wide-ranged and inclusive public health campaigns, featuring well-informed and centralised recommendations, and enforcement programmes to ensure adherence to health and safety precautions.

4.5 Limitation:

Several limitations were encountered during the study, which may have affected the results. One of the limitations was the use of a convenience sampling technique for the survey, which may have resulted in a biased sample. The participants who completed the survey may have been more interested in health risks and preventative measures, which may have affected the results. Additionally, the sample size for the survey was relatively small, which may have limited the generalizability of the results.

Another limitation was the language barrier during the interviews and focus group discussions. The interviews and focus group discussions were conducted in Arabic and English, which may have limited the participation of non-Arabic and non-English speaking participants. The translation of the survey into six languages may have also introduced errors in the translation, which may have affected the results.

4.5.1 Adjustments in the Field

Several adjustments were made in the field to address the limitations encountered during the study. To address the language barrier during the interviews and focus group discussions, interpreters were used to translate the questions and responses. The interpreters were selected based on their language proficiency and knowledge of the Hajj pilgrimage. The use of interpreters allowed for the participation of non-Arabic and non-English speaking participants, which increased the diversity of the sample.

To address the limitations of the survey sample, efforts were made to distribute the survey to a diverse group of participants. The survey was distributed at various locations, including airports, hotels, and Hajj camps, to increase the diversity of the sample. Additionally, the survey was translated into six languages to increase the participation of non-English speaking participants.Moreover, The researcher does not provide a specific reason for why such an analysis has not been presented. However, it is possible that the study was not designed to investigate the relationship between demographic variables and awareness of health risks during the Hajj pilgrimage.

Instead, the study may have focused on other factors, such as the sources of health information and the perceived severity of health risks. It is also possible that the sample size for the study was not large enough to conduct a robust analysis of demographic variables. The researcher notes that the sample size for the survey was relatively small, which may have limited the generalizability of the results.

4.6 Chapter Summary

As the researcher, I chose to present the interviews in a brief narrative format. As a result, the next chapter will provide the interviewees' individualised answers. These will aid the reader in comprehending the subject and establish the groundwork for the creation of codes and themes. Additionally, the presentation will enable other academics to delve into the most pressing problems presented by the Saudi authorities (i.e., the senior decision-makers) concerning health risk awareness among Hajj pilgrims during mass gatherings in Saudi Arabia. Such findings should inform future research on these topics in a variety of situations and give theoretical foundations for studies taking a qualitative and quantitative approaches or employing a mixed methodology like this one.

CHAPTER 5: Understanding the Experiences and Perceptions of Saudi Authorities Regarding Health and Safety During the Hajj: A Qualitative Analysis and Discussion

5.1 Introduction

The focus of the qualitative findings of this study is upon the health and safety challenges faced by both the pilgrims and the Saudi authorities during the Hajj period annually. In presenting the views of government officials in an interview format, the findings presented in this chapter thus seek to outline, interrogate and critique the mitigation measures in place to assure the safety of pilgrims. The interviews comprised of 17 questions put to government officials with their transcripts provided.

The interviews sought to ascertain perspectives on the health and non-health related risks facing Hajj pilgrims. In that sense, they will help us explore the mechanisms of emergencies management put in place during the period of Hajj. The interviews utilised open-ended questions with the participants given enough time to answer them. The themes were derived by identifying the data, coding the responses, omitting the answers that do not serve the purpose of the study, interpreting the data according to the problem of the study and finding out what was important in each datum and what it meant. A comprehensive analysis was then conducted on the data interpreted.

The following sections of this chapter thus discuss the data interpretation conducted by the study based on the finding and results of the analysis regarding the safety of the pilgrimage from a public health perspective. I have chosen to present the research findings and discussion in a single chapter instead of divided them into two separate chapters because I consider it is easier to read the interpretation of a finding immediately after its presentation. In addition, merging the findings and discussion into a single chapter avoids the frequent repetition that occurs when they are presented in separate chapters. The principal themes extracted from the findings have then been organised based on their relation to three research objectives. For convenience's sake, the themes and their subthemes have been present in separate sections with an accompanying discussion.

The overarching goal of this study was to explore the perspectives of government officials about the level of risk awareness among Hajj pilgrims. The perceptions of the Saudi authorities and hajj pilgrims alike are thus shown to be influenced by an understanding of the old and new risks to health and safety at the Hajj pilgrimage. The study's three principal research objectives are given as follows:

1. To assess the perceptions of health risks held by the Saudi authorities involved in Hajj and recommend further preventative measures.
2. To understand the status of the current emergency management system during the Hajj.
3. To determine the current obstacles contributing to the pilgrims' poor awareness of health risk and their failure to follow the instructions given to them.

In response to these objectives, the respondents' answers provided the findings with a logical structure by organising them according to various themes and sub-themes regarding safety, lack of safety and the methods employed to avoid the risks associated with Hajj. The fundamental function of this chapter is hence to present the thematic findings emerging from the data by presenting the participants' opinions, then assessing whether or not their judgments are fair, before evaluating the effectiveness of this approach in relation to the research objectives.

5.2 Theme 1: The Hajj is Safe

The survey data was collected and analysed to identify government workers' perceptions of their own interventions towards the health risks associated with mass gatherings during Hajj. The following Figure 5. 1 presents the answers to the first part of the research questions regarding the authorities' perceptions of how best to assure the safety of pilgrimage from the health perspectives indicated below.

In constituting an answer to the research questions, the following figure (5.1) clarifies the main perceptions of Saudi authorities on the extent of safety assured for the Hajj.

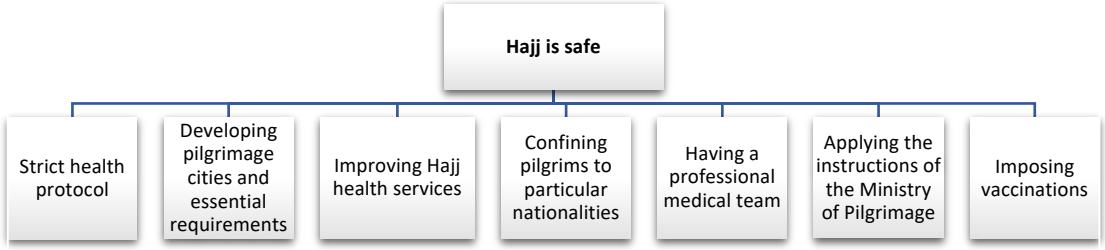


Figure 5.1: Theme 1 and its sub-themes

As shown in Figure (5.1), the perceptions of Saudi authorities regarding the safety of the Hajj pilgrimage are divided into seven sub-themes. Five of the participants indicated that the Hajj is safe because of the strict health protocols imposed by the Ministry of Hajj. Item No. (2) titled "developing pilgrimage cities and providing pilgrims with the essential requirements" occupied the second rank with the same percentage of (3). Similarly, item No. (3) "improving the health service in Hajj pilgrimage" occupied the third rank with the proportion (3).

Two of the respondents suggested that 'confining the pilgrims to certain nationalities' reduce the health risks of pilgrimage. Likewise, two respondents argued that 'having professional medical team' reduces the health risk of pilgrimage. However, one participant indicated that the Hajj is safe because the Ministry of Hajj applies the instructions decided upon by parties involved in the Ministry of Pilgrimage. In the same vein, one respondent pointed out that Hajj is safe because the Ministry of Hajj imposes mandatory vaccination.

The question of the safety of the pilgrimage can thus be summarised into the following sub-themes:

5.2.1 Sub-theme 1: Strict health protocol

The Ministry of Pilgrimage has imposed strict health protocols to maintain the health of pilgrims by harnessing its capabilities of a state authority in the service of the pilgrimage. Five of the participants claimed that the government assures the safety of pilgrims in which one of the participants indicated that "this pandemic did not differ from other pandemics that have occurred in Saudi Arabia. The Saudi authorities have dealt with the pandemic in a manner that guarantees the safety of all pilgrims, which means that Covid-19 pandemic is under control."

(Khan et al., 2021) state that in responding to Covid-19, the government has prepared public and private institutions to manage the pandemic by limiting the number of pilgrims allowed to perform Hajj pilgrimage , while operation on the condition that no cases of Covid-19 infection are observed among the pilgrims. One possible explanation for these measures might be that the Ministry of Health, the government and officials in Saudi Arabia have imposed the strictest health protocols to maintain the safety of pilgrims and guarantee the continuation of the pilgrimage. The participants

are hence of the belief that the measures applied in Saudi Arabia have reduced the risk to the pilgrimage as much as possible, including the health protocols put in place in the Kingdom such as requiring vaccination before arrival in order to reduce the risk.

5.2.3 Sub-theme 2: Developing pilgrimage cities and essential requirements

The powers of the Kingdom of Saudi Arabia have thus been harnessed in the service of pilgrimage. Accordingly, providing pilgrims with everything they need is crucial to protecting them and maintaining their health, which guarantees their safe travel in the Holy Land.

In this regard, R3 participants stated here that "The task of pilgrimage requires a very great effort from us. It also asks us to think differently and the aspirations of the state to develop the pilgrimage system and raise the capabilities of serving pilgrims and investing the season from the legal side, the economic side and the other sides. We have exploited all the possibilities in the country and placed them within the framework of serving the pilgrims and visitors. We have also developed pilgrimage cities and made full use of all these positive possibilities to serve the pilgrimage system."

5.2.4 Sub-theme 3: Improving Hajj health services

Three of the respondents believed that the pilgrimage is safe because of the extraordinary efforts and excellent coordination between government agencies, as well as state investment and organisation, with government leadership then following up on all pilgrimage affairs. R3,R4, and R7 stated that "The pilgrimage system, through our experience in the past years, has been able to develop its work until the pilgrimage

environment became safe." However, these remarks remain subject to critical analsysis that will appear at the end of this study.

According to Abonomi et al. (2022) the Ministry of Municipal and Rural Affairs and the Ministry of Environment, Water and Agriculture have been put in charge of establishing environmental strategies and protection plans for the Hajj. As a result, these measures have helped the pilgrimage environment to be safe. In 2020, the securing of an exceptional environment for the pilgrimage is the clearest evidence that the entire country was concerned with the safety of the pilgrims and the protection of Muslim lives.

5.2.5 Sub-theme 4: Confining pilgrims to particular nationalities

Nonetheless, the state took difficult decisions for the first time to limit the pilgrimage only to certain nationalities. These were chosen from Islamic countries by a method which was creative in finding mechanisms to apply for the first time. The main goal was to enable pilgrims to perform the pilgrimage ritual safely and apply precautionary health requirements and protocols.

R1,and R3 of the respondents indicated that such an intervention has "helped the pilgrimage environment to be safe, and perhaps in 2020, the establishment of the exceptional pilgrimage was the most significant evidence that the entire country was concerned with the safety of the pilgrims and the protection of Muslim lives."

5.2.6 Sub-theme 5: Having a professional medical team

The Ministry of Health has worked to curb the health risks of Hajj with all the professionalism required, such as using distinguished and well-known medical teams. The Kingdom's success in managing the pilgrimage seasons has been embodied in its ability to protect the pilgrims' health, manage crowds and provide food and drink in the presence of health personnel during the pilgrimage season at the Holy Sites. What is also crucial is the ability of health authorities to follow-up on such matters.

5.2.7 Sub-theme 6: Applying the instructions of the Ministry of Pilgrimage

The findings showed that the directives of the High Commissioner, the continuous follow-up of officials, and the preparations that the Ministry of Health make annually in the light of their past experience make the pilgrimage season more secure and safe. In this regard, R3 participants indicated the following: "This pandemic did not differ from other pandemics that have occurred in Saudi Arabia. The Saudi authorities have dealt with the pandemic in a manner that guarantees the safety for all pilgrims, which means that Covid-19 pandemic is under control."

(Khan et al., 2021) state that in responding to Covid-19, the government has prepared public and private institutions to tackle the pandemic by limiting the number of pilgrims allowed to perform pilgrimage (Hajj), while ensuring that no cases of Covid-19 infection were observed among pilgrims. One possible explanation for these results might be that the Ministry of Health, the government and the officials in Saudi

Arabia have given pilgrims and visitors the strictest health protocols to maintain their health and guarantee the continuation of the pilgrimage.

5.2.8 Sub-theme 7: Imposing vaccinations

The participants believe that the measures applied in Saudi Arabia have reduced the risk to the pilgrimage as much as possible, not least the health protocols in place in the Kingdom requiring vaccination before arrival in order to reduce the risk to health and safety. According R1 respondents, “the Saudi government has ensured that the necessary vaccinations are obtained at the ports by reviewing vaccination certificates, providing the necessary vaccinations certificate for those coming from countries affected by certain diseases (such as oral polio vaccine) by following the requirements of the World Health Organisation and in line with international health regulations.”

To conclude, the majority of the research participants believed that the pilgrimage is safe due to the instructions and requirements imposed by Jeddah, Al-Madinah Al-Munawwarah, Makkah Al-Mukarramah and the Holy Sites. In addition to the directly related departments, such as the Emergency Department and the General Department of Health Emergencies in the Ministry of Health, higher government departments have also been involved. These bodies have been concerned with the audit and awareness process, such as the Public Health Department's Patient Awareness Section which educates people about infection control and other issues.

Internal communication has also helped state employees become more aware of their surroundings, all of which guarantees that the pilgrims and visitors meet the

greatest health protocols and requirements for their safety. All of those who are issued with the visa are expected to have first fulfilled a raft of preventative health requirements issued by the Saudi Ministry of Health (Ministry of Heath, 2018).

5.3 Theme 2: Hajj is unsafe, according to Saudi Authorities

To provide an answer to another of the research questions, the following figure (5.2) clarifies the major perceptions of the Saudi authorities about the extent of the safety risk of Hajj.

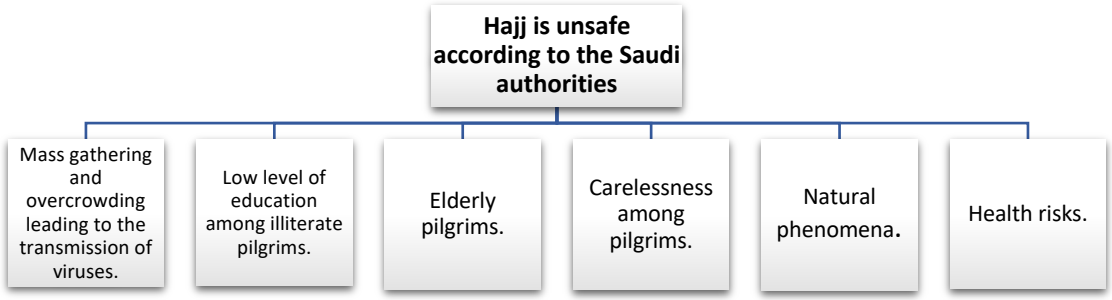


Figure 5.2: Theme 2 and its sub-themes

As shown in Figure 5.2, the perceptions of Saudi authorities regarding the lack of safety of the Hajj pilgrimage can be divided into (7) sub-themes. Seven of the participants indicated that Hajj is unsafe because the mass gathering and overcrowding leads to the transmission of the virus. Item No. (2) “low level of education among illiterate

pilgrims" occupied the second rank with the given percentage (3). Similarly, item No. (3), "elderly pilgrims" occupied the third rank with a proportion (2).

R5, and R10 respondents then suggested that "carelessness among pilgrims" constitutes a threat in Hajj. Likewise, one respondent argued that "natural phenomena, including wind, rain, earthquake, floods, fire, building collapse, rock falls, high winds, and dust storms" are some of the other risks to Hajj. One participant indicated that Hajj is unsafe because it might cause a health risk. In the same vein, another respondent pointed out that the unreliability of vaccination certificates and non-compliance with health procedures has also lead to a health risk in Hajj.

The study summarised the risks of Hajj into the following sub-themes:

5.3.1 Sub-theme 1: Mass gathering and overcrowding leading to the transmission of viruses

Owing to the large number of pilgrims who go to Mekkah to perform pilgrimage, potential risks surround the mass gathering during this period (Jokhdar et al., 2021). This evaluation is in keeping with the opinion of R10, who indicated that "we cannot say that Hajj is fully safe because we receive big crowds that should be gathered in specific times and places which will create potential risks. Even if we did our best to prevent the risk, there would be a chance of risks still occurring."

The risk in performing the pilgrimage occurs when many people are either inside or outside the campus. There is also the question of the movement of large numbers by bus, such as from Masha'ir to Mecca. One of the respondents argued that

such challenges make the pilgrimage risky, including the diversity of pilgrims that need to be managed. To elaborate, such opinions reflect that the Covid-19 pandemic is not under control in Saudi Arabic. However, the afore-mentioned opinions are not in agreement with the information included in section (5.6) when one of the participants indicate that Saudi officials had worked hard to curb Covid-19, entailing that such matters are under control.

In a similar vein, R13, R14, and R16 respondents indicated that "overcrowding or human density is the main reason behind the risk after that comes the issue of weather factors whether raining or heat stress, food poisoning these are the dangers that are existed there. These are the most prominent risks present during the pilgrimage season". The Ministry of Health always publishes a list of risks and diseases discovered during the pilgrimage process. Another respondent pointed out that the health risks can be attributed to the large gatherings of pilgrims in a specific area, with stressful conditions and closed spaces that are difficult for ambulances to reach. Pilgrims can also transmit influenza and other viruses due to the overcrowding.

R14 respondent then suggested that the pilgrims face potential dangers in performing Tawaf Al-Ifadah. As R13 participants pointed out, "the pilgrimage is safe with the organization, and there are many steps in it. The danger is the Tawaf Al-Ifadah". The reason behind this risk might be the gathering of a large group of people in the same place, meaning disease transmission is possible, constituting a threat to their health.

The large number of pilgrims who come to perform pilgrimage in limited time and space, and the different packages of services provided for pilgrims from different nationalities are considered to be the major challenges facing pilgrimage and leading to health risks. Such factors should be taken into consideration by the authorities and according to R13, and R14 informants: “We deal with crowds and groups, in limited time and place, and different packages of services that are provided and deal with different nationalities. And we deal with pilgrims who comes once a year and deal with different age groups in which there are elderly people, which are all considered as challenges.”

R8, R13, and R16 respondents argued that some challenges make the pilgrimage risky, such as the diversity of pilgrims that need to be managed. To elaborate, such an opinion reflects that Covid-19 pandemic in Saudi Arabic is not under control. However, the afore-mentioned response does not agree with the information included in section (5.6.3) when one of the participants indicated that the Saudi officials have worked hard to curb Covid-19 and that matters are under control.

5.3.2 Sub-theme 2: Low education and illiteracy of pilgrims

R7, R9 and R13 respondents stated the following: “The level of education of the pilgrims (especially concerning literacy) means that they need to be educated and provided with information. Regardless of the fact that such problem can be reduced by using digital literacy since the Internet is considered a good way to equip the pilgrims with the information before they go for pilgrimage. However, some of the pilgrims are

elderly who are unaware of using technology and to take advantage of such opportunity to raise their awareness."

Another of the respondents stated that "the low level of education, especially the illiterate people, are considered some of the most important challenges we face in every Hajj season." Similarly, R11 respondents suggested that some of the pilgrims lack full awareness either of health matters or of organisational issues, which is closely related to the educational level of those coming to the pilgrimage because the majority of pilgrims are elderly, and their ages range from 55-80 years old. Accordingly, some of the pilgrims are not fully aware of the health risks that the pilgrimage carries.

R1,R7,R8, and R15 respondents suggested that the low level of awareness among pilgrims is connected to the level of support and awareness raising that is practiced by their own governments before they perform the pilgrimage. As R11, and. R15 respondents stated, "the level of pilgrim's awareness is directly affected to the countries they come from, such as Bangladesh, Afghanistan, Eritrea, Ethiopia, and Sudan." This finding is in keeping with other evidence (The Least Developed Countries Report, 2021) where research has found that the afore-mentioned pilgrims come from the least developed countries in the world.

Most of the respondents agreed that the countries sending their citizens to perform pilgrimage should raise their awareness to guarantee that they have a clear image of the health risks. In this regard, R4, R5. participants indicated that "the Ministry of Pilgrimage puts extra effort into educating such groups before their arrival and when they come to perform the pilgrimage". Moreover, it works hard to raise health

awareness among all the groups of pilgrims who do not comply with precautions, particularly among uneducated pilgrims who are oblivious of the risks associated with pilgrimage. This indicates a certain level of professionalism by the competent authorities in Saudi Arabia when dealing with such groups.

