

## Health information, attitudes and actions at religious venues: Evidence from hajj pilgrims

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### ABSTRACT

Mass gatherings for sporting events, music shows, and religious needs continue to grow in our urban areas, requiring local authorities to develop safety procedures to mitigate the challenges of keeping the attendees safe. These challenges are even more pronounced at pilgrimage venues where social distancing and contact avoidance are difficult as pilgrims are required to perform various rituals in close proximity with others, in a sequential manner, either daily or weekly, as per their religious tenets. Over two million pilgrims attend the Hajj pilgrimage in Saudi Arabia annually. Keeping the local and visiting pilgrims safe from crowd crush, sunstroke, skin infections, recurrence of prior medical issues, and contagious diseases requires the Saudi government to allocate huge investments for health communication and prevention programs every year. However, there is no evidence to date that has empirically tested whether Hajj pilgrims are able to receive such information and are subsequently adopting various health promoting behaviors. This study aims to do that by framing it within the Health Belief Model. Data collected and analyzed from 245 pilgrims in Makkah between September 9th–19th, 2017 suggests that roughly 48% of the pilgrims adopted all five protective measures. However, language barriers, limited health care facilities, and difficulties in purchasing prescription medications were cited as impediments to adopting healthy measures. The study concludes with recommendations for the KSA government agencies, Hajj authorities, Mission authorities and pilgrims, during various phases of travel— i.e. pre-travel, during the pilgrimage and post-travel, in light of new emerging health threats.

### 1. Introduction

There is a worldwide increase in the number of mass gatherings (MGs) for sporting events, music shows, political and religious events. These have “the potential to strain the planning and response resources of the country or community” [40], requiring local authorities and event managers to develop health safety procedures to keep the attendees safe from crowd crush and the spread of infectious diseases [1–3]. These challenges are even more pronounced at pilgrimage venues where social distancing and contact avoidance are difficult to implement and maintain because pilgrims are required to perform various rituals in close proximity with others over a short time frame, either daily or on a weekly basis, in a very prescribed format, as per their religious tenet.

Every year millions of Catholics embark on a pilgrimage to attend the

Papal Mass for Christmas (in December) or Easter (varies between March–April); over 30–40 million Hindu devotees visit the Sabarimala temple in Kerala; millions attend the Hindu Kumbhmela festival and pilgrimage held once in 12 years; and the Muslim pilgrims embark on the annual Hajj pilgrimage. These are made during prescribed dates and months, making these venues extremely prone to the spread of infectious diseases, respiratory diseases and gastrointestinal diseases, due to poor sanitary conditions from overcrowding, and the risk of crowd crush/stampede [10,11,40].

For example, in 2014 Joseph et al. [41] queried doctors at the site of the Sabarimala shrine. The pilgrimage is made on foot by thousands during a prescribed month, through treacherous hilly terrain and forest lands. A risk prioritization index demonstrated that human stampedes and person-to-person communicable diseases were the highest threats to

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pilgrims. Where pilgrims are often required to make *trans*-continental travel, they can become both victims, or carriers of infectious diseases, or common food borne infections like Salmonella and cholera. For example in 1987, Meningococcal disease was contracted by Hajj pilgrims while in Saudi Arabia and transmitted back to their home countries [14].

Thus, it becomes important for pilgrims to understand the health related threats they are likely to face before they embark on their travels, so that they can take protective actions during pre-travel, at the venue during the pilgrimage, and post-travel back in their home country. They need to be part of a detection capability in surveillance networks, and also individually take on the responsibility of preventing the spread of diseases. However, this is not always the case.