5.3.3 Sub-theme 3: Elderly pilgrims

The nature of the pilgrimage and its movements may represent a danger to the elderly or those who have chronic diseases. Elderly pilgrims are more vulnerable to risk compared to other groups in terms of stress, heart attacks, diabetes, and problems with the spatial conditions. To elaborate, R1,R7,R11 believed that the pilgrimage is less safe for elderly pilgrims, who are more vulnerable to health risks than other groups because they are more susceptible to stress, heart attacks, diabetes problems and blood pressure issues. However, according to the Islamic Sharia rules in Hajj, a person who cannot perform Hajj for any valid reason is exempt from performing it, although most of the elderly insist on performing the Hajj to complete their Islamic five pillars.

As mentioned by R1,R7,R11,and R17. of the informants, “most of the concerns of the Ministry of Health regarding the elderly are the health-related risks such as stress, heart attacks, diabetes problems, blood pressure problems, and spatial conditions.” Arguably, the nature of pilgrimage and its movements may represent a danger to the elderly or those who have chronic diseases. In this (Yilmaz et al., 2019) indicate that Hajj has a short-term negative effect on patients with chronic diseases.

5.3.4 Sub-theme 4: Carelessness among pilgrims

One of the respondents claimed that pilgrims are at high risk of acquiring and transmitting infectious diseases. The spread of infection or cases of poisoning as a result of the ignorance of some pilgrims in matters of prevention and safety, crowding, or exposure to heat strokes, constitutes the most significant challenge which results from high temperatures and the pilgrimage taking place in the summer months with large human gatherings, crowd crushes, the transmission of respiratory infection and traffic accidents. R11 participants summarised the following: “The transmission of ‘flu and other viruses due to the overcrowding that sometimes reaches six people per square metres such as infectious diseases that once spread in Mecca. The spread is attributed to the behaviours of pilgrims, such as their lack of hygiene and failure to wash their hands.”

There is also the matter of the irresponsible behaviour of pilgrims in the lack of hygiene and hand washing. In this respect, R3 informants indicates the following: “There are major risks, but some simple observations may occur about the spread of infection or cases of poisoning as a result of the ignorance of some pilgrims in matters of prevention and safety, crowding, or exposure to heat strokes, which happens rarely”.

To continue, the participant indicated that the lack of awareness and compliance with health procedures and requirements among pilgrims is considered to be some of the main reasons behind the health risks of Hajj. R8, R13,R14,and R16 participants pointed out that “the lack of health awareness and commitment among pilgrims to implement what they are required might affect their health.” Finally, R11 respondent

indicated that not all pilgrims are aware of the importance of asking for health advice before performing a pilgrimage, stating that “some pilgrims perform Hajj without asking for health advice because they are oblivious about the health issues related to Hajj; therefore, we send education messages to all pilgrims to guarantee that the majority of them are aware of the health risks”.

5.3.4 Sub-theme 5: Risks from natural phenomena

It is widely acknowledged that natural phenomena such as wind, rain and earthquakes are uncontrollable. R1 respondents stated that “we can raise the place's capacity to become resilient, which leads to sustainability, so we are looking to increase the resilience and flexibility of the place so that it deals with external dangers and allows business continuity”. However, he added that “we cannot control nature, so we consider natural phenomena a challenge. However, the government try their best to decrease its effect on the pilgrims during the Hajj”.

R2, R7,and R11 respondent underlined that “natural accidents (rain and floods, fire, building collapse, rock-falls, high winds, and dust storms) can transmit viruses”. Another respondent R15 stated that “We cannot control nature, so we consider natural phenomena a challenge. However, the government tries their best to decrease its effect on the pilgrims during the Hajj.”

5.3.5 Sub-theme 6: Health risks from infectious diseases

The health risks from infectious diseases during the Hajj pilgrimage, the literature review includes a summary of previous studies that have investigated the prevalence and impact of infectious diseases. Al-Tawfiq et al. (2016) found that respiratory tract infections were the most common infectious diseases among Hajj pilgrims, followed by gastrointestinal infections. Gautret et al. (2016) reported that the incidence of meningococcal disease during the Hajj has decreased significantly since the introduction of mandatory vaccination.

As one of the participants R8 noted, "Health-related risks such as seasonal flu, infection and chronic diseases come mainly from some pilgrims; for example, dengue fever that spread once in Mecca. The epidemic spread because of particular behaviour caused by the indigenous people or pilgrims". Regerttably, studies have found the uptake of certain recommended preventative health measures to be mixed among some of the pilgrims (Razavi et al, 2016). In addition, in many instances, pilgrims do not know about the existence of certain health risks or the importance of some preventative health measures (Barasheed et al., 2016). Unless these omissions are remedied quickly, there is a high likelihood that what was feared in 2009 with the H1N1 pandemic could occur in the future, with deadly consequences.

The discussion explores the implications of these findings for public health interventions and policies. The effectiveness of vaccination campaigns and other preventive measures in reducing the spread of infectious diseases during the Hajj is discussed. The challenges of implementing these interventions, such as limited resources and logistical constraints, are also considered. Furthermore, the discussion highlights the need for further research to better understand the epidemiology and transmission of infectious diseases during the Hajj, as well as the effectiveness of different interventions. Potential areas for future research, such as the impact of environmental factors on disease transmission or the effectiveness of health education campaigns in promoting preventive behaviors, are suggested.

In conclusion, the sub-theme of health risks from infectious diseases during the Hajj pilgrimage is a prevalent public health issue. The literature review and discussion highlight the importance of public health interventions and policies to reduce the spread of infectious diseases during the Hajj. The need for further research to better understand the epidemiology and transmission of infectious diseases during the Hajj is also emphasized.

5.3.6 Sub-theme 7: False vaccination certificates and medical non-compliance

The literature review highlights the role of social capital theory in understanding the behaviours of individuals in mass gatherings. The study suggests that social capital theory can help explain the behaviours of individuals in mass gatherings, including their compliance with health behaviours and the credibility of vaccination certificates

265. The discussion explores the implications of these findings for public health interventions and policies. The challenges of implementing interventions, such as limited resources and logistical constraints, are considered. Furthermore, the discussion highlights the need for further research to better understand the effectiveness of different interventions and the credibility of vaccination certificates. Tow participant R11, and R13 suggested that while some pilgrims do not comply with the required health behaviour, some of them go as far as to falsify vaccination certificates. One of the respondents R9 questioned "the extent of the credibility of vaccination certificates, especially from some authorities from which the pilgrim submits and non-compliance with health behaviours". In conclusion , this study provides valuable insights into the awareness of health risks during the Hajj pilgrimage and the role of social capital theory in understanding the behaviour of individuals in mass gatherings.

5.4 Theme 3: Maintaining the safety of pilgrims

In constituting another answer to the research questions, the Figure 5.3 below illustrates the main perceptions of the Saudi authorities about the methods employed by the government in Saudi Arabia to maintain the safety of pilgrims.

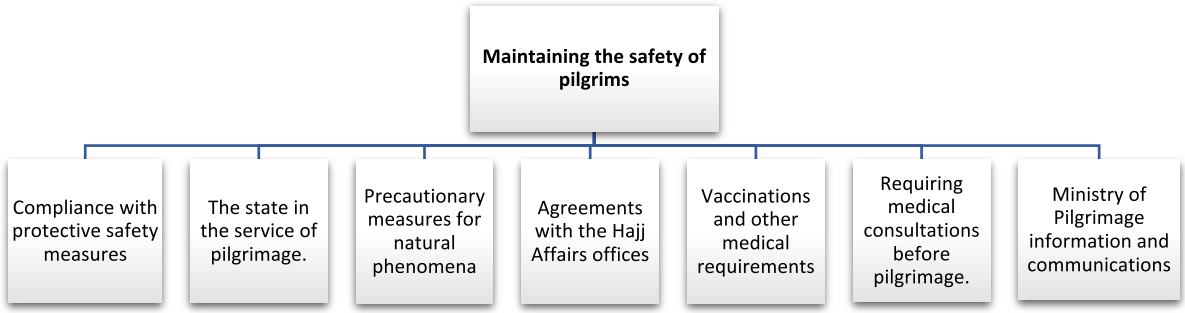


Figure 5.3: Theme 3 and its sub-themes

As shown in Figure 5.3, the perceptions of Saudi authorities regarding the methods of maintaining the safety of pilgrims are divided into (8) sub-themes. Five of the participants indicated the necessity of complying with protective measures such as hand-washing, as well as facilitating transportation and crowd management.

Item No. (2) involved "harnessing the capabilities of the state in the service of pilgrimage" and occupied the second rank with the percentage (4). Similarly, item No. (3), "precautionary measures for reducing the risks of natural phenomenon" occupied the third rank with a proportion of (3). One of the respondents suggested that "making

an agreement with the Hajj Affairs offices! maintains the safety of the pilgrimage. Likewise, R12 underlined the protocol of "requiring pilgrims to take seasonal vaccination, completing medical reports for pilgrims with chronic health problems, and postponing pilgrimage for pilgrims with uncontrollable medical situations."

R14 indicated that using technology enables the pilgrims to communicate with the Ministry of Pilgrimage online by using their websites. In the same vein, one respondent pointed out that the current recommendations and guidelines of the Ministry of Health are sufficient to mitigate the health risks in Hajj, all of which goes to maintaining the safety of pilgrims during the Hajj season.

The study summarised the maintaining of pilgrims' safety in the following sub-themes:

5.4.1. Sub-theme 1: Compliance with protective safety measures

To maintain the pilgrims' health, the Ministry of the Hajj requires pilgrims to wash continually, to wear masks and to take other protective measures by managing the crowds and mass gathering. R2 respondents indicated that "the security men in pilgrimage move and observe the areas and streets in order to prevent traffic jams and mass gathering, while they guarantee that all pilgrims comply with the protective measures."

The Ministry of Pilgrimage facilitates both the protection of the site and the management of traffic for pilgrims. Their security plan also ensures entry and movement to transport the injured and transfer them. The Holy Makkah Municipality

conducts a cordon process and maintains cleanliness, although each relevant authority has a responsibility for the safety of the site.

There is no doubt that the pilgrimages might spread epidemics if the government did not have tight plans to protect the pilgrims. In this regard, three of the participants R1,R11,and R12, offered the following: “I would like you to refer to the general emergency plan issued under the name of the Minister of the Interior and the Civil Defence Department. It can provide a very accurate classification of natural and industrial risks, human-induced risks and even acts of sabotage, meaning in a very accurate and user-friendly classification you work can on and use as a basis for your message.”

Similarly, another respondent R8 indicated that organising the movement of transportation inside and outside the rituals involved grouping and scheduling journeys up to the minute with a precise follow-up system for pilgrims and buses. Thus, the respondent believed that crowd management is fundamental to reducing traffic jams and crowd crushes because the crowd management system prevents the risks that cause accidents.

5.4.2. Sub-theme 2: The state in the service of pilgrimage.

One participant believe all the capabilities of the state have been placed and harnessed in the service of pilgrimage. In this regard, four of the informantsR11,R12,R14, and R16 stated that “the state exploits all the possibilities in the country and places them within the framework of serving the pilgrims and visitors by providing pilgrims with

everything they need, which plays a pivotal role in protecting them and maintaining their health, which guarantees their safe travel in the Holy Land."

5.4.3 Sub-theme 3: Precautionary measures for natural phenomena

During heavy rain, the government will take precautionary measures such as rescheduling the time of rituals until it stops raining. According to R12,R13,and R16 respondents, "the Ministry of Pilgrimage avoid heat exposure by providing umbrellas for pilgrims."

5.4.4 Sub-theme 4: Agreements with the Hajj Affairs offices

Three respondents stated that the Ministry of Pilgrimage makes agreements with the pilgrimage missions and with pilgrimage affairs offices. These agreements involve the pilgrimage affairs offices. R2 participants indicated that "The pilgrimage affairs offices should educate the pilgrims about the requirements that help them perform the pilgrimage safely."

5.4.5 Sub-theme 5: Vaccinations and other medical requirements

Four respondents professed a belief in the necessity of obtaining the seasonal flu vaccine, obtaining complete medical reports for pilgrims with chronic health problems, and possibly postponing the pilgrimage if the pilgrim is sick because it might be extremely stressful for those who suffer from significant health problems.

R2 respondents stated that “It should be obligatory for pilgrims to attend health awareness sessions and obtain the seasonal flu vaccine. Also, they should obtain complete medical reports for those who have chronic health problems, with the possibility of postponing the pilgrims that are at risk because the pilgrimage as a journey may be very stressful for those who suffer from major health problems that are uncontrollable.”

5.4.6 Sub-theme 6: Requiring medical consultations before pilgrimage.

Two respondents suggested that people who seek to perform pilgrimage should consult their doctors before committing themselves to the journey. Their doctors should inform them of the safety measures they should adopt to ensure a safe pilgrimage R8 informants stated that "the pilgrims should consider the doctor's advice who follows the pilgrim’s case in his or her country. The reason behind that might be attributed to the fact that some pilgrims might have acute diseases, such as diabetes, cancer, and so forth."

Moreover, the participant added that pilgrims with chronic diseases should ask for health advice before performing the pilgrimage.R11,R12,R13 and R17 respondents underscored the importance of asking for health advice before performing the pilgrimage, particularly those who suffer from chronic diseases in which one of the respondents R7 pointed out that “health advice should be taken for pilgrims with

chronic diseases, and it is generally recommended to take medical advice to ensure that all necessary vaccinations are met.”

5.4.7 Sub-theme 7: Ministry of Pilgrimage information and communications

One respondent suggested that the pilgrims should communicate with the Ministry of Pilgrimage online by using their websites. The pilgrims can then learn about what is going on in the pilgrimage and what is required of them before they come to the Kingdom of Saudi Arabia.

There are webpages that pilgrims can access and benefit from which will increase their awareness in all aspects. The respondent R8 argued that "there is now a website (the Path of Pilgrimage) that can be accessed online. From this website, pilgrims can know the meals served to them, their movements, transportation, and when they should go down to the Haram, and when to do the farewell circumambulation. Also, this website provides the pilgrims with all information that will help them perform a safe Hajj."

5.4.8 Sub-theme 8: Recommendations and guidelines of the Ministry of Health

One of the participants agreed that the current recommendations and guidelines of the Ministry of Health are sufficient for mitigating the health risks associated with performing pilgrimage. These precautions are summarised as follows:

- Taking the required vaccination and submitting valid vaccination certificate.
- Providing clean and washed vegetables and fruits.
- Ensuring that all pilgrims wash their hands before and after going to toilet.

- Requiring pilgrims to drink sufficient water and to avoid sun exposure.
- Wearing masks in crowded places.

These findings are corroborated by the website of the Ministry of Health of the Saudi Government regarding wearing masks, avoiding sun exposure, taking vaccinations and consuming sufficient amount of water. Such recommendations have become a global reference point in dealing with crowds.

The Ministry of Pilgrimage also benefits from looking at the previous Hajj experiences. One of the respondents R10 stated that, "the current recommendations and guidelines adopted in the Ministry of health are sufficient due to the experiences gained over the past years and the ingenuity of the officials in its management." Moreover, the Ministry of Pilgrimage takes advice from all the parties participating in the pilgrimage mission and accredited scientific bodies in consultation with experts from the World Health Organisation and the Centre for Disease Prevention.

According to one of the respondents R8 , "the participating parties participate annually as advisory teams that provide technical support and scientific advice with the Ministry of Health team". In this sense, the government integrates a national strategy to limit the health risks and implements an integrated national action to anticipate risks in advance by limiting the number of pilgrims and complying with precautionary measures.

It can thus be deduced that the Ministry of Pilgrimage makes every efforts to safeguard the safety of pilgrims, although the pilgrims should be aware of the risks that exist in pilgrimage and they should not neglect the importance of vaccination and

compliance with preventive measures for their safety. In this respect, numerous models have attempted to explain the differential use of preventive behaviour, while one of the most consistently and widely used is the health belief model (HBM) (Skinner et al., 2015). This model holds that individuals base their decisions on preventative behaviour founded on two key elements.

In accordance, the Saudi government has taken two key measures in imposing restrictions on social gatherings and scaled down the Hajj to reduce the number of pilgrims. The country has preserved all the basic health immunisation programmes and services, while encouraging other key proposals for COVID-19 vaccines and other drug treatments (Khan et al., 2021).

5.5 Theme 4: Avoiding the health risks of pilgrimage

Figure 5.4 illustrates the major perceptions of Saudi authorities about the methods employed by the government in Saudi Arabia to improve Hajj safety and avoid health risks, which constitutes a further answer to the research questions.

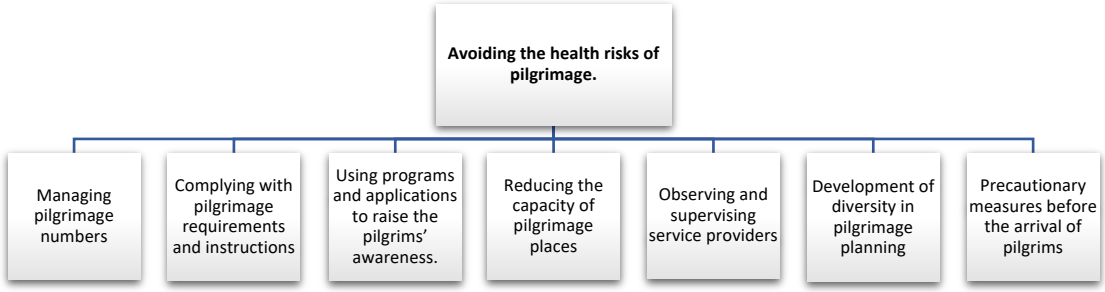


Figure 5.4: Theme 4 and its sub-themes

As shown in figure (5.4), the perceptions of Saudi authorities of the correct methods to avoid health risks to the pilgrims are divided into (7) sub-themes. Five of the participants indicated that dividing the pilgrims into groups and reducing the numbers of pilgrims helps to avoid the health risks of Hajj. Four respondents R2,R8,R11,R12 indicated that "complying with the requirements and instructions during the pilgrimage", followed by three respondents R7,R8, and R13 who suggested "using programs and applications to raise the pilgrims' awareness", and then R11, and R12 participants who indicated the value of "reducing the place capacity to overcome natural phenomenon".

One respondent R16 underlined the importance of "observing and supervising service providers". Similarly, another participant R17 opined that "working with some

developmental aspects due to a great diversity in the categories of pilgrims" to give the sixth sub-theme. Finally, R14 respondents suggested "taking precautionary measures before the arrival of pilgrims", all of which help in avoiding health risks of Hajj.

For the purposes of the study, we have summarised the following points with regard to improving the safety of Hajj and placed them into sub-themes below:

5.5.1 Sub-theme 1: Managing pilgrimage numbers

Three participants suggested dividing the pilgrims into groups tailored to the pilgrims' desires, beliefs, age group and health status. In other words, the officials in Saudi Arabia should establish standards according to the pilgrims' level of experience. They concluded that the pilgrimage is safe so long as people work in all these areas, as identifying the desires, age group and health conditions of pilgrims arguably enables officials to pinpoint their needs and find the correct methods of protecting them, such as providing exceptional care for elderly people.

Two respondents R2, and R7 suggested that the government deals with the risks by applying the appropriate mechanisms and actions by limiting the number of pilgrims. The state took difficult decisions for the first time to limit the pilgrimage only to certain nationalities, which were chosen from Islamic countries through a method that was creative in applying mechanisms for selection for the first time. The main goal was to enable pilgrims to perform the pilgrimage ritual safely and apply precautionary health requirements and protocols.

The Ministry of Health deals with curbing the health risks of Hajj with every professionalism, such as providing distinguished and well-known medical teams. The Kingdom's success in managing the pilgrimage seasons is embodied in its ability to protect the pilgrims' health, manage crowds and provide food and drink in the presence of health personnel during the pilgrimage season at the holy sites.

What is also important is its ability to follow up on such matters. It is commonly known that mass gatherings might be correlated with harmful effects on health services (WHO, 2015; WHO, 2020) and it would therefore be better to reduce the number of pilgrims to avoid such health risks. Preventive measures including vaccination, immunisation and wearing face masks mitigate and prevent health risks (Tobaiqy et al., 2021).

5.5.2 Sub-theme 2: Complying with pilgrimage requirements and instructions

Four participants recommended compliance with the requirements and instructions during the pilgrimage to guarantee that pilgrims will not be vulnerable to diseases. However, it would be counterproductive if the pilgrims did not comply with the instructions.