Hamer and Conner [15] studied the Knowledge, Attitude, and Practices (KAP) of American travelers related to health risks prior to their travel to developing nations. They found that KAP for American travelers was very low and mostly limited to the acquiring a visa for travel. When asked to assess the risk of contracting Malaria infection, respondents' based their risk perception on the country of travel. A majority were intent on practicing preventative measures including covering skin, using air conditioning, limiting drinking tap water, and using insect repellents. However, only a small percentage traveling to high risk areas were carrying anti-malarial chemo-prophylaxis. Surprisingly, even though 74% agreed that vaccines could prevent infections from influenza and other such preventable infections, few sought pre-travel health care advise to enhance their health risk knowledge. A majority (82%) simply presumed that treatments would be available at their destination [15]. This last factor is alarming especially if the venues are overcrowded and creates unique challenges for the health care sector in host nations that need to surge capacity of health facilities to meet the needs of the religious tourist population.

This study is focused on expanding understanding of health information, attitudes and actions of Hajj pilgrims to Makkah in the Kingdom of Saudi Arabia (KSA), as it is the most crowded and complicated annual event in the world. Every year over 2 million believers, from more than 140 countries congregate over a few days to perform religious rituals and are faced with unique health and safety challenges including crowd crush, heatstroke and infectious diseases [6–10]. Despite huge built infrastructure investments year in and year out by the Saudi government, to reduce overcrowding and crowd crush accidents and technological enhancements for crowd monitoring and management, pilgrims continue to be wary. The memories of a stampede in 2004 that killed over 250, another in 2006 that claimed 360 lives, and one in 2015 near the Al Jamarat Bridge in the Mina shrine area that killed 769 pilgrims and injured hundreds, are still fresh in their memories. Furthermore, in 2013, over a million of these pilgrims (local and international) visited Makkah's health care facilities, predominantly complaining of crowd crush related injuries or cardiovascular problems [11], p. 899].

To ensure the safety and security of Hajj pilgrims, the Saudi Ministry of Health (MOH) is investing in health promotion materials and suggesting preventative measures that pilgrims can take. These include requiring a medical check-up before embarking on the journey, getting the required vaccinations, carrying personal medical equipment and medications for chronic illnesses, eating healthy food, avoiding heatstroke by using an umbrella and staying hydrated, using hand sanitizer, masks and washing frequently and limiting smoking in public places etc. Although the MOH focuses on more recent contagious diseases and viruses like MERS, Corona and Ebola, it also reminds visitors of the risks from lesser known diseases like Cholera, Meningitis, Yellow fever, Rift Valley fever, and Dengue fever etc. [13].

Research in health promotion and communication have consistently highlighted how "planned, persuasive messaging and communication campaigns can change awareness and health behavior within populations" [12], p.39]. Hence, as part of their health awareness initiative in 2016, the MOH also distributed roughly 2 million health awareness information fliers, 716 Roll-up signs, 767 banners, 5298 posters, 10

Uni-pole signs (i.e. large billboard type signs placed atop a very high pole typically on highways), 4 billboard trucks and 125 televisions placed strategically in public places. They also handed out 47,800 disposable filter masks to protect against particulate pollutants like gases, as well as bacteria and viruses, 70,640 hand sanitizers, 68,960 umbrellas to protect against the daytime summer temperatures of over 40 °C (104 °F), 9770 'Your Health in Hajj and Umrah' booklets, and text messages to all cellphones in use at Hajj sites. The ministry further disseminated information on official social media sites as well as more traditional Public Service Announcements (PSAs) on various television and radio channels [13]. However achieving compliance from pilgrims is often difficult because they are from underdeveloped, developing and developed countries with varying risk perceptions, threat knowledge and protective action capacities and attitudes.

To date there have been no studies that enquire what health related threats concern foreign Hajj pilgrims visiting Saudi Arabia, how they typically seek information to be better prepared against these threats, and what economic, social, language and cultural barriers they face. This study does that and presents findings from 245 Hajj pilgrims surveyed in 2017. It uses the Health Belief Model to examine what factors influence pilgrims' choice of risk communication channels and their decisions to take protective actions. The subsequent sections begin with a description of the Health Belief Model which is used as the theoretical framework for this study and the survey research questions generated. Following this, the methods section elaborates on the convenience sampling strategy and surveying of both English and Arabic speaking pilgrims. The descriptive statistics, chi-square analyses and Cramér's V post-tests provide key findings that suggest associations between significant perceived health threats—crowd crush and pre-existing health conditions and popular preventative measures—bringing prescription drugs from home, getting vaccinated, maintaining personal hygiene and washing hands. The discussions and conclusions highlight policy implications for practitioners including Hajj authorities and travel and tours operators in the host and sending nations.

## 2. Theoretical framework - Health Belief Model (HBM)

Pilgrims become functionally dependent on the national and local governments in host countries to ensure safe lodging, transportation, food, water, security, and a functioning health care system. These agencies face the challenge of meeting the needs of this surge population, while maintaining the standard of care for their own citizens. They do this with the support of multi-media information and education campaigns. However, public health literature suggests that such efforts by government agencies often fail because recipients of this information fail to adopt health-promoting actions either due to not understanding the information, or facing economic or access challenges. In the 1950s the Health Belief Model (HBM) was developed by social psychologists Hochbaum, Rosenstock and Kegels working at the U.S. Public Health Services [23] to further understand this phenomenon, and is among one of the first theories postulating factors that influence the adoption of healthy behavior by individuals.

The HBM model explains the nuanced relationship between environmental health and safety education and protective action adoption [24]. It suggests that both intrinsic factors related to oneself and extrinsic factors related to one's environment, influences a person's acceptance of health information advice and associated protective actions. Since then the HBM framework has been used in various health promotion programs in the US with success and has been influential in changing individuals' perceptions towards vaccines, cancer screening, and exercising etc.

It has been tested and empirically supported by many studies [17,18] and remains "one of the most widely used social cognitive models in health behavior research" [19]: p.2]. For example, Babazadeh et al. [20] conducted a cross-sectional study using HBM based questionnaire to test the key cognitive determinants of cervical cancer Screening Behavior

(CCSB). The authors interviewed 280 housewives and found that those who believed they would benefit from such early screening and detection tests and had few barriers in accessing the screening and had high self-confidence were more likely to opt for such a preventive screening measure. Razmara et al. [22] used HBM to explore what prompted safe driving behavior in Iran. They sampled 184 taxi drivers and found that external cues and perceived benefits inspired drivers to adopt safe driving behavior while perceived barriers deterred such behavior. Therefore, the authors recommend using advertisements and campaigns to highlight the critical role of safe driving behavior and modification of barriers.

As shown in Fig. 1, HBM has several components that explain the likelihood of a person engaging in health promoting behavior. The first is *perceived threat* which is influenced by *perceived seriousness* and *perceived susceptibility* [22,25]. Perceived seriousness is the degree of danger as well as the consequences of that danger that individuals believe they will encounter from a health issue. In other words, it is the perception of how badly the threat or illness will affect an individual's health. HBM posits that people who think seriously about a certain health issue tend to be involved in behavior to prevent or reduce that health threat. For instance, individuals are not worried about catching the common cold but definitely worried if a life-threatening disease like the Ebola virus is spreading in various parts of the world. Also, people are more serious about catching a cold during the work week as it impedes productivity, and not so much during holidays. On the other hand, perceived susceptibility is a subjective evaluation of the extent to which individuals believe that they are prone to a certain disease either due to inherent physiological weaknesses due to age or prior illnesses, which leads them to be involved in proactive health promotional behavior.

*Perceived benefits* is another component that refers to the value or efficacy of engaging in a health promoting behavior. For instance, individuals who think that a flu shot will most likely prevent them from getting sick will be more likely to get the shot [21,23]. *Perceived barriers* on the other hand are the likely obstacles that individuals may encounter in attempting to prevent or reduce potential risk [46]. These can be a combination of monetary, capability or accessibility barriers, which make it less likely for someone to be involved in health promoting behavior [19,26]. Individuals' make proactive behavioral changes when the perceived benefits trump perceived barriers including cost and access to medications, drugs' side effects and availability [23]. The HBM conceptual diagram highlights this interconnectedness by presenting both elements in one box.