5.5.3 Sub-theme 3: Using programs and applications to raise the pilgrims' awareness.

Many programmes and applications are available to raise pilgrims' awareness of the safety procedures that can be applied to safeguarding their health in general, and especially that of the elderly or those who have chronic diseases. The Ministry of

Pilgrimage has created a centre for grouping pilgrims in order to raise their awareness of the safety measures that should be taken to protect them.

R1 could argue that the level of measures and precautions provided by the authorities in Saudi Arabia is high, which means that the government in Saudi Arabia takes a good range of precautionary measures to protect pilgrims. As one of the respondents R9 stated, "The Hajj will be more safe and secure if all pilgrims follow the rules and instructions set by our government officials. However, some pilgrims will break the rules, which will create a chance to that some risk will arise for them and the other pilgrims. The Saudi Government takes special care to deal with elderly people, especially those with chronic disease because they are more vulnerable even to small risks."

Two of the respondents R14, and R17 then confirmed the following: “the pilgrimage with its applications, requirements and instructions is considered safe and secure, but the possibilities of a health risk existed in the event of shortcomings or non-compliance with the rules.”

5.5.4 Sub-theme 4: Reducing the capacity of pilgrimage places

To mitigate the risks of natural accidents, two of the respondents R14, and R17 suggested “raising the place's capacity to become resilient, which leads to sustainability, so we are looking to increase the resilience and flexibility of the place so that it deals with external dangers and allows business continuity.”

5.5.5 Sub-theme 5: Observing and supervising service providers

The Ministry of Pilgrimage observes and supervises service providers. In this respect, one of the informants R3 underlined that "the Ministry of Pilgrimage plays a fundamental role as a supervisory organisation on the service providers and institutions of pilgrimage companies, ensuring that companies and institutions play an entrusted role in raising the pilgrims' awareness."

5.5.6 Sub-theme 6: Development of diversity in pilgrimage planning

The efforts expended by the government in the Kingdom of Saudi Arabia, whether in the planning stages or the implementation stages, reflect their high level of awareness some of which might have emanated from their previous experience with epidemics. In this respect, Fineberg (2014) points out that the high level of readiness and awareness of the government is due to the lessons they learnt in previous pandemics.

5.5.7 Sub-theme 7: Precautionary measures before the arrival of pilgrims

One of the respondents confirmed that some measures have been taken before the arrival of pilgrims from their countries in order to raise their awareness and to ensure that they have already had their vaccination as a mandatory requirement before their arrival to perform the pilgrimage, i.e., through the issuance of pilgrimage visas. One of the participants R9, recalled that, "From the day the pilgrim comes they will be checked for a medical examination and vaccinations as preventive plans in the aspect of health."

In addition, the government accepted only a limited number of pilgrims. Plans were made for the movement of crowds and the flows of pilgrims for all stages of the pilgrimage. The numbers of pilgrims did not therefore exceed the carrying capacity.

Moreover, service providers are observed and supervised by the Ministry of Hajj to guarantee the safety of pilgrims and to avoid the health risks of pilgrimage. To summarise, the study concluded that the risks associated with pilgrims have been reduced owing to the efforts exerted by the Ministry of Pilgrimage in raising awareness of the risks of pilgrimage.

5.6 Theme 5: Safety training in the Ministry of Pilgrimage

The following figure (5.5) illustrates the major perceptions of the Saudi authorities about the training sessions for the workers in the Ministry of Hajj to improve the safety of pilgrimage. This constitutes another answer to one of the research questions.

As shown in Figure 5.5, the perceptions of Saudi authorities regarding the training sessions for staff in the Ministry of Hajj to improve the safety of pilgrimage are divided into (6) sub-themes. Six of the participants indicated that the training centres manage crowd management and transportations. Four respondents underlined the necessity of training centres for workers in the Ministry of Pilgrimage, while three participants suggested training programs for overcoming common diseases.

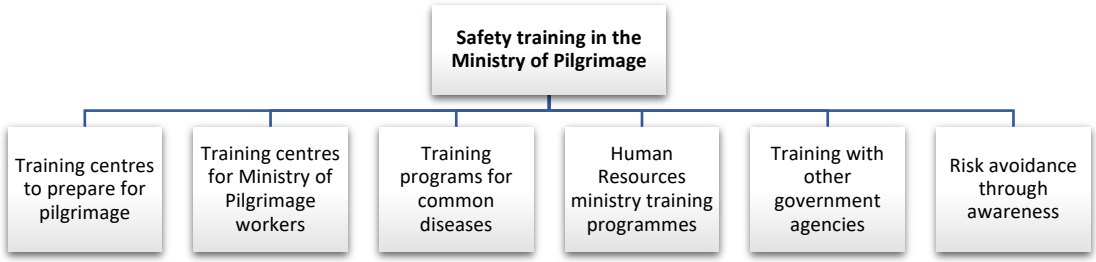


Figure 5.5: Theme 5 and its sub-themes

Two respondents then claimed that the Human Resources Department offers a set of training programmes for the workers in the Ministry of Pilgrimage and Umrah annually. One respondent R9 indicated the existence of training workshops and lectures with other government agencies. Another participant argued that the Ministry of Hajj trains the workers in health facilities. Such training sessions for the workers improve the safety of the Hajj.

5.6.1 Sub-theme 1: Training centres to prepare for pilgrimage

Employees in all the government sector, institutions and departments have training centres that offer them special programmes regarding transportation and crowd management for the pilgrimage. Training programmes are then made available to all workers according to their specialisation.

Six of the informants R1, R7, R8, R12, R13, and R16 suggested that "there are training programmes for each guide, whether a bus guide or a group guide has a training

programme, who does not participate in the season unless he obtains a certificate approved by the supervisory authority, which is the pilgrimage and Umrah Training Centres in the Ministry of Pilgrimage". These training centres are used to ensure that the organisation has chosen trained and qualified workers.

The findings indicate that health improvements have been made for the Hajj. However, (Aldossari et al., 2019) study underscores the necessity of enhancing international collaboration to improve health management during the Hajj.

5.6.2 Sub-theme 2: Training centres for Ministry of Pilgrimage workers

The Ministry of Pilgrimage already has a training centre with a set of courses and training programmes that all the people working on either the pilgrimage or the Umrah are obliged to take as part of their job requirements. As two of the participants R8 and R12 pointed out, "The Hajj and Umrah Workers Training Centre has a set of courses and programmes that offer and represent certain training points for workers in the pilgrimage system.

Specific courses for ministry employees are then held to train pilgrimage workers. Courses are also held for pilgrimage institutions and companies. One university has started to run Bachelor and Diploma programmes in the field of pilgrimage and Umrah. As two of the participants R1, and R8 stated, "there is a collaboration between the Ministry of the Hajj with their huge experiences and Umm Al-Qura University to establish a department in the university aims directly for the Hajj

and Umrah". They have a bachelor's degree specialising in pilgrimage and Umrah. It is under the College of Business Administration.

5.6.3 Sub-theme 3: Training programs for common diseases

Two of the participants indicated that there are training programmes available to public administrators related to health practices regarding common diseases that might be acquired during the pilgrimage. These guide them in dealing with such common situations and diseases. Moreover, the duration of the training programme depends on the programme's objectives, and the quality of training that should be delivered to the trainee, which is why the duration of the courses might last from one to three days.

Furthermore, training is not only conducted in the training centres but in the field depending on its necessity. One of the participants R2 pointed out that: "There is set of seasonal training courses related to health practitioners on common diseases during the Hajj and how to deal with them. The duration of courses ranges from one to three days, depending on the requirements, whether in the centres or in the field."

5.6.4 Sub-theme 4: Human Resources ministry training programmes

One of the respondents stated that the Human Resources Department offers training programmes for the workers in the Ministry of Pilgrimage and Umrah annually. Moreover, they send emails about educational and awareness courses and reminders regarding the necessity of complying with official procedures and standards for participating in the pilgrimage. One of the participants. R9 pointed out that, "For

workers in the Ministry of Pilgrimage and Umrah, our Human Resources Department offers a set of training programmes annually."

This respondent also indicated that the training program is effective in raising pilgrims' awareness. However, he suggests that improving ministry employees' ability to improve electronic applications are highly effective". Nevertheless, the literature indicates that the integration of digital applications might provide a number of advantages, such as tracking a pilgrim's health status, increasing user satisfaction and informing decision-making (Aljohani et al., 2022).

5.6.5 Sub-theme 5: Training with other government agencies

As one of the participants R13 pointed out, "Training workshops and lectures are held face-to-face or online, training on specific skills such as infection control procedures, training on emergency plans and medical evacuation, joint disaster training with other government agencies. It operates annually and the training intensification increases in the weeks preceding the pilgrimage season to determine the readiness."

5.6.6 Sub-theme 6: Training in health facilities

One respondent expressed the belief that raising awareness and prioritising health facilities in the pilgrimage comes from training the workers in health facilities.R13 stated that "Hospitals are based on a team specialised in dealing with the common health problems, such as heat stress. Of course, the protocol includes the process of training workers in health facilities." This respondent suggested that every stage has its

challenges, while training and upskilling help workers face up to any factors that might affect the development process.

The Ministry of Pilgrimage has developed its own emergency plans and has alternative plans to face any challenges in the development. Moreover, the ministry advises all the other ministries that participate in the pilgrimage mission to have their particular training and skills for their crews to overcome any challenges they might face. In addition, training and skills are essential components of the governmental development process. The participant continued that "the Ministry of Pilgrimage ensure that all ministries that participate in the pilgrimage mission to train their crews and put their crews through some competency exam to make them ready to face any challenges that might happen during the Hajj season."

This finding is inconsistent with the conclusions of (Tavan et al., 2019) insofar as there is insufficient research on how pilgrims perceive risk, the variables influencing information transmission, and how these aspects eventually impact readiness and training. Based on the findings presented above, the majority of participants believe that the workers in the Ministry of Pilgrimage are trained to protect and serve pilgrims.

5.7 Theme 6: Risk avoidance through awareness

Figure 6 given below illustrates the methods employed by the government in Saudi Arabia to avoid health risks at Hajj. The Saudi authorities do so by raising pilgrims awareness and these initiatives are discussed below in answer to another of the research questions.

Figure 5.6: Theme 6 and its sub-themes

Figure (5.6) shows the perceptions of the Saudi authorities regarding the methods employed by the government in Saudi Arabia to avoid risks by raising pilgrims' awareness according to Saudi authorities' perspectives. They are divided into (8) sub-themes, with the first six participants stressing the value of distributing awareness messages and brochures to raise pilgrims' awareness.

Five respondents R3,R8,R12,R13, and R17 then mentioned implementing and publishing health protocols to raise pilgrims' awareness, while three respondents stressed the importance of raising the nutritional awareness of pilgrims. Two respondents underscored the significance of imposing the instructions and increasing the pilgrims' awareness of mass gathering, while one respondent pointed to awareness programs and sessions to raise pilgrims' awareness.

One participant R9 indicated the value of educating the pilgrims from their own countries, while another respondent underscored the use of technology to raise the

pilgrims' awareness about the instructions of performing pilgrimage and for measuring their satisfaction. Finally, one informant argued that watching the official channels is one of the most important strategies for raising the pilgrims' awareness of the necessity of seeking health advice. Such methods have been used by the government in Saudi Arabia to avoid risks by raising pilgrims' awareness according to the perspective of the Saudi authorities.

5.7.1 Sub-theme 1: Pilgrim messaging and raising awareness

The Ministry of Pilgrimage distributes awareness packages to the pilgrims in their country of origin - i.e., before their arrival at Mecca - regarding the health risks associated with the pilgrimage. They also provide awareness messages and brochures in different languages for pilgrims during their journey in the pilgrimage season.

Three of the respondents R8, R12, and R13 underline the value of "awareness messages for pilgrims during their flights by air or by boat, and upon their arrival at the port, by providing awareness messages in their languages and when transporting them by bus by displaying pictures or audio messages in their languages and distributing awareness-raising leaflets" Such messages aim to educate pilgrims about the importance of adhering to health procedures.

Two of the participants R4 and R6 mentioned that one of their plans is for all pilgrims in general, and elderly pilgrims in particular, to read a magazine or brochure about the pilgrimage to raise their awareness level, while the illiterate pilgrims should take an educational course to raise their awareness. According to R13 respondents,

“one of our plans is to encourage pilgrims to take an educational course, read a leaflet, read a magazine or brochure about pilgrimage, use information technology, and use translators. By doing so, the Ministry of Pilgrimage will guarantee that most pilgrims are aware of the risks associated with pilgrimage.”

5.7.2 Sub-theme 2: Health protocols to raise awareness

Four of the respondents pointed out that the Ministry of Pilgrimage has implemented a health protocol and published it for the pilgrims through audio-visual media such as the official Saudi TV and awareness teams who visit them at their residence to raise their health awareness. As R13 of the participants stated, “the health protocol implemented by the Ministry of the Hajj is published for the pilgrims through audio-visual media, and as well as through awareness teams that visit them at their residence to raise health awareness.”

5.7.3 Sub-theme 3: Raising pilgrims’ nutritional awareness

One respondent stated that the Ministry of Pilgrimage raises the pilgrims’ awareness of diet by providing them with information to educate them more about the benefits of a balanced diet to help them keep healthy and help increase their immunity. Two of the participants R3,and R9 confirmed that “We aspire to educate the pilgrim in terms of nutrition during a pilgrimage to reduce infectious diseases and to perform safe and easy Hajj for the pilgrims". However, changes in diet might not induce positive changes in the community in such a short timescale. In this respect, (Taibah et al., 2020) point out that difficulties in purchasing prescription medicines and the existence of limited health

care facilities were more likely to impede the adoption of healthy measures significantly. Thus, Hajj authorities, KSA government agencies, mission authorities and the pilgrims themselves were recommended to face health risks during Hajj throughout several phases of travel, such as pre-travel and post-travel.

5.7.4 Sub-theme 4: Increasing awareness of mass gathering

One respondent stated that the Ministry of Pilgrimage believes that greater awareness on the part of the pilgrims will facilitate crowd management during the pilgrimage season. He stated that "the Ministry of Pilgrimage has to impose the instructions and rules to control the pilgrimage and increase the pilgrims' risk awareness in order to manage the crowds." In this sense, the Ministry has worked hard to ensure that other parties working on the pilgrimage follow instructions and rules to adhere to deadlines and procedures in order to ensure that everyone performs a safe pilgrimage.

Furthermore, all the parties participating in the pilgrimage mission have a role in increasing pilgrims' awareness, which will eventually help the authorities control the crowds because the pilgrims will be aware of the risk of not complying with the rules. In this sense, the pilgrims' will develop greater awareness of the health and non-health-related risks to which they are vulnerable while performing pilgrimage. Such rules are manifested in reducing the scale of mass gathering, raising pilgrims' general awareness, enforcing the wearing of masks and maintaining social distance.

According to Almehmadi et al. (2021), both the carelessness of pilgrims and their immense numbers are considered to be the main drivers affecting public health

and safety during pilgrimage. As a general conclusion then, it is the process of conveying information to the pilgrims that should be improved.

5.7.5 Sub-theme 5: Awareness programmes and courses

One of the participants R14 stressed that awareness programmes have been provided by the Ministry of Pilgrimage and several other parties, containing information and the criteria for safe pilgrimage provided to pilgrims before their arrival. He added that "Awareness programmes are presented in several languages in which there are messages in which criteria are directed to the pilgrims before they perform the pilgrimage". Similarly, another participant R6 pointed out that "we send messages to the pilgrims about the preventive measures that should be applied during pilgrimage to mitigate the potential risks that might occur".

Other participants also confirmed the necessity of attending health awareness sessions, though (Nabil & Ahmed, 2016) conclude that the majority of pilgrims have insufficient knowledge of the health risks that might occur in pilgrimage and unsatisfactory practice. The level of education and awareness of pilgrims need to be considered and then developed with the use of modern technology such as the Internet and smartphones. Here the same participant stated that "the level of education and awareness of pilgrims are increasing, especially due to the use of modern technology".

The response of the Ministry of Pilgrimage is to send text messages and applications to pilgrims in order to remind them of the safety measures with which they should comply when they come to perform the pilgrimage. All such measures help to

raise the level of awareness of pilgrims regarding the health risks. Some of the respondents also argued that the Ministry overcomes most obstacles to communication by using technology and multiple information programmes to manage the pilgrimage.

In this sense, the Ministry of Pilgrimage does not face overwhelming challenges because all the issues are under control thanks to recognition that "technology is the most important factor in the leadership of the pilgrimage", as one of the participants indicated. However, such findings are inconsistent with the data presented in (5.6.2) point (2) that the low level of education among illiterate pilgrims hinders them from taking advantage of the technology.

5.7.6 Sub-theme 6: Pre-pilgrimage education

One of the participants R2 emphasised the necessity of educating the pilgrims in their own countries about the pilgrimage rituals, so providing them with instructions they should follow upon their arrival in order to maintaining their safety and the safety of others. He pointed out that "Other countries must help in the process of educating their pilgrims about the ritual of pilgrimage and the instructions that they should follow after coming to help us in decreasing the risks for all pilgrims".

Likewise, some of the research participants believed that raising the pilgrims' awareness is not limited to the pilgrim's arrival in the Kingdom of Saudi Arabia. The initiative should hence come from their contributing countries, where ideally there should be a mechanism to inform the pilgrims in cooperation with all the other

participating parties, services and authorities, such as security staff, health personnel and emergency agencies.

The same participant added that there is coordination between the institutions and organisation involved from the pilgrims' countries of origin in supporting health awareness programmes. In this regard, the respondent gave the following conclusion: "the coordination with pilgrimage institutions with the countries from which pilgrims come through the embassies of the Custodian of the Two Holy Mosques will help in supporting health awareness programmes, increasing education and awareness teams, using voluntary bodies to support health awareness programmes, making use of social media to spread health awareness."

5.7.7 Sub-theme 7: Technology to raise awareness and measure satisfaction

One of the respondents underlined how essential it is to use information technology extensively by sending messages and emails to give the pilgrims instructions to raise their awareness about the of performing pilgrimage. Spreading awareness by using mobile applications makes the pilgrims better aware of the safety measures with which they should comply to protect their safety. Moreover, the use of technology is now a universal tool to help the Ministry of Pilgrimage to raise awareness and organise people's time, as R9 respondents noted that "I expect that even the elderly pilgrims are now using technology".

Two other participants confirmed that there are now programmes using technology to measuring pilgrims' satisfaction and consent. They noted that "we have

internal pilgrims because they are the ones who enter and register from the electronic track after the end of the pilgrimage season. They receive emails with a link to evaluate the service they receive from service providers and pilgrims abroad. We have field teams that go down using iPads for identifying the pilgrims' evaluation of the services."

Another participant R11, R15, R17 suggested that the Ministry of Pilgrimage has created a centre for grouping pilgrims in order to raise their awareness of the safety measures that should be taken for their protection. It is thus arguable that the level of measures and precautions provided by the authorities in Saudi Arabia is high, which means that the government in Saudi Arabia have succeeded in providing a good range of precautionary measures to protect pilgrims.

One of the respondents confirmed that Ministry of Pilgrimage has developed several methods to help the pilgrims obtain health advice by emphasising that "the Ministry has developed several ways to obtain health advice, including free contact numbers and the Ministry of Health applications, which have become accessible to everyone, in addition to hospitals and health centres in the field when needed."

5.7.8 Sub-theme 8: Raising health awareness through official channels

The research participants suggested that watching the official channels presents the pilgrims with a series of standards and requirements that aim to raise their awareness of the necessity of seeking health advice before performing the pilgrimage. R9 participants recommended to "Look at the well-known official sources of the Ministry or the well-known official channels in which the Ministry sets known standards and

requirements. Before and during the Hajj season, the Ministry of Pilgrimage communicates with organisers and offices of pilgrims' affairs. Also, they will send circular messages addressed to pilgrims."

To sum up, the findings revealed that the otherwise low level of health and safety awareness can be reduced by the Ministry of Pilgrimage's works to educate the pilgrims about the new risks during pilgrimage before and upon their arrival. In doing so, the pilgrims will have a clear picture of the risks, striving to avoid them, while their level of awareness will be increased. This finding is consistent with that of (Wynberg et al., 2012), who stated that pre-travel health preparation, including seeking education, improves the health outcomes of international travellers.

5.8 Theme 7: Measuring pilgrims' satisfaction with health services

The following figure (5.7) illustrates the methods employed by the government in Saudi Arabia to measure the pilgrims' satisfaction with the health service. These reflections on the measures and perspectives of the Saudi authorities offers a seventh response to the research questions.

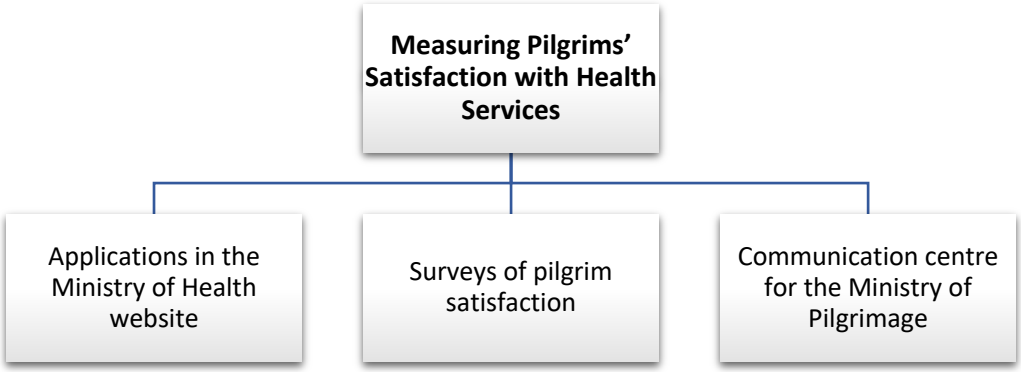


Figure 5.7: Theme 7 and its sub-themes

Figure (5.7) gives the perceptions of the Saudi government regarding the methods employed by the government to measure the pilgrims' satisfaction with the Kingdom's health services. These perspectives of the Saudi authorities are divided into (3) sub-themes.

Eight of the participants placed the emphasis on electronic applications and programs in the Ministry of Health website. Five respondents indicated that survey studies have been created to serving the pilgrims and communicating with them in the event of facing any difficulties. Four respondents then emphasised the communication centres set up by the Ministry of Pilgrimage and Umrah to measure pilgrims' satisfaction with these health services.

Given that this section is concerned with identifying the level of satisfaction of pilgrims with the Kingdom's health services, the following sub-themes have been created:

5.8.1 Sub-theme 1: Applications in the Ministry of Health website

Eight participants stressed that the methods for measuring pilgrims' satisfaction with the Ministry of Health services are articulated in health websites. Seven of the participants then emphasised the existence of digital technology for measuring pilgrims' satisfaction and consent using. As two of the respondents stated, "We have internal pilgrims because they are the ones who enter and register from the electronic track after the end of the pilgrimage season. They receive emails with a link to evaluate the service they receive from service providers and pilgrims abroad. We have field teams that go down using iPads for identifying the pilgrims' evaluation of the services."

5.8.2 Sub-theme 2: Surveys of pilgrim satisfaction

Five participants R1,R2,R9,R12, and R13 underline the existence of survey studies to identify the pilgrims' satisfaction levels with the health service. The participants confirmed here that "survey studies are carried out by all parties that have the honour to serve the pilgrims. There are lines of communication open to everyone to hear their voice in case of facing any difficulties or problems." A study conducted by (Al-Hoqail et al., 2010) to explore pilgrims' satisfaction with ambulatory health services in Makkah found that patient satisfaction with paramedical personnel amounted to (21%), while the satisfaction level for patients with physicians accounted for (4.7%).

(Al-Hoqail et al., 2010) concluded that satisfaction with ambulatory Hajj health services is acceptable, while (Rahmah et al., 2020) study of pilgrims' satisfaction with health services indicated that their satisfaction level is acceptable though affected by

affective and cognitive elements. On the positive side, satisfaction levels are not affected by the age of the pilgrims and their level of education.

5.8.3 Sub-theme 3: Communication centre for the Ministry of Pilgrimage

Two respondents mentioned the Communications Centre of the Ministry of Pilgrimage and Umrah measuring the satisfaction of the pilgrimage experience. Two of the respondents R12, and R13 noted that, in general, "The Communication Centre that measures the performance and satisfaction in the Ministry of Pilgrimage and Umrah is associated with the Strategic Office, linked to the Services Sector the Services Agency."

The study concluded that survey studies, electronic programs, the Communications Centre of the Ministry of Pilgrimage and Umrah all measure pilgrims' satisfaction with health services. All of these measures are considered to be good indicators to improve the developmental plans in the Ministry of Hajj.

5.9 Theme 8: The challenges leading to pilgrimage safety issues

The following figure (5.8) unravels the challenges hindering government health and safety measures. As these barriers can leading to a loss of health and safety in pilgrimage, which constitutes an answer to the research questions.

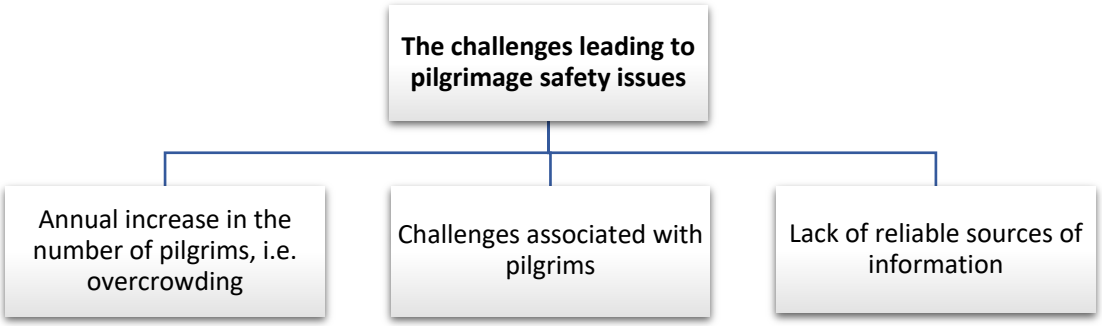


Figure 5.8: Theme 8 and its sub-themes

Figure 5.8 shows the research participants views on the challenges to the government's plans possibly leading to poor health and safety in the pilgrimage. They have been divided into (3) sub-themes, with ten of the participants mentioned the annual increase in the number of pilgrims, i.e. overcrowding. Seven respondents then suggested that such challenges obstruct or hinder the plans put in place by the authorities, resulting in a risk to the pilgrims.

The respondents held the view that such development plans encounter some challenges owing to several reasons, as follows.

5.9.1 Sub-theme 1: Annual pilgrimage increases and overcrowding

Overcrowding is considered a significant challenge for the government to overcome by building bridges, alternative roads and widening roads, as confirmed by ten of the participants R1, R2, R4, R8, R9, R12, R13, R15, R26, and R17 who mentioned the following: “Variation in temperatures from season to season summer and winter, and the global epidemiological situation Covid-19 pandemic and limited Carrying capacity of the holy sites for the expansion in the number of pilgrims in particular in Mina site and the steady increase in the number of pilgrims.”

5.9.2 Sub-theme 2: Challenges associated with pilgrims

Fraudulent Covid-19 vaccination certificates were also mentioned as a risk to the health of pilgrims. Here the participant indicated that such an issue is pervasive in Hajj even if it has not been cited in literature. Moreover, non-compliance with such a preventative measure can expose pilgrims to health risks and obstruct the government’s plan for the pilgrimage.

5.9.3 Sub-theme 3: Lack of reliable sources of information

Here, seven of the respondents R1, R2, R8, R11, R14, R15, and R17 stated that “The sources of official information about the Hajj and Umrah still need more effort to be made available to all pilgrims, especially some from the developing countries that do not have adequate Internet connections.”

To conclude, from the authorities’ perspectives the challenges hindering the government’s plans and leading to the health risks to the pilgrimage included

overcrowding, fraud in the pilgrims' vaccine certificates and the lack of reliable official resources. Although the number of pilgrims has been reduced by the Ministry of Hajj, large numbers of pilgrims still come to perform pilgrimage, which might constitute a threat to the spread of infectious diseases.

During the Hajj, the diversity of the pilgrim population raises the level of health risk during the large gathering Owing to the huge crowds, the Hajj provides multiple avenues for the transmission of diseases. In fact, several airborne infections such as tuberculosis and meningitis have been recorded at the annual mass pilgrimage (Memish et al., 2011). Moreover, non-compliance with the preventive measures can expose pilgrims to health risks alongside the lack of official reliable resources, including a reliable Internet connection to give the pilgrims access the government website.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Introduction: The importance of the findings on health and disease prevention

The last chapter focused on highlighting the various findings of the research in light of the literature reviewed. The findings of the epidemiological data showed that significant respiratory infections have been reported in the pilgrimage. According to Balkhy et al. (2004), up to a third of all pilgrims that embark on the Hajj experience respiratory symptoms associated with the influenza virus which has consequently led to influenza infection during the mass pilgrimage to be informally referred to as the Hajj cough.

While the Saudi response to the global COVID-19 pandemic has been targeted at safeguarding public health, it has also reduced the country's capacity to hold a large mass gathering event. Nonetheless, compared to other countries, Saudi Arabia's standing as one of the leading authorities on mass gathering medicine has left the country better prepared to combat a potential coronavirus pandemic. Additionally, as a signatory to WHO's International Health Regulation, the Kingdom has regularly monitored and reported on its pandemic preparedness (Algaissi et al., 2020). The country set up a national committee to prepare for the pandemic more than two months before its first case was reported.

However, while infectious diseases are by far the most prevalent health risks during the Hajj, they are regrettably not the only ones. Non-infectious diseases and other health risks do occur far less frequently but still account for a significantly greater proportion of mortalities during the annual pilgrimage (Shujaa & Alhamid, 2015). To elaborate, the data derived from other studies shows a number of non-infectious and uncontrollable incidents during the Hajj pilgrimage, such as stampedes, traffic accidents and pilgrims sliding or falling. Sadly, much of the mortality and morbidity associated with these non-infectious-related risks is in fact avoidable. As such, it is not surprising that many of the preventative health measures recommended to pilgrims before embarking on the Hajj touch on non-infectious health risks.

A significant portion of the studies investigating adherence to preventative health measures during the Hajj have concentrated on the uptake of the influenza vaccine. The WHO and numerous national health bodies report vaccination as the most effective mitigation strategy against seasonal influenza (Alfelali & Rashid, 2014). As with the Hajj, the Kumbh Mela is also faced by a significant risk of human stampedes. While this mass gathering does not occur within a fixed structural boundary, the movement of pilgrims is mainly limited to the banks of rivers (Balsari et al., 2016). As such, overcrowding is common on these riverbanks, and in extreme cases has resulted in deadly crowd crushes events. For example, in 1954, a mass crowd crushes occurred at one mass gathering killing 500 people and injuring thousands more (Balsari et al., 2016).

6.2 Mass gatherings and public health

Mass gatherings have been shown to increase risks to public health significantly. A number of findings have thus been realised based on the objectives of the research. The research revealed that the various public health needs of the pilgrims should be addressed. For instance, overcrowding in the pilgrimages increases the risk of spreading communicable diseases and worsens existing non-communicable diseases.

During the Hajj, the diversity of the pilgrim population raises the level of health risk in these large gatherings. Pilgrims from all over the world come to perform the Hajj and while this happens in a religiously significant context, it raises a lot of issues in terms of public health. These pilgrims, naturally , arrive with a wide range of medical backgrounds. Although some come from places where particular strains of disease are not seen anywhere else on the planet (Cobbin et al., 2017), the majority of participants were confident that the pilgrimage was safe.

Our findings indicate that the participants were conscious of the various health-related risks associated with the mass gatherings. The participants gave an in-depth view of the health and non-health risks existing during the pilgrimage season. Notably, their opinion was that Saudi government played a critical role in the management of public health during the pilgrimage season. Moreover, the Saudis were more willing to contribute to the development of effective public health promotion strategies. As such, the authorities should leverage the public support to promote healthy behaviour among the pilgrims.

The participants believed that the interventions by the Saudi authorities were significant in safeguarding their health as pilgrims. Here the majority of the participants were of the opinion that the instructions of authorities were highly significant. For example, the means of transport utilised during the pilgrimage provided an opportunity to conduct religious rites safely. These instructions were crucial because they provided clear guidelines regarding the prevention of Covid-19 transmission. As such, it is clear that mass gatherings present a significant public health risk in spreading viruses.

Internal communication also helps employees become more aware of their surroundings, all of which guarantees that the pilgrims and visitors adhere to the most effective health protocols to guarantee their safety. All those issued with the visa are expected to have first fulfilled a raft of preventative health requirements issued by the Saudi Ministry of Health (Ministry of Heath, 2018). Notably, some participants were of the opinion that some risks still persisted during pilgrimage, such as the educational level of pilgrims.

According to Wynberg et al. (2012), pre-travel health preparation, including seeking education about risk in advance, improves the health outcomes of international travellers. The findings thus revealed that the risks of mass gathering can be reduced by working with some developmental plans such as dividing pilgrims according to groups of packages. Such packages are tailored to the pilgrims' desires, beliefs, their age group and health status.

In addition to the work of related departments such as the Emergency Department and the General Department of Health Emergencies in the Ministry of

Health, other departments are concerned with the audit and awareness process. Departments in charge of auditing and guiding the administration, such as the Public Health Department's Department of Patient Awareness thus educate people about infection control and other issues.

Another key factor in mass gatherings are natural hazards such as wind, rain and earthquakes, which play a role in increasing the risk to health and safety. This finding is consistent with the WHO's (2019) report that mass gatherings are becoming particular relevant as a vector of possible pandemic diseases, such as those associated with the mutation of the Avian influenza virus. According to Atsi-Selmi et al. (2016), the risk of accidents or disasters in mass gatherings events typically comes from the hazards of interacting with individuals with existing vulnerabilities. Hence, much of the current research focuses on the transmission of travel-related infectious diseases.

As a matter of fact, such problems can be reduced by dividing pilgrims into small groups in order to avoid mass gathering, so ensuring that the pilgrims have been vaccinated and equipping pilgrims with educational brochures to raise their awareness regarding the safety measures that should be taken to protect their health. Our study indicates that training programs are considered as another suitable solution to educate illiterate pilgrims where the possibility of disease transmission is significant and thus poses a major health risk. On the other hand, natural phenomena are unpredictable and uncontrollable, entailing that the only way to reduce them is by informing the pilgrims beforehand about the weather conditions in order to be completely aware of the methods that should be employed for dealing with them.

Overall, our findings indicate that mass gatherings do indeed increase public health risks. Experts from the various virtual WHO mass gathering collaboration centres and global academic and public health faculty have provided important insights to guide development of optimal health and medical prevention at mass gatherings. By 2014, mass-gathering medicine had been formalised as a new discipline. This study hence contributes to this new discipline and to the corresponding literature in identifying the health risks of mass gathering and the methods employed by the government to reduce health risks and the recommendations that should be applied by the pilgrims to mitigate health risks. By doing so, the health risks of mass gatherings might be under control.

Several risks and hazards are associated with mass gatherings. The first risk is the transmission of communicable diseases including antibiotic resistant bacterial infections. These infections can escalate into deadly epidemics and adversely impact public health among the affected communities. Consequently, is always important to establish effective containment measures for communicable diseases, particularly in the context of mass gatherings.

The third important health risk related to mass gatherings is water- and sanitation-related. Mass gatherings take many forms besides pilgrimages, and might include sports events, music festivals, and regional and national commemorative events. It is important to be cognisant of the reality that the main danger associated with mass gatherings is the potential for infectious disease transmission. Essentially,

mass gatherings bring people into proximity and increase the chances of infection transmission.

Policymakers should thus focus on anticipating and mitigating some of the public health risks associated with mass gatherings. Establishing and consolidating a specialised field of medicine here is vital to address mass gatherings with specific public health strategies. Mass-gathering medicine can help in conducting pre-event risk assessments, conducting surveillance, and reporting procedures for monitoring patient presentations and organising onsite medical facilities and services. Here the practical challenges that characterise the H1N1 influenza pandemic have informed some of the mass gathering health strategies and practices.

Religious gatherings are frequently characterised by the creation, enaction and persistence of a community through the collective behaviours of members. For instance, the month-long Hindu Magh Mela has been associated with improved health and wellbeing among the participants. The pilgrims often report improvements in their health and wellbeing compared to non-attendees. A variety of scholars have argued that an exclusive emphasis on the public health risks of mass gatherings could overshadow their potential benefits to a society.

Indeed, there is a consensus on the importance of participants experiencing a strong sense of social connection at mass gatherings. The shared emotional experience among the participants can contribute significantly to positive social outcomes. These connections can give rise to powerful feelings of solidarity, leading to the development of a mutually supportive social unit. As such, mass gatherings should be encouraged

rather than discouraging them. Policymakers can leverage social gatherings to influence a sense of social integration and wellbeing of citizens.

However, mass gatherings also increase the risk of infectious disease transmission and may lead to the globalisation of pathogens, including antibiotic resistant bacteria. For instance, the most common infectious diseases during the Hajj are respiratory diseases, particularly upper respiratory tract infections. For example, up to a third of all pilgrims that embark on the Hajj are reported to experience respiratory symptoms associated with the influenza virus (Balkhy et al., 2004). This has consequently led to influenza infection during the mass pilgrimage to be referred to informally as the Hajj cough.

While the Saudi response to the global COVID-19 pandemic is targeted at safeguarding public health, it has also reduced the country's capacity to hold a large mass-gathering event. Compared to other countries, Saudi Arabia's standing as one of the leading authorities on mass gathering medicine has left the country better prepared to combat a potential coronavirus pandemic. Additionally, as a signatory to WHO's International Health Regulation, the Kingdom has regularly been monitoring and reporting on its pandemic preparedness (Algaissi et al., 2020). The country set up a national committee to prepare for the pandemic more than two months before its first case was reported.

Regrettably while infectious diseases are by far the most prevalent health risks during the Hajj, they are not the only ones. Non-infectious-related health risks occur far less frequently but account for a significantly greater proportion of the mortality

during the annual pilgrimage (Shujaa & Alhamid, 2015). Sadly, much of the mortality and morbidity associated with non-infectious-related risks are in fact avoidable.

The research data has shown a number of unavoidable risks associated with Hajj, ranging from the transmission of virus to the risk of dangerous natural phenomena. The data has also demonstrated the reasons behind the unavoidable risks resulting from mass gathering, such as a low level of education, elderly pilgrims, carelessness among pilgrims, natural phenomena, health risks, the incredibility of vaccination certificates and the non-compliance with health procedures.

6.3 International health frameworks

It is important to realise that the coordination and coalition of experiences of the various mass gatherings organisers on a range of communicable and non-communicable diseases can offer ideal platforms to take the formal discipline of mass-gathering medicine which will help in obtaining a strong evidence base along with updated mass gathering specific and individual guidelines. Here the World Health Organisation has developed the Health Emergency and Disaster Risk Management framework for strengthening preparedness, response and recovery from health emergencies in mass gatherings. The framework presents an all-hazard mass-gathering risk assessment tool that provides a benchmark for monitoring progress made in strengthening capacity over a given period (World Health Organization, 2019).

The WHO framework has also introduced a reputational risk assessment domain aimed at complementing the vulnerability and capacity assessment matrices.

The tool comprises of four key elements: hazard identification and prioritisation, a vulnerability assessment matrix, capacity assessment matrix and reputational risk.

Based on the participants' perceptions of health and safety at the Hajj, four main trends can be extracted regarding the health- and non-health-related risks associated with pilgrimage: infections; natural and hazard risks; leadership follow-up and elderly pilgrims. The participants believed that infections are highly significant arguably due to the spread of infection, cases of poisoning or pilgrims' negligence about safety measures, as well as seasonal flu, infection, chronic diseases and the dengue fever that spread once in Mecca.

Consideration of viral infections is crucial because their spread has disastrous consequences on the health of pilgrims, who may be prevented from getting vaccinations, particularly during the COVID-19 pandemic. The WHO and numerous national health bodies have reported vaccination as the most effective mitigation strategy against seasonal influenza (Alfelali & Rashid, 2014). It may thus be deduced that spreading infectious diseases is considered to be one of the riskiest elements that exist during pilgrimage.

The majority of the participants believe that pilgrimage is unhealthy because of the natural and hazard risks associated with pilgrimage. It is unhealthy because of seasonal flu, infection, chronic diseases and dengue fever that once spread in Mecca. Pilgrims from countries affected by the Zika virus disease or dengue fever have been required to show certification that they have completed disinfection measures (Ministry of Heath, 2018). Meanwhile, poor behaviour on the part of pilgrims, such as the lack

of hygiene and hand-washing, can contribute to health problems. One possible explanation for this might be that poor hand hygiene can encourage bacteria and germs to replicate leading to a greater spread of infection and disease.