The HBM also considers certain *modifying variables* that refer to individual demographic characteristics such as age, gender and ethnicity, psychosocial characteristics such as personality and social class, and structural variables such as previous information and/or experiences with a disease. It assumes that these variables indirectly affect the engagement in health promoting activities by affecting the perceived seriousness, susceptibility, benefits, and barriers [23].

*Cues to Action* is the component that focuses on individuals' perceptions of any signal as an indication of the onset of a hazard [19,26]. These cues are necessary to trigger or motivate individuals to act. Cues can be internal (such as pain and symptoms), or external (such as risk information received through various channels). The assumption is that raising awareness of a disease mitigates health risks because higher awareness leads to intelligent decisions [24]. Finally, Rosenstock, Strecher and Becker [27] added the *Self-efficacy* component to HBM to make it more accurate in describing individuals' differences. This component refers to the level of self-confidence that individuals have in their ability to take a successful action. HBM posits that individuals who are highly confident in their ability to prevent or reduce potential risk from a disease will be more likely to engage in health promoting behavior.

The review of literature pertaining to the theoretical underpinnings of the HBM helped generate the following research questions related to the experiences of Hajj 2017 pilgrims.

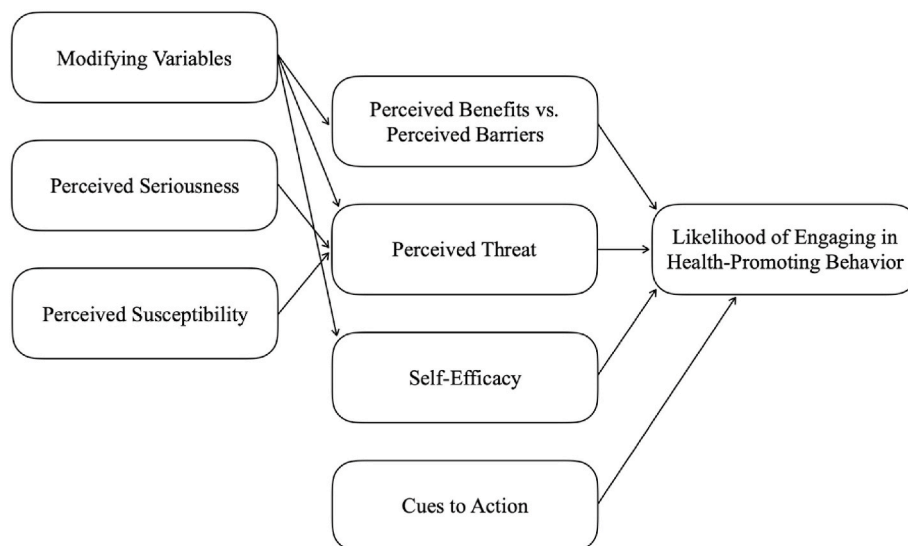
**RQ1.** What actions do pilgrims take or are willing to take to ensure their good health during Hajj? (*Perceived Benefit*)

**RQ2.** Which health threats—whether pre-existing or emerging during Hajj— did pilgrims perceive to be serious and requiring the adoption of health-promoting actions? (*Perceived Threat*)

**RQ3.** What are the barriers/ perceived challenges that pilgrim's encounter when attempting to prevent or reduce the health risks during Hajj? (*Perceived Barriers*)

**RQ4.** What are the internal and external cues that prompt pilgrims to take health-promoting actions to reduce the potential of health risks during Hajj? (*Cues for Action*)

**RQ5.** How can pilgrims' perceptions of self-capacity or capability influence their willingness to take health-promoting actions? (*Self-Efficacy*)



**Fig. 1.** Health belief model (HBM). Source: [25].

### 3. Methods

#### 3.1. Sample

In the summer of 2017 (September 9–19) a research team comprising of the lead author and five surveyors with bilingual capabilities (Arabic and English only), commenced data collection. The team adopted a convenience sampling strategy to identify and collect responses from 245 pilgrims willing pilgrims milling around in the central marketplace or various lodges of Makkah City in Saudi Arabia or in lodges and hotels. Such as sampling strategy was adopted because a population based probability sampling technique would have been very costly, time intensive and challenging. The Hajj pilgrims population is unique as the total number of pilgrims visiting in a given year is ever changing, and socio-demographic characteristics including nationalities, income, and language proficiencies are different (more than 140 countries), making it is difficult to bring clarity in defining the target population to conduct probability sampling [42].