Essentially, the Hajj provides multiple avenues for the transmission of diseases, and several airborne infections such as tuberculosis and meningitis have been recorded at the annual mass pilgrimage (Memish et al., 2011). Furthermore, poor hygiene behaviour among some of the pilgrims, coupled with inadequate adherence to recommended preventative measures, facilitates the easy spread of infectious diseases. Although many of these infectious diseases are controllable this finding accords with the policy of the Saudi Ministry of Health (Ministry of Heath, 2018) which takes serious health conditions such as advanced chronic illnesses to be reason to exempt pilgrims from undertaking the Hajj under Islamic law.

What is more, our research participants believed that developing the necessary health and safety plans are highly significant. Here the risks can be summarised as not being vaccinated, the challenges of crowd management, the pilgrims' non-compliance with safety measures and, in transport terms, the lack of overlapping bus routes and the presence of pedestrians entering the bus routes or bus lanes which might lead to accidents. In the first place, providing vaccinations and treatment not only reduces the risks associated with pilgrimage but also guarantees the safety of pilgrims.

One possible explanation of this finding may be due to the fact that the Ministry of Pilgrimage seeks to provide the best for pilgrims by giving them free vaccinations in case if they did not take one before arriving. In further support of this finding,

vaccinations and hygiene standards have indeed been found to be effective in numerous studies (Razavi et al., 2016). It is notable that all the pilgrims arriving in Saudi Arabia have been required to show a valid meningococcal meningitis vaccination certificate. Here the Ministry accepted either the trivalent ACYW135 polysaccharide vaccine or the trivalent ACYW135 conjugate vaccine (Ministry of Heath, 2018).

For both yellow fever and meningococcal meningitis, pilgrims have been required to have received their vaccination shots no more than ten days before travelling to the Kingdom. Equally, pilgrims from countries at a high risk of polio reintroduction have been required to show a poliomyelitis vaccination certificate (Ministry of Heath, 2018). As such, applying appropriate mechanisms and actions has played a crucial role in protecting pilgrims and reflects the fact that the Ministry of Pilgrimage has an emergency plan for confronting the risks that might be manifested in pilgrimage. These measures include providing umbrellas to protecting pilgrims from the heat of the sun along with facing the accidents that happen in the camps, tunnels or vehicles. These are also very important measures to be taken in the event of a power cut or water outage such as stopping the service, while taking precautions during heavy rain to reschedule the time of rituals until it has stopped.

Interestingly, my research findings indicate that the majority of the participants were aware of the risks associated with mass gatherings. This finding could be explained by the commitment by the Ministry of Pilgrimage to educate pilgrims about the risks that exist during pilgrimage before and upon their arrival. In doing so, the pilgrims wanted to have a clear picture of the risks and how they will avoid them, while

their level of awareness is increased. This finding is consistent with those of (Wynberg et al.,2012) who observe that pre-travel health preparation, including seeking education, improves the health outcomes of international travellers.

Furthermore, the awareness programmes provided by the Ministry of Pilgrimage and several other parties are presented in several languages to provide information and the criteria of pilgrimage before the pilgrims' arrival. The level of health education and safety awareness of pilgrims has thus been raised through the use of technological means. As such, the majority of participants believe that the pilgrimage is safe due to the instructions and requirements imposed by the Ministry of Pilgrimage and technological expansion.

The research findings have hence highlighted the importance of pre-travel advice for pilgrims. Having pre-travel advice on preventative health measures can arm pilgrims with useful strategies for preventing any public health problems. The participants believed that the audio-visual media bulletins and awareness teams working to raise the pilgrims' awareness of both health and non-health-related risks were operational during the pilgrimage. Raising the pilgrims' awareness about the non-health related risks has proven significant because being fully aware of the risks can guarantee the pilgrims' safety. The Ministry of Pilgrimage has thus sought to provide the best for pilgrims by applying preventive measures and requirements to raise the pilgrims' awareness in terms of guaranteeing that the pilgrims are vaccinated.

In fact, awareness of other preventative measures targeting infectious respiratory diseases, such as good hygiene and face masks, concerned only 50% of the

respondents who stated that they knew about them at all (Memish et al., 2011). Arguably, Covid-19 immunisations helps protect pilgrims from becoming extremely ill even if they do contract Covid-19 while getting vaccinated may help prevent contraction of the virus by others, particularly those at risk of severe Covid-19 sickness.

It can be inferred that the Ministry of Pilgrimage has channelled all its efforts into informing and educating pilgrims about the health risks that exist during pilgrimage, not only by using technological means but also by raising their awareness before their arrival in order to be fully prepared. Many of these measures have indeed been found to be effective in numerous studies (Razavi et al., 2016), including vaccinations and hygiene standards. Additionally, the Hajj offices that exist in each country have concluded agreements with the Kingdom's Ministry of Pilgrimage to be informed about the risk. Here, to the best of my knowledge, they inform pilgrims in advance about the risks and the precautions with which they should comply in order to safeguard their health.

Furthermore, each authority and ministry has its own policies and strategies in terms of applying important elements of awareness and prevention. For example, the security authorities must deal with crowd control, mobility management, criminal concerns and so on. Each authority has a plan in this regard, while each party is competent to operate with the utmost professionalism. In addition, committees have been created for collective work, which means that if an issue emerges then there will be united group activity. In doing so, the Ministry of Pilgrimage ensures the pilgrims' safety, focused on providing the best services for pilgrims.

Moreover, during and in advance of pilgrimage training is given to health practitioners on common diseases and how to deal with them. Now health practitioners have a clear picture of how to deal with pilgrims in case of their vulnerability to some diseases. The pilgrimage and Umrah services rely heavily on experience, while the repeated experiences of service providers are considered by the Ministry of Pilgrimage to be one of the adopted training methods used during pilgrimage.

Furthermore, instructional and awareness booklets are always issued to employees via e-mail about the need to adhere to official protocols and standards when participating in the pilgrimage and how they should do so. This finding is inconsistent with (Tavan et al., 2019) conclusion that there has been insufficient research on how pilgrims perceive danger in terms of the variables influencing information transmission, and how these aspects eventually impact upon readiness and training. For example, in our research the majority of participants simply believe that the workers in the Ministry of Pilgrimage are trained to protect and serve pilgrims.

Nonetheless, the Saudi authorities have played a critical role in the promotion of health in pilgrimages. Our findings indicate that the current recommendations and guidelines of the Ministry of Health are sufficient to mitigate the health risks in pilgrimage, including sufficient recommendations, a process and diversity among pilgrims. The research participants believe that the current recommendations and guidelines of the Ministry of Health are sufficient for mitigating the health risks associated with performing pilgrimage.

However, this does not inhibit the Ministry of Pilgrimage from extracting value from all their experience, while taking advice from all participating parties and accredited scientific bodies in consultation with experts from the World Health Organisation and the Centre for Disease Prevention. The Ministry of Pilgrimage organises annual participation with this partner organisations by setting up advisory teams that provide technical support and scientific advice to the Ministry of Health. All of these initiatives are considered to be the keen interest of the Ministry of Pilgrimage in complying with the instructions and guidelines for protecting the pilgrimage from the various risks associated with performing pilgrimage.

Moreover, the Ministry of Pilgrimage seeks to improve its own performance by benefitting from all the experiences and participating parties which, in turn, guarantee the safety of pilgrimage. Both the harmony and the organisational processes of the Ministry of Pilgrimage are thus the secret of success. Others claim that that the recommendations imposed by the Ministry of Health should be taken as a process of defining directions and procedures that are imposed. The success of the pilgrimage is thus down to the harmony in which everyone serves the other according to his/her competence, while certainly requiring adherence to the instructions that come from the health sector. If there are instructions from the Ministry of Interior and Public Security regarding traffic, then it is for citizens and pilgrims alike to adhere directly to the procedures and instructions that come from all aspects.

Accordingly, all the instructions for the protection and safety of pilgrims or those concerned with the safety of pilgrims are imposed to be complied with. Here,

host governments essentially play a critical role in ensuring the safety of mass gathering participants. For instance, the Ministry of Pilgrimages ensures that the pilgrims are satisfied with the health services provided for pilgrims in order to identify the challenges that face them and so improving their health services by tackling them. In this respect, (Al Rabeeah et al., 2012) underline that the World Health Assembly of Ministers of Health has lent greater legitimacy to field by adopting it as a formal discipline in 2014.

The priorities given to different measures in the Saudi strategy to manage Hajj safety are summarised in the following points. First, distributing awareness messages and brochures to raise the pilgrims' awareness. Second, implementing and publishing health protocols. Third, raising the nutritional awareness of pilgrims. Fourth, imposing health and safety instructions and increasing the pilgrims' awareness. Fifth, using awareness programmes and sessions to raise the pilgrims' awareness about the instructions of performing pilgrimage and for measuring their satisfaction.

This research has highlighted the need to address the various public health risks associated with mass gatherings. The increasing threat of mass gatherings to global public health has attracted attention from global players. For instance, mass-gathering medicine has become a particularly pertinent topic of discussion in recent years. According to Yezli & Alotaibi (2016), mass-gathering medicine can be defined a field of study within medicine that deals with the public and private health risks and health impact of mass-gathering events. Mass-gathering medicine has been in operation for decades through the delivery of health services at mass gathering events. However, it

was only formalised as a field of study within medicine by the 2010 Jeddah Declaration.

Mass-gathering medicine deals with a wealth of health risks associated with these events. Some of these risks include infectious and non-infectious illnesses, injury, environmentally related illness and illnesses injuries related to deliberate acts (Yezli & Alotaibi, 2016). Given this variety of health risks, mass-gathering medicine is described as being very diverse. Combined with it having only recently emerged as a formal medical discipline, numerous knowledge gaps have emerged in areas requiring further exploration. All that being said, there is a consensus that much of this knowledge can be gained by investigating the large and frequent mass religious gathering, such as the Hajj and the Kumbh Mela events.

According to Atsi-Selmi et al. (2016), disaster risk in mass gatherings events typically form hazards in interaction with individual's existing vulnerabilities, yet much of the current research is concentrated on the transmission of travel-related infectious diseases. Moreover, (Alexander ,2016) highlights that planning pandemics need to consider both the medical and non-medical aspects of health issues, including factors such as the implications of a globalised society and global transportation networks in facilitating the spreading of infection. A significant portion of the research into mass-gathering events has concentrated on global sporting events. Events such as the Olympics and the World Cup not only occur frequently and attract millions of visitors, but they also occur at different locations, thus allowing for the collection of varied insights.

According to the US Centre for Disease Control and Prevention, the assessment of mass gathering events can effectively be done by looking at characteristics related to "location, venue, purpose, size, participants, duration, timing, activities, and capacity" (CDC, 2013). The question of location is crucial as different countries have different levels of infrastructure development, health regulations, climates and security arrangements – all of which may affect the health risks posed to visitors. For example, in the lead up to the 2018 FIFA World Cup in Russia, visitors were advised to have diphtheria vaccinations (European Centre for Disease Prevention and Control, 2018). This proved to be a crucial recommendation considering the location of the event in Russia, which in past years has had numerous incidences of diphtheria (Netesov & Conrad, 2001).

As the current literature continues to expand and its relevance increases, there is a strong need to define the existing gaps in the research and the areas in need of strengthening in order to improve practices associated with the implementation of the SFDRR. There has been a particular need to focus on physical dynamics at mass gatherings and how they influence the spreading of contagious illnesses. In addition, the role played by awareness, training and risk perception in the spreading of these illnesses also needs to be defined.

There are several country-specific religious mass-gathering events that attract pilgrims from other countries. For instance, the Arbaeen pilgrimage or Karbala Walk in Iraq attracts millions of pilgrims from around the Middle East. The event takes place in the Iraqi city of Karbala and poses significant public-health risks. In Senegal, West

Africa, the Grand Magal religious pilgrimage attracts millions of Muslim pilgrims from the country and the surrounding nations. It is the largest religious mass gathering in West Africa. The Grand Magal is also notable for attracting individuals from outside Africa, increasing the potential for globalisation of local endemic infectious diseases. As such, it is important to develop effective strategies for addressing the associated public health challenges. Hence, the Africa CDC has played a critical role in improving coordination and public health capacity building initiatives in partnership with event organisers.

Essentially, mass gatherings provide unique opportunities for cross-continental multidisciplinary collaborations on public health and basic science research. The hope is that this will allow for the development of strong evidence-based strategies for public health planning. Global health experts should share information garnered from various mass gatherings around the globe which will help in the creation of an effective mass-gathering medicine specialist society or formal network to enhance international collaborations on mass-gathering medicine.

It is also crucial to carry out surveillance of any antibiotic-resistant bacteria in order to prevent the globalisation of such pathogens. Here evidence-based strategies have been utilised for combating public health issues at mass gatherings. For instance, the World Health Organisation has developed the Health Emergency and Disaster Risk Management framework for strengthening preparedness, response and recovery from health emergencies in mass gatherings. The framework presents an all-hazard mass-

gathering risk assessment tool that provides a benchmark for monitoring progress made in capacity strengthening over a given period.

The framework also introduces a reputational risk assessment domain aimed at complementing the vulnerability and capacity assessment matrices. This tool comprises of four key elements: hazard identification and prioritisation; vulnerability assessment matrix; capacity assessment matrix; and reputational risk.

The Health Emergency and Disaster Risk Management framework should be utilised in tackling specific public health risks from mass gatherings. Basically, the framework categorises hazards into four groups alongside their potential data sources. These include endemic diseases, current local or international disease outbreaks, historical data from similar events and threats arising from changing hazard characteristics. The classification allows for the identification of the greatest potential hazards for prioritisation. This prioritisation scores for all the identified hazards which are then assessed and those with the highest scores selected for further assessment. The number of selected hazards included in the risk assessment framework is a trade-off between the availability of risk assessment resources, including the time and the risk management objectives of the various mass gatherings.

The vulnerability assessment matrix is another important element of the Health Emergency and Disaster Risk Management framework. Essentially, vulnerability refers to the individual circumstances of people that make them susceptible to the damaging effects of a hazard. The initial step in the vulnerability assessment is to develop a set of scientifically-based indicators from hazard and population

characteristics and the predisposing factors. Two distinct standardised indicators incorporate hazard magnitude and vulnerability which can then be developed to address infectious hazards and non-infectious hazards. With regard to infectious hazards, several indicator areas should be considered while dealing with infectious diseases.

According to Hoang et al. (2019), respiratory tract infections are the primary reason behind the infectious diseases in pilgrims to a percentage of 50–93%. The various indicators in operation here include case fatality rate, endemicity and severe illness ratio, route of transmission, vulnerable population, vaccine effectiveness and effective treatment. On the other hand, non-infectious hazard vulnerability indicators include the morbidity rate, complications, mortality rate, vulnerable population, types of risk factors, and prevalence of risk factors.

The corresponding risk areas are defined and ranked in order of increasing vulnerability. Each indicator is assigned a weight which is ranked quantitatively from one to five. The weight score is then obtained from the product of the indicator score and the weight.

The capacity assessment matrix involves the evaluation of the strengths, attributes and resources available within a community which can be harnessed to minimise the adverse effects of hazards. These capacity indicators include governance, infection prevention and control, risk communication, surveillance of diseases, rapid response team, laboratory capacity and case management. The main indicator areas for non-communicable diseases are the following: screening for chronic diseases; core healthcare workers density and access to health services; in-patient bed density; referral

system; and health promotion. With regard to the external causes of morbidity and mortality, the relevant indicator areas include incident command and coordination, pre-hospital triage management, communication and emergency response time. It is crucial to estimate the risk of each hazard in order to develop the most effective public health intervention strategies.

It is important to note that mass gatherings provide unique opportunities for cross-continental multidisciplinary collaborations on public health and basic science research (Aitsa-Selmi et al., 2016). These collaborations will allow for the development of strong evidence-based strategies for public health planning. Global health experts should hence share information from various mass gatherings around the globe. This will help in the creation of effective mass-gathering medicine specialist society or formal networks that will enhance international collaborations on mass-gathering medicine.

Cross-continental multidisciplinary research and training thus presents are multiple needs and opportunities. For instance, there is need for the development of a stronger evidence base for public health planning and health services for mass gatherings. It is crucial to acknowledge that the coordination and coalition of experience from the organisers of mass gatherings on a range of communicable and non-communicable diseases can offer an ideal platform to take forward the formal discipline of mass gathering medicine through a strong evidence base along with specific and individual mass gathering guidelines. The World Health Organisation has hence developed the Health Emergency and Disaster Risk Management framework for

strengthening preparedness, response and recovery from health emergencies in mass gatherings (WHO, 2019).

6.4 Research achievements and challenges

Undertaking this research at the Hajj was a highly engaging and rewarding experience. The Hajj pilgrimage only occurs over a five-day period in which pilgrims follow a strict schedule for religious rituals. The study had to be conducted with consideration for this significant time constraint. While this creates a several challenges, the research still presented significant achievements.

All in all, the research was a successful endeavour. The successful completion of the study could only be facilitated with cooperation from Saudi government officials. They were fully willing to issue a research permit and provide a list of travel agencies involved in the pilgrimage. Equally, the travel agencies were cooperative in connecting the researcher will pilgrims.

Arguably the greatest challenge facing this research was the time constraint. The study needed to be undertaken before pilgrims commenced the pilgrimage which only left a small window of time to find participants and issue the survey questionnaire. As such, some crucial processes may have been overlooked during the study. What is more, undertaking the research required constant interaction with government officials, travel agencies and pilgrims. This endeavour was not only time consuming, but also exhausting owing to the numerous bureaucracies involved.

Strengths:

1. Comprehensive literature review: The study includes a comprehensive literature review that provides a thorough overview of the existing research on health risks during the Hajj pilgrimage. This allows the author to contextualize their study within the broader literature and identify gaps in the existing research.

2. Mixed-methods approach: The study uses a mixed-methods approach that combines both quantitative and qualitative data collection methods. This allows the author to gather a more complete understanding of the awareness of health risks during the Hajj pilgrimage.

3. Practical implications: The study has practical implications for public health officials and policymakers who are responsible for managing health risks during the Hajj pilgrimage. The findings of the study can be used to inform the development of interventions and policies aimed at reducing health risks during the pilgrimage.

Limitations:

1. Limited sample size: The study has a relatively small sample size, which may limit the generalizability of the findings. The sample consists of only 280 participants, which may not be representative of the larger population of Hajj pilgrims.

2. Self-reported data: The study relies on self-reported data, which may be subject to bias and inaccuracies. Participants may not accurately recall or report their awareness of health risks during the Hajj pilgrimage.

3. Limited scope: The study focuses specifically on the awareness of health risks during the Hajj pilgrimage in Saudi Arabia. The findings may not be applicable to other religious mass gathering events or other contexts outside of Saudi Arabia.

6.5 Future recommendations

In the lights of the study findings, our research makes the following recommendations:

1. The study recommends Saudi authorities face the health risks of mass gathering by monitoring them annually and developing the necessary plans to avoid them. Such plans can be summarised in the following points:

- Pre-assessment of risks.
- Developing plans to deal with any source of risk.
- Defining tasks for the concerned authorities to deal with any potential risks.
- Raising the level of readiness of the concerned authorities and providing all the equipment and supplies to deal with any potential risk.
- Raising the awareness of pilgrims and those who serve them to reduce sources of danger.
- Ensuring the implementation of the preventive requirements before the arrival of the pilgrims in terms of taking vaccinations.
- Ensuring compliance with security and safety requirements at the residences of pilgrims.
- Developing a crowd management plan.

- Ensuring compliance with appropriate requirements for catering kitchens for pilgrims and familiarising catering workers with the proper handling of foodstuffs and health centres.
- The Ministry of Pilgrimage has presented plans that depend primarily on achieving the safety and security of pilgrims from any emerging risks in coordination with the Civil Defence with service providers.

2. Taking bank guarantees from service providers in the event of deficiencies, where mechanisms and actions will correct the conditions in the event of a malfunction. To elaborate, banks guarantee the work to reduce or change the impact that the management will fail. In this respect, (Alfiyanti et al., 2019) underline the existence of Hajj fund management policies for religious protection, including the establishment of a fair and transparent haj allotment, the construction of pilgrimage infrastructure, and the enforcement of terms and conditions, as well as providing and funding Hajj monitors, improving catering, lodging, transportation and health services, and providing congregational data to the Ministry of Health. These have are all proven ways to save lives.

3. The study recommends that the Saudi authorities review the mechanisms, strategies and recommendations annually and periodically. In fact, pilgrims are aware of health risks, but they do not comply with the preventive measures; therefore, improving

inclusive public health campaign is essential for the pilgrims' safety (Almehmadi et al., 2021).

4. Meetings are recommended with the many international representatives who are responsible for the pilgrimage missions in their countries. The outcomes of such meetings can be used in the process of future governmental development plans.

5. It would also be advisable for the Ministry of Pilgrimage to adhere to the instructions emanating from the health sector.

6. Our study also recommends improving the health safety of pilgrims by providing vaccinations and treatments free of charge to citizens and residents in the Kingdom of Saudi Arabia in order to prevent the spread of any epidemics. The Ministry of Hajj should guarantee that the vaccination certificates are not falsified.

7. Raising the level of awareness among pilgrims from the country of origin by using different means such as technology, magazines, brochures and training sessions. In this context (Hassan et al., 2022) point out that the *Eatmarna* application is beneficial in presenting a safe environment for pilgrims, which was identified by the usability of app, which has facilitated the improvement of the Umrah experience.

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Appendices

APPENDIX A: Questionnaires (seven languages)

The questionnaire (English Version)

Questionnaires

Note: participants are free to withdraw from the study at any time of their wanting. Additionality, you are assured of complete anonymity even after completing the following survey questionnaire.

Nationality:_____ Age: _____ Gender: M - F Date: _____ _____

Intended duration of stay in Mecca_____

Number of times you have embarked on the Hajj_____

Level of education (Tick the appropriate answer):

a) Did not attend high school
b) High school diploma
c) Undergraduate
d) Postgraduat

Tick the option (s) you feel is appropriate for each the following questions

a) Do you consider the Hajj safe?

- Yes
- No

b) How do the following factors influence public health safety at the Hajj?

	Strongly undermine	Undermine	Neutral	Support	Strongly support
Hajj climate					
Overcrowding					
Diversity of pilgrim population					
Poor preparation by public health officials					
Pilgrim recklessness					

c) Have you sought pre-travel health advice before embarking on the Hajj?

- Yes
- No

d) If you have sought pre-travel health advice, please indicate the source(s) used

- From the Saudi Ministry of Health Website
- From another government or international organization source
- From the travel agent
- From a medical professional
- From another pilgrim
- From family and friends

e) How would you describe your pre-travel advice seeking experience?

- Positive (helpful)
- Negative (not helpful)

f) Tick on the recommended preventative health measures that you have adopted

- Yellow Fever vaccine (for pilgrims from high-risk areas)
- Polio vaccine (for pilgrims from high-risk areas)
- Meningitis vaccine
- Influenza vaccine
- Face mask
- Handwashing with soap or disinfectant

g) **Tick on the preventative measures you believe to be effective and leave those that you do not believe to be effective unticked**
   - Yellow Fever vaccine (for pilgrims from high-risk areas)
   - Polio vaccine (for pilgrims from high-risk areas)
   - Meningitis vaccine
   - Influenza vaccine
   - Face mask
   - Handwashing with soap or disinfectant

h) **Do you think there is a risk of a global infectious disease outbreak starting at the Hajj?**
   - Yes
   - No

i) **Do you think the weather at Hajj poses a risk to your health?**
   - Yes (if yes, how so?)
   - No

I) **Are you satisfied with the current enforcement level of the preventative health measures at the Hajj?**
   - Yes
   - No (if no, what would you like to see change?)

The questionnaire (Malay Version)

Soal Selidik Survei Pendahuluan

Warganegara: _____ **Umur:** _____

Jantina: (lelaki- perempuan) **Tarikh:** _____

Tempoh penginapan yang dijangka di Mekah: _____

Bilangan kali anda telah memulakan Haji: _____

Tahap pendidikan (Tandakan jawapan yang sesuai):
a) Tidak menghadiri sekolah menengah

b) Diploma sekolah tinggi
c) Sarjana
d) pascasiswazah

Tandakan pilihan yang anda rasa sesuai untuk setiap soalan berikut

a) Adakah anda menganggap haji selamat?
• Ya
• Tidak

b) Bagaimanakah faktor berikut mempengaruhi keselamatan kesihatan awam di haji?

	Sangat lemah	Melemahkan	Neutral	Sokongan	Sangat menyokong
Iklim haji	○	○	○	○	○
Kesesakan	○	○	○	○	○
Kepelbagaian penduduk jemaah	○	○	○	○	○
Persediaan sukar oleh pegawai kesihatan awam	○	○	○	○	○
Kecuaian peziarah	○	○	○	○	○

c) Pernahkah anda meminta nasihat kesihatan pra-perjalanan sebelum memulakan Haji?
• Ya
• Tidak

d) Jika anda telah meminta nasihat kesihatan pra-perjalanan, sila nyatakan sumber yang digunakan
• Dari Laman Web Kementerian Kesihatan Saudi
• Dari sumber organisasi atau antarabangsa yang lain
• Daripada ejen perjalanan
• Dari seorang profesional perubatan
• Dari peziarah lain
• Dari keluarga dan rakan-rakan

e) Bagaimana anda menerangkan pengalaman mencari nasihat pra-perjalanan anda?
• Positif (membantu)
• Negatif (tidak berguna)

f) Tandakan langkah-langkah kesihatan pencegahan yang disyorkan yang telah anda terima
• Vaksin Yellow Fever (untuk jemaah dari kawasan berisiko tinggi)
• Vaksin polio (untuk jemaah dari kawasan berisiko tinggi)
• vaksin meningitis
• Vaksin influenza
• Masker muka
• Mencuci tangan dengan sabun atau pembasmi kuman

g) Tandakan langkah-langkah pencegahan yang anda percayai menjadi berkesan dan biarkan orang-orang yang tidak percaya menjadi tidak berjaya
• Vaksin Yellow Fever (untuk jemaah dari kawasan berisiko tinggi)
• Vaksin polio (untuk jemaah dari kawasan berisiko tinggi)
• vaksin meningitis
• Vaksin influenza
• Masker muka
• Mencuci tangan dengan sabun atau pembasmi kuman

h) Adakah anda fikir terdapat risiko penyakit berjangkit global yang bermula pada haji?
• Ya
• Tidak

Adakah anda fikir cuaca pada musim haji menimbulkan risiko kepada kesihatan anda?
• Ya (jika ya, bagaimanakah?)
• Tidak

Adakah anda berpuas hati dengan tahap penguatkuasaan semasa langkah pencegahan pada musim Haji?

• Ya

• Tidak (jika tidak, apa yang anda ingin melihat perubahan?)

3. The questionnaire (Urdu Version)

ابتدائی سروے سوالنامہ۔

قومیت: _____

عمر:_____

صنف _____

تاریخ:_____

مکہ مکرمہ میں قیام کی عمدہ مدت۔_____ **آپ نے حج کا آغاز کتنی بار کیا ہے۔**_____

تعلیم کی سطح (مناسب جواب پر نشان لگائیں)

- ہائی اسکول نہیں پڑھا۔
- ہائی اسکول ڈپلوما۔
- انڈرگریجویٹ۔
- پوسٹ گریجویٹ۔

_____

مندرجہ ذیل ہر سوال کے آپ کے اختیارات (انتخاب) کو مناسب محسوس کریں۔

۱) کیا آپ حج کو محفوظ سمجھتے ہیں؟

- جی ہاں
- نہیں

۲) حج میں صحت عامہ کی حفاظت کو درج ذیل عوامل کس طرح متاثر کرتے ہیں؟

	سختی سے متفق نہیں۔	متفق نہیں۔	غیر جانبدار۔	میں اتفاق کرتا ہوں	پوری طرح سے اتفاق کرتا ہوں۔
حج کی آب و ہوا۔	○	○	○	○	○
ہجوم	○	○	○	○	○
لوگوں کی تفریق	○	○	○	○	○
صحت عامہ کے عہدیداروں کی ناقص تیاری۔	○	○	○	○	○
حجاج کرام کی لاپرواہی	○	○	○	○	○

۳) کیا آپ نے حج سے پہلے سفر سے پہلے صحت سے متعلق مشورے طلب کیے ہیں؟

- جی ہاں
- •نہیں

٤) اگر آپ نے سفر سے پہلے صحت سے متعلق مشورے طلب کیے ہیں تو ، براہ کرم استعمال شدہ ماخذ (اشارے) کی نشاندہی کریں۔

- سعودی وزارت صحت کی ویب سائٹ سے۔
- کسی اور حکومت یا بین الاقوامی تنظیم کے ذریعہ سے۔
- ٹریول ایجنٹ سے۔
- طبی پیشہ ور سے۔
- دوسرے حاجی سے۔
- کنبہ اور دوستوں سے۔

٥) آپ اپنے تجربہ سے پہلے کے مشورے کو کس طرح بیان کریں گے؟

- مثبت (مددگار)
- منفی (مددگار نہیں)

٦) صحت سے متعلق حفاظتی تدابیر کا استعمال کریں جو آپ نے اختیار کیے ہیں۔

- پیلے بخار کی ویکسین (اعلی خطرہ والے حجاج کرام کے لئے)

- پولیو ویکسین (اعلی خطرہ والے حجاج کے لئے)
- میننجائٹس کی ویکسین۔
- انفلوئنزا ویکسین۔
- چہرے کا نقاب
- صابن یا جراثیم کشی سے ہینڈ واشنگ

۷) ان احتیاطی تدابیر پر گامزن ہوجائیں جن کے بارے میں آپ کو یقین ہے کہ وہ کارآمد ثابت ہوگا اور ان لوگوں کو چھوڑ دیں جن کے بارے میں آپ کو یقین نہیں ہے کہ وہ غیر موثر ہیں۔

- پیلے بخار کی ویکسین (اعلی خطرہ والے حجاج کرام کے لئے)
- پولیو ویکسین (اعلی خطرہ والے حجاج کے لئے)
- میننجائٹس کی ویکسین۔
- انفلوئنزا ویکسین۔
- چہرے کا نقاب
- صابن یا جراثیم کشی سے ہینڈ واشنگ

۸) کیا آپ کے خیال میں حج سے شروع ہونے والے عالمی متعدی بیماری کا خطرہ ہے؟

- جی ہاں
- نہیں

۹) کیا آپ کے خیال میں حج کا موسم آپ کی صحت کے لئے خطرہ ہے؟

- ہاں (اگر ہاں ، تو کیسے؟)
- نہیں

۱۰) کیا آپ حج پر روک تھام کرنے والے حفاظتی اقدامات کے موجودہ نفاذ کی سطح سے مطمئن ہیں؟

- جی ہاں
- نہیں (اگر نہیں تو ، آپ کیا تبدیلی دیکھنا چاہیں گے؟)

4. The questionnaire (Indonesia Version)

Kuisioner Survei Pendahuluan

Kebangsaan: _____ Usia: _____

Jenis Kelamin: _____ Tanggal: _____

Berapa lama tinggal di Mekkah: _____

Berapa kali Anda memulai haji: _____

Tingkat pendidikan (Centang jawaban yang sesuai):
a) Sekolah Dasar
b) SLTP
c) Sarjana
d) Pascasarjana

_____

Centang opsi yang menurut Anda sesuai untuk masing-masing pertanyaan berikut:

a) Apakah Anda menganggap haji aman?
- Aman
- Tidak

Bagaimana faktor-faktor berikut mempengaruhi keselamatan kesehatan masyarakat di Ibadah Haji?

	Sangat tidak setuju	Tidak setuju	Netral	Saya setuju	Sangat setuju
Iklim haji	○	○	○	○	○
Kerumunan	○	○	○	○	○
Keragaman peziarah	○	○	○	○	○

Persiapan yang buruk oleh pejabat kesehatan masyarakat	○	○	○	○	○
Ketidakpedulian para peziarah	○	○	○	○	○

b) Apakah Anda sudah mencari nasehat kesehatan sebelum bepergian sebelum berangkat haji?

- Iya
- Tidak

c) Jika Anda telah mencari saran kesehatan sebelum bepergian, harap tunjukkan sumber yang digunakan

• Dari Situs Web Kementerian Kesehatan Saudi
• Dari sumber pemerintah atau organisasi internasional lain
• Dari agen perjalanan
• Dari seorang profesional medis
• Dari peziarah lain
• Dari keluarga dan teman

d) Bagaimana Anda menggambarkan pengalaman mencari saran sebelum perjalanan?

• Positif (membantu)
• Negatif (tidak membantu)

e) Centang pada tindakan pencegahan kesehatan yang direkomendasikan yang telah Anda adopsi

• Vaksin Yellow Fever (untuk peziarah dari daerah berisiko tinggi)
• Vaksin polio (untuk peziarah dari daerah berisiko tinggi)
• Vaksin meningitis
•Vaksin flu
•masker
• Mencuci tangan dengan sabun atau disinfektan

f) Centang pada tindakan pencegahan yang Anda yakini efektif dan biarkan yang Anda yakini tidak efektif

• Vaksin Yellow Fever (untuk peziarah dari daerah berisiko tinggi)
• Vaksin polio (untuk peziarah dari daerah berisiko tinggi)
• Vaksin meningitis
•Vaksin flu
•Topeng wajah
• Mencuci tangan dengan sabun atau disinfektan

g) Apakah Anda pikir ada risiko wabah penyakit menular global mulai dari ibadah haji?

- Iya
- Tidak

h) Apakah Anda pikir cuaca di Haji menimbulkan risiko bagi kesehatan Anda?
• Ya (jika ya, bagaimana bisa?)
• Tidak

I) Apakah Anda puas dengan pemberian informasi kesehatan selama musim Haji?
• Iya
• Tidak (jika tidak, apa yang ingin Anda lihat berubah?)

5. The questionnaire (Turkish Version)

Ön Anket Anketi

Uyruğu: **Yaş:**
Cinsiyet: erkek- kadın **Tarih:**
Mekke'de konaklama süresi **Kaç kez**
Hac'a gittin:

Eğitim seviyesi (Uygun cevabı işaretleyiniz):

a) Liseye devam etmedi
b) Lise diploması
c) Lisans
d) Lisansüstü çalışmaları-

_____

Aşağıdaki sorulardan her biri için uygun olduğunu düşündüğünüz seçenekleri işaretleyin:

1) Hacın güvenli olduğunu düşünüyor musunuz?
•Evet
•Yok hayır

2)Aşağıdaki faktörler Hac'da halk sağlığı güvenliğini nasıl etkiliyor?

	Kesinlikle katılmıyorum	Katılmıyorum	nötr	Katılıyorum	Şiddetle destek
Hac iklimi	○	○	○	○	○
aşırı nüfus yoğunluğu	○	○	○	○	○
Hacı nüfusun çeşitliliği	○	○	○	○	○
Halk sağlığı görevlileri tarafından yapılan zayıf hazırlık	○	○	○	○	○
Hacı umursamazlık	○	○	○	○	○

3) Hac'a başlamadan önce seyahat öncesi sağlık tavsiyesi istediniz mi?
•Evet
•Yok hayır

4) Seyahat öncesi sağlık danışmanlığı istediyseniz, lütfen kullanılan kaynakları belirtiniz
• Suudi Sağlık Bakanlığı İnternet Sitesinden

• Başka bir hükümet veya uluslararası kuruluş kaynağından
• Seyahat acentesinden
• Bir tıp uzmanından
• Başka bir hacıdan
• Aileden ve arkadaşlardan

5) Seyahat öncesi tavsiyede bulunma deneyiminizi nasıl tarif edersiniz?
• Olumlu (yardımcı)
• Olumsuz (yardımcı değil)

6) Kabul ettiğin önleyici sağlık önlemlerini seç.
• Sarı humma aşısı (yüksek riskli bölgelerden gelen hacılar için)
• Çocuk felci aşısı (yüksek riskli bölgelerden gelen hacılar için)
• Menenjit aşısı
•Grip aşısı
•Yüz maskesi
• Sabun veya dezenfektan ile el yıkama

7) Etkili olduğuna inandığınız önleyici önlemleri işaretleyin ve etkili olduğuna inanmadığınız önlemleri
• Sarı humma aşısı (yüksek riskli bölgelerden gelen hacılar için)
• Çocuk felci aşısı (yüksek riskli bölgelerden gelen hacılar için)
• Menenjit aşısı
•Grip aşısı
•Yüz maskesi
• Sabun veya dezenfektan ile el yıkama

8) Hac'dan başlayarak küresel bulaşıcı hastalık salgını riski olduğunu düşünüyor musunuz?
•Evet
•Yok hayır

9) Hac'daki havanın sağlığınız için bir risk oluşturduğunu düşünüyor musunuz?
• Evet (evet ise nasıl?)
•Yok hayır

10) Hac'daki koruyucu sağlık önlemlerinin mevcut uygulama seviyesinden memnun musunuz?
•Evet
• Hayır (eğer hayırsa, değişimi görmek ister misiniz?)

6. The questionnaire (Persian Version)

پرسشنامه بررسی مقدماتی

ملیت: **سن:**

جنس: **تاریخ:**

چه مدت در مکه اقامت داشتید: **چند بار حج را شروع کرده اید؟**

سطح تحصیلات (دور جواب مناسب):
الف) به دبیرستان نرفت
ب) گواهینامه دبیرستان
ج) کارشناسی
د) تحصیلات تکمیلی

گزینه ای را انتخاب کنید که احساس می کنید برای کلیه سؤالات زیر مناسب است

1) آیا حج امن است؟
- بله واقعاً
- نه

2) **عوامل زیر در ایمنی بهداشت عمومی در حج چه تاثیری دارد؟**

	به شدت مخالفم	مخالفم	خنثی	موافقم	شدیدا موافقم
آب و هوای حاج	○	○	○	○	○
پر ازدحام	○	○	○	○	○
تنوع زائران	○	○	○	○	○
آماده سازی ضعیف توسط مقامات بهداشت عمومی	○	○	○	○	○
بی تفاوتی زائر	○	○	○	○	○

3) آیا قبل از سفر به حج مشورت ، آیا به دنبال توصیه های بهداشتی بوده اید؟

- بله واقعاً
- نه

4) اگر قبل از مسافرت به مشاوره درمانی نیاز دارید ، لطفاً منبع (های) مورد استفاده را ذکر کنید

- از وب سایت وزارت بهداشت عربستان سعودی
- از یک منبع دولتی یا بین المللی دیگر
- از نمایندگی سفر
- از یک پزشک حرفه ای
- یک زائر دیگر
- از خانواده و دوستان

5) تجربه مشاوره قبل از سفر را چگونه توصیف می کنید؟

- مثبت (مفید(
- منفی (غیر مفید(

6) اقدامات بهداشتی پیشگیرانه توصیه شده اتخاذ شده توسط:

- واکسن تب زرد (برای زائران مناطق پرخطر(
- واکسن فلج اطفال (برای زائران مناطق پرخطر(
- واکسن مننژیت
- واکسن آنفولانزا
- ماسک صورت
- دست ها را با صابون یا پاک کننده بشویید

7) اقدامات پیشگیرانه ای را که معتقدم مؤثر است ، علامت گذاری کنید و آن دسته از اقدامات را که معتقد نیست بدون دخالت مؤثر است ، بگذارید

- واکسن تب زرد (برای زائران مناطق پرخطر)
- واکسن فلج اطفال (برای زائران مناطق پرخطر)
- واکسن مننژیت
- واکسن آنفولانزا
- ماسک صورت
- دست ها را با صابون یا پاک کننده بشویید

8) به نظر شما خطر ابتلا به بیماریهای عفونی جهانی که از حج شروع می شوند وجود دارد؟

- بله واقعاً
- نه

9) فکر می کنید هوای حج برای سلامتی شما خطرناک است؟

- بله (اگر بله ، چگونه؟(

- نه

10) آیا از سطح فعلی اعمال اقدامات پیشگیرانه بهداشتی در حج رضایت دارید؟

- بله واقعاً
- نه (اگر نه ، چه چیزی را می خواهید تغییر ببینید؟)

7. The questionnaire (Arabic Version)

استبيان المسح الأولي

ملاحظة: يحق للمشاركين الانسحاب من الدراسة في أي وقت يريدونه. بالإضافة إلى ذلك، ثق تماما انه لن يكشف عن هويتك الكاملة حتى بعد الانتهاء من الاستبيان التالي.

الجنسية _____ **العمر:** ____

الجـــــــنس: ذكـــــــر - انثـــــــى التـــــــاريخ: _____

كم مدة الإقامة في مكة المكرمة: _____

عدد المرات التي شرعت فيها للحج: _____

مستوى التعليم (ضع علامة دائرة على الإجابة المناسبة):

أ) المرحلة ما قبل الثانوية
ب) المرحلة الثانوية
ج) المرحلة الجامعية
د) الدراسات العليا

حدد الخيار (الخيارات) التي تشعر أنها مناسبة لكل الأسئلة التالية

١) هل تعتبر الحج آمنا؟

- نعم فعلا

- لا

٢) كيف تؤثر العوامل التالية على سلامة الصحة العامة في الحج؟

	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
مناخ الحج	○	○	○	○	○
الازدحام	○	○	○	○	○
تنوع الحجاج	○	○	○	○	○
سوء الإعداد من قبل مسؤولي الصحة العامة	○	○	○	○	○
عدم المبالاة من الحاج	○	○	○	○	○

٣) هل طلبت المشورة الصحية قبل السفر أو قبل الشروع في الحج؟

- نعم فعلا
- لا

٤) إذا طلبت نصيحة صحية قبل السفر، يرجى الإشارة إلى المصدر (المصادر) المستخدمة:

- من موقع وزارة الصحة السعودية
- من مصدر حكومي أو دولي آخر
- من وكيل السفر
- من طبيب محترف
- من حاج آخر
- من العائلة والأصدقاء

٥) كيف تصف تجربة الحصول على المشورة قبل السفر؟

- إيجابي (مفيد)
- سلبي (غير مفيد)

٦) ضع علامة على التدابير الصحية الوقائية الموصي بها التي اعتمدتها:

- لقاح الحمى الصفراء (للحجاج من المناطق الشديدة الخطورة)
- لقاح شلل الأطفال (للحجاج من المناطق الشديدة الخطورة)
- لقاح التهاب السحايا
- لقاح ضد الانفلونزا

- قناع الوجه
- غسل اليدين بالصابون أو المطهر

٧) ضع علامة على التدابير الوقائية التي تعتقد أنها فعالة واترك تلك التدابير التي لا تعتقد أنها فعالة من دون تدخل:

- لقاح الحمى الصفراء (للحجاج من المناطق الشديدة الخطورة)
- لقاح شلل الأطفال (للحجاج من المناطق الشديدة الخطورة)
- لقاح التهاب السحايا
- لقاح ضد الانفلونزا
- قناع الوجه
- غسل اليدين بالصابون أو المطهر

٨) هل تعتقد أن هناك خطرًا لحدوث تفشي عالمي للأمراض المعدية يبدأ من الحج؟

- نعم فعلا
- لا

٩) هل تعتقد أن الطقس في الحج يشكل خطرا على صحتك؟

- نعم (إذا كان الجواب نعم، كيف ذلك؟)
- لا

١٠) هل أنت راضي عن مستوى التطبيق الحالي للتدابير الصحية الوقائية في الحج؟

- نعم فعلا
- لا (إذا كان الجواب بالنفي، فما الذي تود أن ترى في التغيير؟)

APPENDIX B: KSA ETHICAL APPROVAL

Institutional Review Board Opinion Letter

Date of Issue	**07.02.2021**
Research Title	**INVESTIGATING HEALTH RISK AWARENESS AND PERCEPTIONS IN MASS GATHERING AMONG HAJJ OFFICIALS: A CASE STUDY FROM SAUDI ARABIA**
Primary Investigator	**Mater Almehmadi**
IRB Number:	**H-02-K-076-0121-453**
Category of Approval	**Approved (Expedited)**

Dear / Mater,

This is to inform you that the above-mentioned proposal has been reviewed and discussed by IRB Committee and was approved according to ICH GCP guidelines. Please note that this letter is from research perspective only. You will still need to get permission from the head of research department in the Directorate of health affairs, Makkah Region to commence data collection and start your project.

We wish you all the best in your project and request you to keep the IRB informed of the progress on a regular basis, using the IRB log number shown in this letter.

Please be advised that regulations require that you submit a progress report on your research every 6 months. You are also required to submit any manuscript resulting from this research for approval by IRB before submission to journals for publication.

As a researcher, you are required to have a valid certification on protecting human research subject.
If you have further questions, feel free to contact me:

(research-makkah@moh.gov.sa).

[redacted]

وزارة الصحة
Ministry of Health

إقرار بالموافقة المستنيرة علي المشاركة في بحث علمي
الحد الأدنى من المخاطر
Minimal Risk Informed Consent Template

Protocol Number:	..... N/A.....	رقم البحث العلمي
Name of Subject:	..... N/A.....	اسم المشارك
Medical Record Number:	..... N/A.....	رقم السجل الطبي
Study Title:		عنوان البحث العلمي
investigating health risk awareness and perceptions in mass gathering among Hajj pilgrims: a case study from Saudi Arabia.		التحقيق في الوعي بالمخاطر الصحية والتصورات في التجمعات الجماهيرية بين الحجاج: دراسة حالة من المملكة العربية السعودية.
Principal Investigator:		الباحث الرئيس
Mater Almehmadi		ماطر بن مطر المحمادي
Address:		العنوان
Institute for Risk and Disaster Reduction (IRDR) University College London (UCL) London, WC1E 6BT, UK Mobile: +44(0)2076793157 (internal 33157)		Institute for Risk and Disaster Reduction (IRDR) University College London (UCL) London, WC1E 6BT, UK Mobile: +44(0)2076793157 (internal 33157)
Telephone: **0509634303**		رقم الهاتف: ٠٥٠٩٦٣٤٣٠٣

1- Why Is This Study Being Done?

There are a number of reasons for doing this study. First, the lack of a qualitative and quantitative study of the topic. Second, there is no study in the Kingdom that studied risk awareness of internal and external Hajj pilgrims. There is no study that measures the awareness and

1.ما سبب القيام بهذا البحث العلمي ؟

هناك عدد من الأسباب المتعلقة لقيامي بهذه الدراسة. أولها، عدم وجود دراسة الموضوع بطريقة نوعية وكمية. ثانياً، لا توجد دراسة في المملكة درست حجاج الداخل والخارج. ولاتوجد دراسة تقيس إدراك ووعي الحجاج بالمخاطر التي يتعرضون لها بالحج.

awareness of pilgrims of the risks to which they are exposed to Hajj.

2. How Many People Will Take Part in This Study?
15-35

.2 كم عدد الأشخاص المفترض مشاركتهم في هذا البحث العلمي؟
٣٠-٥٠ شخص

3- What is involved in the Study?

Interview and discussion

.3 ماذا يتضمن هذا البحث العلمي؟
مقابلات ومناقشات على مستوى فردي

4- Study location:

Within the Ministry of Health

.4 موقع إجراء هذا البحث العلمي:
ستكون المقابلة بوزارة الصحة والمشاركين للموسم الحج

5- What is Expected of Me During the Study?

It is expected from you to answer the interviewer questions and engage in the discussion.

.5 ما المطلوب مني خلال هذا البحث العلمي؟
المطلوب ان تقوم بالجواب على الأسئلة الملقاة على حضرتك خلال فترة المقابلة ومشاركة الباحثين برائيك.

6- How Long Will I Be in This Study?
45 to 60 minutes

.6 كم مدة مشاركتي في هذا البحث العلمي؟
مدة المشاركة من ٤٥ الى ٦٠ دقيقة

7- Can I Stop Being in This Study?

You can decide to stop at any time. Taking part is purely voluntary.

.7 هل يمكنني إنهاء المشاركة في هذا البحث العلمي؟
المشاركة طوعيه محضة ويمكنك أن تنهيها في أي وقت تشاء.

8- What are the Benefits of This Study?

.8 ما هي فوائد هذا البحث العلمي؟

There will be no direct benefit to you from taking part in this study. Study results may be useful to the hajj pilgrims in the future.

لن تكون هناك أي فائدة مباشرة لك من المشاركة في هذا البحث العلمي. نتائج هذا البحث قد تكون مفيدة للحجاج في المستقبل.

9- What are the Risks of This Study?

There is low risks to participants in this research. If any question cause the participants to become uncomfortable, the researcher will react appropriately by postpone or terminate the interview immediately. This is unlikely, however, given the topic of this research.

9. ما هي المخاطر المتوقعة من المشاركة في هذا البحث العلمي؟

لا توجد أي مخاطر متعلقة بهذه الدراسة بسبب نوعية وطبيعة الدراسة. اذا تعرضت لضيقة او تعب خلال وقت المقابلة سيتم إيقاف وتأجيل المقابلة لوقن اخر

10- What if I am Injured Because I Took Part in This Study?

If you are injured as a result of being in this study, treatment will be provided by Ministry of Health at no cost to you.

10- ماذا سيحدث إذا أصابني ضرر جراء المشاركة هذا البحث العلمي؟

إذا حدث أن أصبت بضرر نتيجة مشاركتك في هذا البحث العلمي، ستقدم لك مستشفى وزارة الصحة للعلاج دون أي تكلفة لك.

11- What are the Costs of This Study?

There are no costs to you if you take part in this study.

11- وما هي تكاليف المشاركة في هذا البحث العلمي؟

لا توجد تكاليف للمشاركة في هذه هذا البحث العلمي.

12- Will I Be Paid for Taking Part in This Study?

Nothing.

12-هل هنالك اجر مقابل المشاركة في هذا البحث العلمي؟

لا يوجد.

13- What are the Alternatives?

Nothing.

13- ما هي البدائل؟

لا يوجد.

14- Will My Information Be Kept Private?

Your personal information will be kept private. It will be given out only if required by law. Your personal information will not be used in any reports.

14-هل سيتم الحفاظ علي معلوماتي بسرية؟

معلوماتك الشخصية سيتم الحفاظ عليها بسرية تامة. ولا تعطي إلا إذا اقتضى الأمر وذلك في حدود النظم والقوانين المطبقة بهذا الخصوص. معلوماتك الشخصية لن تستخدم في أي تقارير.

15- What are My Rights if I Take Part in This Study?

Taking part in this study is your choice. You may choose to take part or not to take part. If you decide to take part in the study, you can quit at any time. There will be no penalty to you for your decision. Your medical care will not change.

15- ما هي حقوقي إذا شاركت في هذا البحث العلمي؟

المشاركة في هذا البحث العلمي هي بمحض اختيارك. يمكنك أن تختار المشاركة أو لا. إذا قررت أن تشارك في هذا البحث العلمي، يمكنك التوقف في أي وقت تشاء. وإذا لم تشارك لن تكون هناك أي عقوبة لك, ولا تتأثر الرعاية الطبية المقدمة لك بسبب هذا القرار.

16- Who Do I Call if I Have Questions or Problems?

If you have questions about the study, you can call 0509634303. If you have any questions about "rights of human subjects," you may call the Chairman of the IRB at

. If you have an emergency, call 112

.

16- بمن يمكنني الاتصال إذا كان لدي أسئلة أو مشاكل؟

إذا كانت لديك أسئلة عن هذا البحث العلمي ، يمكنك الاتصال بالباحث الرئيسي على هذا الرقم 0500000000. إذا كانت لديك أي تساؤلات حول "حقوق الاشخاص موضوع البحث، " يمكنك الاتصال برئيس لجنة أخلاقيات البحث العلمي (IRB) على الرقم . إذا كان لديك مكالمة طارئة اتصل ب .

CONSENT:
Subject
I will receive a signed copy of this consent form.

إقرار بالموافقة
المشارك
أقر أنا بأن هذا البحث العلمي وإجراءاته قد تم شرحها لي. لقد سمح لي بأن اسأل كل سؤال لدي الآن. ويمكنني أن اسأل أي أسئلة إضافية في أي وقت لاحق. كما يمكنني إنهاء المشاركة في هذا البحث العلمي في أي وقت دون أن تتأثر الرعاية الصحية المقدمة لي.
سأحصل على نسخة موقعة من الإقرار بالموافقة.

Subject Signature _____

توقيع المشارك _____

Date:

التاريخ / /

Time (AM ☐ PM ☐)

الوقت (ص ☐ م☐)

Person Obtaining Consent:

I have explained the nature and purpose of the study and the risks involved. I have answered and will answer questions to the best of my ability. I will give a signed copy of the consent form to the subject.

الشخص الحاصل علي الإقرار بالموافقة

أقر بأنني قد شرحت بصورة كاملة, طبيعة هذا البحث العلمي والغرض منه وما ينطوي عليه من مخاطر. ولقد أجبت على جميع الأسئلة بقدر الإمكان. سأعطي نسخة موقعة من الإقرار بالموافقة للمشارك المذكور أعلاه.

Signature of Person Obtaining Consent

توقيع الشخص الحاصل على الإقرار بالموافقة

Date / /

التاريخ: / /

Time (AM ☐ PM ☐)

الوقت ص ☐ م☐

To be filled by PI
Principal Investigator: Mater Almehmadi

يتم ملئ هذا الجزء بواسطة الباحث الرئيس
إسم الباحث الرئيسي: ماطر المحمادي

Signature of Principal Investigator

التوقيع :

Date:22/01/2021

التاريخ :

Time (AM ☐ PM ☐

الوقت ص ☐ م☐

Appendix C: Certificate of Completion from The National Committee of BioEthics

Certificate of completion

شهادة اتمام دورة الكترونية

The National Committee of BioEthics (NCBE) at King Abdulaziz City for Science and Technology (KACST), certifies that

تشهد اللجنة الوطنية للأخلاقيات الحيوية بمدينة الملك عبدالعزيز للعلوم والتقنية بأن

Mater Matar N Almehmadi

ماطر مطر المحمادي

Successfully completed the NCBE Web-based training course (Bioethics online training course), so he was awarded this certificate.

قد اجتاز الدورة الالكترونية لأخلاقيات البحوث الحيوية عبر الموقع الالكتروني للجنة. وبذلك تم منحه هذه الشهادة.

[redacted]

Expiry Date \ 13 Dec 2023 Valid Duration \ Three Years

مدة صلاحية الشهادة / ثلاث سنوات تاريخ الإنتهاء جمادى الأولى 1445 29

APPENDIX D: Two Holy Mosques Institute for Hajj and Umrah Research as a supervisory institution.

المملكة العربية السعودية
وزارة التعليم
جامعة أم القرى

031

الموضوع: الموافقة لجمع بعض المعلومات
للمبتعث/ ماطر المحمادي من المعهد.

سعادة الأستاذ/ماطر بن مطر المحمادي سلمه الله

السلام عليكم ورحمة الله وبركاته وبعد

فيهدي معهد خادم الحرمين الشريفين لأبحاث الحج والعمرة لسعادتكم أطيب تحياته وتقديره، وإشارة إلى خطاب سعادتكم رقم (٤٢٠١٠٥٤٨٢٤) المؤرخ في ١٤٤٢/٠٥/٢٣هـ، بشأن جمع بعض البيانات التي تساهم في إنهاء دراسة سعادتكم لمرحلة الدكتوراه في موضوع "التحقق في الوعي بالمخاطر الصحية والتصورات في التجمعات الجماهرية بين الحجاج: دراسة حالة من المملكة العربية السعودية" تحت إشراف قسم البحوث البيئية والصحية بالمعهد.

نفيد سعادتكم بأنه لا مانع لدى المعهد من تحقيق رغبة سعادتكم خلال الفترة من تاريخ ٢٠٢١/٠٢/٠١م إلى ٢٠٢١/٠٤/٠١م، تحت إشراف قسم البحوث البيئية والصحية بالمعهد، دون أدنى مسؤولية على المعهد.

أرجو من سعادتكم إكمال اللازم باتخاذ الإجراءات النظامية اللازمة.

[redacted] كم ورحمة الله وبركاته.

عميد معهد خادم الحرمين الشريفين
لأبحاث الحج والعمرة

[redacted]

[redacted]

المشفوعات: .....

الرقم:

APPENDIX E: PERMISSION LETTER TO VISIT THE RESEARCH SITE

سعادة مدير إدارة الحج والعمرة بصحة منطقة مكة المكرمة **المحترم**

السلام عليكم ورحمة الله وبركاتة

إشارة إلى طلب الباحث / ماطر بن مطر المحمادي ، هوية رقم (١٠١٢٢٠٨٨٩٦) طالب دكتوراة ببرنامج خادم الحرمين الشرفين ببرطانيا ، (تخصص التقليل من الكوارث والمخاطر) ، والذي يرغب في القيام بدراسة بحثية لديكم تحت عنوان:

(Investigating health risk awareness and perceptions in mass gathering among Hajj pilgrims: a case study from Saudi Arabia)

والذي من المتوقع أن يتم تنفيذه خلال عامنا الحالي الى نهاية **1442** هـ، لذا نأمل من سعادتكم تسهيل مهمة الباحث في إجراء الدراسة على أن يتم الالتزام بما يلي:

1. الحفاظ على سلامه المرضى.
2. الحفاظ على السرية العلاجية وسرية المرضى.
3. ألا يكون هناك تأثير على خدمة المراجعين خلال قيامكم بمهام البحث.
4. في حال التمديد أو تغيير خطة البحث، يطلب من الباحث أن يتقدم بخطاب خطي لمنسق البحوث بالجهة التي يتم تنفيذ البحث بها للتعامل نظاما مع الطلب.
5. على الباحث قبل البدء بتنفيذ بحثه التوجه لمنسق البحوث بالجهة المراد القيام تنفيذ البحث بها.
6. على الباحث أن يعلم بأن وزارة الصحة تضمن حقوقها في نتائج البحث من خلال اتفاقية المشاركة في البيانات.

على الباحث عدم نشر الدراسة دون الحصول على موافقة لجنة اخلاقيات البحوث وإكمال المسوغات والمتطلبات المعتمدة من قبل الإدارة العامة للبحوث والدراسات بوزارة الصحة، وحيث صدر للباحث قرار اللجنة المحلية لأخلاقيات البحوث بصحة مكة المكرمة رقم : **(H-02-K076- 0121-453)**

[redacted]

وتقبلوا فائق تحياتي،

[redacted]

APPENDIX F: INTERVIEW QUESTIONS

Interview questions for senior decision maker at Hajj

Demographic:

Age:

Experience:

Specialization:

Occupation:

position:

How many times you are worked at Hajj:

1. How is the safety of the pilgrimage assured from a health perspective?
2. What are the health and non-health related risks that existed during the pilgrimage?
3. How do you face these risks at the present time?
4. Is it possible to develop these plans in the future? Please explain.
5. Do you think that pilgrims are adequately aware of the health risks that exist during the pilgrimage? Explain?
6. What are the measures and instructions followed to educate pilgrims about the health and non-health related risks during Hajj?

7. What are the training methods used to qualify participants in providing pilgrim services?
8. Are the current recommendations and guidelines of the Ministry of Health sufficient to mitigate health and non-healthy related risks during Hajj? Explain?
9. What additional measures do you think should be taken to increase pilgrims' awareness about the health and non-health related risks of Hajj?
10. What are the obstacles or challenges in applying the additional measures?
11. Are there any methods for measuring pilgrims' satisfaction with health services? Explain?
12. What are the sources that may consider valid and recommended to seek health advice before travelling?
13. Should pilgrims seek health advice before embarking on Hajj? Explain?
14. What strategies that provided to increase the pilgrim's awareness of the recommended sources for seeking health advice?
15. What are the current obstacles or challenges contributing to the inadequate awareness of pilgrims about health and non-health related risks and not following the instructions?
16. Are there any plans to raise the level of services provided to increase awareness among pilgrims?
17. Do you think there will be obstacles that will affect the improvement of the level of the service in pilgrimage?

APPENDIX G: Investigating health risk perceptions during the Hajj: Pre-Travel advice and adherence to preventative health measures

Research Article

Investigating health risk perceptions during the Hajj: Pre-Travel advice and adherence to preventative health measures

Mater Almehmadi*, Gianluca Pescaroli, Jaber S Alqahtani, Tope Oyelade

Abstract

Background: Every year, over 2 million people gather together to observe the Hajj pilgrimage in Mecca. This presents a public health risk to both Saudi and the pilgrims' country of origin. The aim of this study was to evaluate the risk perception and the source of health advice by the pilgrims.

Methods: We conducted a cross-sectional survey among internal and external pilgrims performing the Hajj. The survey evaluates the general safety and preventative measures applied, factors influencing public health safety at Hajj, source of pre-travel health advice, recommended preventative health measures, and the effective preventative measures.

Results: A total of 280 pilgrims from 28 different countries were approached of which 233 completed the survey with response rate of 83%. The majority (219 [94%]) of the respondents considered the Hajj as safe while 205 (88%) sought pretravel health advice. The most popular source of pre-travel health advice among the pilgrims were from medical professionals (83 [25.6%]) and other pilgrims (44 [18.9%]). Diversity and carelessness were believed to be the main factors influencing public health safety in the Hajj by 184 (79%) and 181 (78%) of the respondents respectively. Yellow fever (117 [50%]) and wearing of face masks (56 [24%]) were the most and least adopted recommended public health measures respectively while most pilgrims believed handwashing (137 [59%]) and wearing of face mask (119 [51%]) are the most effective preventative health measures.

Conclusion: Our study shows a reduced perception by pilgrims of the health risk of the Hajj and highlights the need to improve how information is channelled to prospective pilgrims about preventative health measures. The discordance between recommended preventative health measures and adherences by pilgrims shows a need for a comprehensive enforcement program underpinned by the Saudi Ministry of Health (MoH).

Keywords: Saudi Arabia, Pilgrims, Mass gathering, Risk, Preventive Measures

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Introduction

Healthcare is one of the essential elements to consider in planning for mass gatherings. Even in events where everything is managed smoothly, it has been noted that approximately 1.5% of people will require medical assistance, associated both with different kind of 'physical stress' or 'pre-existing' medical conditions.[1] Every year, approximately three million Muslims from all over the world journey to the Saudi city of Mecca to complete the Hajj pilgrimage. The event is distinguished by intense congestion, a hot climate, diverse hygiene standards and shared accommodation.[2] The combination of these circumstances creates a facilitative environment for health risks.

The Hajj pilgrimage has been strictly observed for centuries. It is one of the five pillars of the Islamic religion and must be observed at least once by every able Muslim.[3] As the global Muslim population has grown over the centuries, the number of those willing and able to complete the annual pilgrimage has increased significantly, with the 2019 edition attracting approximately 2.5 million visitors.[4] As the host country of the most sacred sites in the Islamic world, the Saudi government has the responsibility to safeguard the health of all pilgrims. As such, Saudi public health officials are constantly engaged in the process of managing the prevalent health risks associated with the Hajj. Additionally, foreign governments and international health agencies are awake to the mass gathering's health risks as there is a possibility that pilgrims will import infectious diseases presumably to their countries of origin. To address the health risks that pilgrims face while in Mecca, the Saudi Ministry of Health decrees a number of preventative health measures before every Hajj cycle. In addition to these measures, pilgrims have a wide array of sources for health education that they access before embarking on the Hajj. This is advantageous, as studies have consistently shown that pre-travel health preparation, including seeking education, improves the health outcomes of international travellers.[5] Sadly, however, the uptake of the recommended preventative health measures has been found to be lacking in certain pilgrim populations.[6] The underlying reasons for this are still largely unclear, as there has been very limited research into pilgrims' perceptions of the health risks that exist during the Hajj and the preventative health measures recommended by the Ministry of Health. Ultimately, the decisions by Hajj pilgrims on seeking pre-travel health advice and adopting recommended preventative health measures are greatly influenced by their beliefs and attitudes that have been shaped by years of cultural and social influenc-

es. As such, aggressive public awareness and education are needed in order to sensitize pilgrims about the need to seek pre-Hajj health advice and act on all recommended preventative health measures. Therefore, the aim of this study is to determine the level of risk awareness among external and internal Hajj pilgrims, in particular the nature of pre-travel advice seeking behaviour how they influence the preventative health measures recommended by the Saudi Ministry of Health.

Methods

Survey development

We designed a survey to provide quantitative data on risk perceptions based on the questions identified in the literature. A cross-sectional design was chosen to provide an overall picture of the state of health risk perception among pilgrims using the limited time available.[7] A total of 280 pilgrims were approached, 233 of which are from 28 different countries outside of Saudi Arabia responded with a response rate of 83%. The first section of the survey was to collect demographic information. The second section of the instrument assessed pilgrim's pre-travel advice seeking behaviour and uptake of preventative health measures. This section also enquired about pilgrim's attitudes towards various health risks and preventative measures recommended by the Saudi Ministry of Health. The questions in the survey questionnaire were created by the researchers and tested for face and content validity with a panel of experts. The survey was then translated from English to six languages, Arabic, Urdu, Indonesia, Malay, Turkish, and Persian. The translation was conducted by official language translation agency and tested by official translators in each consulate general of the countries.

Survey administration

To identify all the external and internal pilgrims, we contacted the Institute of Hajj and Umrah Research in Mecca. We received an approval to access all the holy places in Mecca during Hajj 2019. A first quantitative data collection was carried out between August 4th to 25th 2019 in Mecca, aiming to gather as much quantitative data as possible, within that time frame. We randomly approached 294 pilgrims in different places in Mecca.

Statistical analysis: Descriptive statistics using SPSS 24 version was used to analyse the collected responses. A P value 0.05 was accepted as significant.

Ethical considerations: Permission was sought from the Saudi Ministry of Health to conduct a public health study at the Hajj. Indeed, the ethical approval was not required as this survey was voluntary with no patient's involvement. Additionally, each participant was provided with a consent form that they will have to sign before participating in the study.

Results

Most respondents were from Malaysia 26 (11.1%) and Pakistan 21 (9%). The mean age (± Standard Deviation) was 42.88 ± 12.15 and 130 (55.8%) of them were male. Of the respondents, 90 (38.6%) had undergraduate degree and only 29 (12.4%) did not attend high school. The intended duration of stay in Mecca for the whole sample was 23.25 ± 11.02 (Table 1). 219 (94%) considered Hajj as a safe, while 205 (88.0%) had sought pre-travel health advice before embarking on the Hajj. 121 (52%) did not think there is a risk of a global infectious disease outbreak starting at the Hajj and 189 (81.1%) were satisfied with the current enforcement level of the preventative health measures at the Hajj, (Table 2).

Table 1: *Demographic data on the pilgrims*

Demographics (n=233)	Mean ± SD N (%)
Nationality	
Afghanistan	8 (3.4%)
Algeria	16 (6.8%
Australia	4 (1.7%)
Egypt	16 (6.8%)
France	5 (2.1%)
German	5 (2.1%)
India	10 (4.3%)
Indonesia	8 (3.4%)
Iran	1 (0.4%)
Iraq	5 (2.1%)
Jordan	10 (4.3%)
Kuwait	4 (1.7%)
Lebanon	11 (4.7%)
Libya	10 (4.3%)
Malaysia	26 (11.1%)
Morocco	8 (3.4%)
Nigeria	4 (1.7%)
Pakistan	21 (9%)
Palestine	3 (1.3%)
Philippines	14 (6%)
Saudi Arabia	12 (5.1%)
Sudan	3 (1.3%)
Sweden	1 (0.4%)
Syria	5 (2.1%)
Tunisia	4 (1.7%)
Turkey	15 (6.4%)
UAE	2 (0.9%)
United Kingdom	2 (0.9%)
Age (Mean ± SD)	42.88 ± 12.15
Gender	
Male	130 (55.8%)
Female	103 (44.2%)
Intended Duration of Hajj (Days, Mean ± SD)	23.25 ± 11.02

Number of Hajj performed (Mean ± SD)	1.97 ± 3.18
Level of education	
Did not attend high school	29 (12.4%)
High school diploma	50 (21.5%)
Postgraduate	64 (27.5%)
Undergraduate	90 (38.6%)

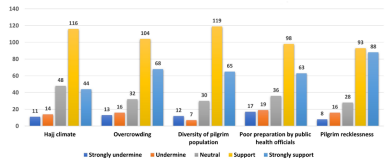
Table 2: *General questions about safety and applied measures*

	N (%)
Do you consider the Hajj safe?	
Yes	219 (94%)
No	14 (6%)
Have you sought pre-travel health advice before embarking on the Hajj?	
Yes	205 (88.0%)
No	28 (12.0%)
How would you describe your experience of seeking pre-travel advice?	
Negative	4 (2%)
Positive	201 (98%)
Do you think there is a risk of a global infectious disease outbreak starting at the Hajj?	
Yes	112 (48%)
No	121 (52%)
Do you think the weather at Hajj poses a risk to your health?	
Yes	104 (44.6%)
No	129 (55.4%)
Are you satisfied with the current enforcement level of the preventative health measures at the Hajj?	
Yes	189 (81.1%)
No	44 (18.9%)

Factors influence public health safety at the Hajj

Respectively, 184 (79%) and 181 (78%) of the respondents believed diversity of pilgrims' population and carelessness to be the two main factors influencing health safety at Hajj. Overcrowding at Hajj, poor preparation by public health officials and Hajj climate were ranked third, fourth and fifth respectively, (Figure 1). Indeed, 36 (15.5%) of the respondents believed poor preparation by public health officials is not an important contributing factor affecting public health safety at the Hajj. There were no major differences between those who were educated (204) and not educated (29) in term of their selection except that the educated believed poor preparation by public health officials is not an influencing factor. Those who were not educated believed there is no significant relationship between preparation by public health officials and public health safety at Hajj (Figure 2).

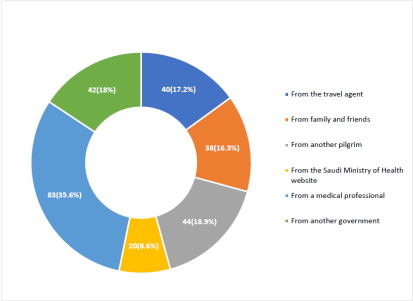
Figure 1: *Factors influence public health safety at the Hajji.*



Seeking pre-travel health advice among external and internal hajj pilgrims

In total, 83 (35.6%) and 44 (18.9%) of the respondents sought pre-travel health advice from medical professionals and from other pilgrims respectively. Out of the 205 (88.0%) respondents who sought pre-travel health advice before embarking on the Hajj, 20 (8.6%) sought it from the Saudi Ministry of Health Website (Figure 2). No differences were found between educated and non-educated pilgrims regarding pre-travel advice seeking.

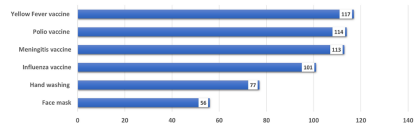
Figure 2: *Seeking pre-travel health advice among external and internal hajj pilgrims*



Recommended preventative health measures adopted by Hajj pilgrims

Figure 3 shows the breakdown of the six preventive health measures among the pilgrims. Yellow fever vaccine was the most popular preventive health measure adopted by 177 of the pilgrims. This is closely followed by Polio vaccine (114) and meningitis vaccine (113). Hand washing and face mask were not used frequently by pilgrims. There were no differences between educated and non-educated pilgrims regarding the preventative health measures adopted.

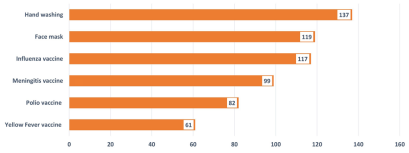
Figure 3: *Preventative recommended health measures that have adopted among Hajj pilgrims*



The preventative measures that have be effective among hajj pilgrims

Hand washing and wearing of face mask were believed to be effective by most pilgrims (Figure 4) despite being the least adopted preventative health measures (Figures 3). A minority of participants indicated that vaccines in general were effective compared to other preventive health measures. Regarding the preventative health measures believed to be effective, there was no observable difference in choice between educated and non-educated pilgrims.

Figure 4: *The preventative measures that pilgrims believe in to be effective*



Discussion

We present here for the first time the Hajj pilgrims' perception of health risk associated with pilgrimage to the holy city with focus on the use and source of pretravel health advice and adoption of preventative health measures.

This study reports the various factors influencing public health safety at the Hajj. According to 79% of the respondents, the main factor influencing public health safety is the diversity of the pilgrims' populations. Considering the religious significance of Hajj, it is no surprise that pilgrims' population at any point in time is often made up of pilgrims with diverse race, age, gender, and medical background to mention but a few.[8] This diversity presents a public and global health challenge and have attracted global health players such as the World Health Organisation attentions in the past regarding the design and implementation of preventative measures against public health risks posed by mass gatherings.[9,10] Diversity may manifest for instance, in the form of reduced perception of health risks by pilgrims coming from parts of the world with less developed health systems. This may affect how public health advice, recommendations and regulations are received and followed by the pilgrims.

Further, 78% of these study participants also believe that pilgrims' carelessness is another main factor influencing public health safety at the Hajj. Other factors that were reported by the respondents include overcrowding, poor preparedness by public health officials and the climate. With over two million people converging every year for the Hajj, overcrowding is a specific feature of the holy pilgrimage often resulting in an increased risk of spread of communicable diseases and stampeding. This overcrowding also put significant pressure on the medical facilities available during the Hajj especially since the number of pilgrims varies from year to year.[11] Because of the geographical location of the Mecca; one of the main public health issues has been the hot weather conditions. With temperatures that go above 40°C in summer, Heatstroke, heat exhaustion, sunburn and dehydration are a common occurrence during the Hajj.[12,13] Several preventative measures have been implemented by the Saudi government over the years to prevent heat related incidence. These include increased awareness campaign, installation of cooling units along the route of the pilgrimage and provision of facilities to prevent heatstroke. However, despite these measures, the problem persists.[14] This suggest the need for improvement in how these problems are tackled.

In total, 205 of 233 (88%) of the participants in this study sought pre-travel health advice. Our study corroborates previous studies that looked at Saudi Arabian and Australian pilgrims to the Hajj.[15,16] Among others, we found that the major source of health advice remained medical professionals. This agrees with previous studies where two third of Hajj pilgrims were reported to have sought health advice from medical professionals including family doctors and travel clinics. The Saudi Ministry of Health (MoH) remains the least source of Hajj-related health advice in this study with only 8.6% of pilgrims consulting the ministry for health advice. This agrees with the study by Alqahtani et al. where only 4% of Saudi Hajj pilgrims reported Saudi MoH as their source of health advice. We recommend a complete overhaul of the Saudi MoH information system to improve accessibility especially by prospective Hajj pilgrims. This should help boost awareness of Hajj-related health risks and available preventative health measures. Indeed, the importance of awareness campaign about the benefits of seeking travel health advice before the Hajj pilgrimage cannot be overemphasized and have been found to be associated with improved health consciousness and behaviours in Hajj pilgrims.[17]

In this study, we report the recommended preventative health measures adopted by Hajj pilgrims. In all respondents, Yellow Fever vaccine was the most popular preventative health measures with 117 adopters. Polio, Meningitis and Influenza vaccines were adopted by 114 (48.9%), 113 (48.5%) and 101 (43.4%) respondents respectively. The coverage of influenza vaccine among Hajj pilgrims in this study (43.4%) vary considerably compared to other studies where higher and lower coverages has been reported.[18,19] This is especially noteworthy, as respiratory tract infections, especially from Influenza viruses, are very

contagious and have been reported as the main cause of outpatient department visit during the Hajj pilgrimage.[20] High and rapid rate of genetic mutation makes the influenza virus strains a global public health concern and this is exacerbated by the continuous close contact and overcrowding intrinsic to the Hajj pilgrimage.[21] Various measures have been recommended by the Saudi MoH including donning of face masks, handwashing and reasonable distancing; all of which have been reported to reduce the spread of respiratory tract infections (RTI).[22] In future, the Saudi MoH should also consider the possibility of introducing and enforcing further preventative public health measures including making vaccination against the various strains of influenza and other RTI viruses a prerequisite for performing the Hajj pilgrimage to prevent outbreak and its associated burden on health care systems.[23,24] This is especially important in the face of the recent global outbreak of the SARS-CoV-2 virus which have been shown to be prevalent and more severe in people with comorbidities.[25,26]

In this study, 137 and 119 participants believed handwashing and facemask donning to be effective preventative health measure followed by vaccination for influenza, meningitis, polio and yellow fever. This study is consistent with previous study which reported that majority of pilgrims believed handwashing is the most effective preventative health measure against respiratory infections (15). However, hand washing and wearing of facemask are also the least adopted preventative health measures even though most pilgrims believe they are efficient. This can be considered as an archetypical case of unconflicted inertia whereby pilgrims maintain their status quo even when aware of the health risk associated with not following preventative guidelines. Accordingly, yellow fever, polio, meningitis, and influenza vaccines are the most adopted preventative health measures by the respondents.

Some limitations associated with this study include the smallness of the sample size which may reduce the statistical power of the findings and limit the extension of the results to a wider, larger global population. Also because of the heterogeneity of the study population, it presents a challenge when trying to control for pilgrims' medical history and country of origin both of which may affect the perception of health risk and adoption of preventative health measures. A larger, targeted cohort study will address these limitations.

This study shows that there is significant scope for improving the perception of public health risk associated with Hajj among pilgrims. We emphasize the need to revamp how Hajj-related preventative health measures is communicated and enforced especially by the Saudi MoH with special consideration of pilgrims' diversity. This study shows that there is significant scope for improving the perception of public health risk associated with Hajj among pilgrims. We emphasize the need to revamp how Hajj-related preventative health measures is communicated and enforced especially by the Saudi MoH with special consideration of pilgrims' diversity.

Conclusion

This study shows that there is a lapse in pilgrims' perception of health risk associated with the Hajj pilgrimage. We prove that lack of centralized and a unified information source leads in the difference in perception of risk and adherence to preventative health measures. Although most pilgrims understand the effective preventative health measures, adherence or use of these measures does not align with this understanding. This could be improved by wide ranged and inclusive public health campaign, centralized and informed recommendations and enforcement programs to ensure adherence.

Acknowledgment

None

Conflict of Interest

The authors declare that there are no conflicts of interest.

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APPENDIX H: Healthcare Research in Mass Religious Gatherings and Emergency Management: A Comprehesive Narrative Review

healthcare

MDPI

Review

Healthcare Research in Mass Religious Gatherings and Emergency Management: A Comprehensive Narrative Review

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Abstract: Religious mass gatherings, especially pilgrimages of various faiths, involve overcrowding and the international movement of people, exposing individuals to significant health risks, such as the spread of infectious diseases, crowds, exposure to bad weather, physical stress, or risks due to pre-existing medical conditions. This paper aims to review the literature related to health care research on religious mass gatherings, with special reference to the role of awareness creation, training, and risk awareness for individuals during Hajj. The results indicated that the research on health risks associated with large-scale gatherings showed that some countries (which witness religious gatherings) follow effective preventive measures to reduce health risks, while some countries did not (and linked this to its poor infrastructure and the low standard of living in it, such as India). It also showed that most studies overlooked identifying the causes of infectious diseases and determining the perceptions of participants in mass gatherings. While it showed that environmental factors strongly influence the emergence of infectious diseases among individuals, the results also showed the scarcity of research that revolves around the awareness of community members, the health risks of mass gatherings, preventive measures against diseases, and the main effects on individuals' perceptions of risks. The results also showed a lack of research evidence on how pilgrims perceive risks, adopt information, and interact with their willingness to be trained in preventive measures.

Keywords: mass; religious; gatherings; research; Hajj; infectious diseases

Citation: Almehmadi, M.; Alqahtani, J.S. Healthcare Research in Mass Religious Gatherings and Emergency Management: A Comprehensive Narrative Review. *Healthcare* **2023**, *11*, 244. https://doi.org/10.3390/healthcare11020244

Academic Editor: Mustafa Z. Younis

Received: 13 December 2022
Revised: 5 January 2023
Accepted: 11 January 2023
Published: 13 January 2023

1. Introduction

Healthcare is one of the essential elements to consider in planning for mass gatherings. Even in events in which everything is managed smoothly, it has been noted that approximately 1.5% of people will require medical assistance, associated both with different kind of 'physical stress' or 'pre-existing' medical conditions [1]. These include, for example, exposure to bad weather and injuries from crowd stampedes. Mass gatherings are becoming particularly relevant as vectors for possible epidemic viral diseases in which the event may help the virus to mutate, as in the case of avian influenza [2]. Crowded spaces, coupled with the stress and fatigue that characterize them, can create a suitable environment for the spread of infectious diseases [3]. This presents different challenges for analysis. A large amount of the state-of-the-art explained how viruses spread and the physical dynamics of spreading, such as in case of influenzas or allergy [4], but this has not been consistently translated in the academic literature on disaster risk reduction, until recently [5].

While the concept of mass gathering medicine is not new, it has especially become a topic of discussion in recent years. According to Alrabeeah et al. [6], mass gathering medicine can be defined as a field of study within medicine that deals with the public and private health risks and the health impact of mass gathering events. Mass gathering medicine has been in effect for decades through the delivery of health services at mass gathering events. However, it was only formalized as a field of study within medicine