Two versions of the semi-structured quantitative survey instrument, one in English and the other translated into Arabic, were used. The survey instrument was pretested and fine-tuned to address any issues arising from translations and suggestions made by the local population. Respondents answers derived from face-to-face interactions were first hand written by the interviewers and then translated as required into English, transcribed, coded and analyzed using IBM SPSS software. Every effort was made to target pilgrims from as many nationalities as possible, notwithstanding their ability to speak one of the two languages, due to limitations of the bilingual team.

This is likely to have left out the preferences of those speaking other languages and is a limitation that can be overcome in future research with a multi-lingual team. The final sample represents pilgrims from six world regions – Southeast Asia – (38 Indonesians and 18 Malaysians), South Asia (27 Indians and 43 Pakistanis), North Africa (52 Egyptians and 33 Algerians) and Europe and the Americas (34). Pilgrims that come from these regions make up about 88.6% of the whole population (1,758,722 pilgrims) in the Hajj of 2017 [28].

#### 3.2. Measures

Two types of questions were used to measure the research concepts. Likert scale rating type question with responses ranging from 1 = Not at all, 2 = Some extent, 3 = Great extent, and 4 = Very great extent, and binary response questions, recorded as 1 = Yes, 0 = No. Finally, a Chi-square analysis was conducted to determine the significance followed by a Cramér's V post-test to measure the relative strength of the association between the perceived seriousness of a health risk and the adoption of health promoting actions. A Cramér's V coefficient ranges from 0 to 1 (perfect association). In practice, even a 0.10 value, may be considered a good minimum threshold for suggesting a substantive relationship between two variables [34,35]. The questionnaire structure for each concept measured are detailed below.

##### 3.2.1. Demographic characteristics

The questionnaire asked respondents to report their demographic characteristics—age, gender (coded male = 0, female = 1), number of days to spend in Saudi Arabia during the visit, highest level of education (post graduate, undergraduate, some education, no education), household income (computed using a proxy of 'accommodation type i.e. whether in tents, three Star, Four Star or Five Star hotels, that a pilgrim stayed in), and Nationality.

##### 3.2.2. Communication channels for health information

To assess which communication channels were accessed for health information, respondents were asked to recall the extent to which (not at all = 1, 2 = some extent, 3 = great extent, 4 = very great extent), they received information from Pamphlets, Television, Radio, Messages at

Mosques, Public Events, Health Clinics, Facebook, Twitter, WhatsApp, Text Messaging, Billboards, Face-to-Face - Family/Friends, Face-to-Face from Hajj Authorities, Face-to-Face from Mission Authorities (i.e. their country government's International office), and Face-to-Face from other Pilgrims.

##### 3.2.3. Health protective actions

To measure subsequent decisions to take the various health promoting actions, respondents were provided with a list of five—brought medicines from country of origin, taken vaccination/s prior to travel for Hajj, were maintaining personal hygiene were using hand sanitizer, and were washing their hands. Their binary responses to taking the action or not, were recorded as 1 = Yes, 0 = No.

##### 3.2.4. Perceived health threats

To assess which health threats were a major concern to pilgrims, respondents were asked the extent to which (1 = not at all, 2 = some extent, 3 = great extent, 4 = very great extent) they were concerned with five health related threats which were at the physiological level—heatstroke, vomiting, diarrhea, pre-existing conditions, epidemics and six environment related health threats—car accident, crowd crush. Subsequently a nominal variable was created in such a way that respondents who were 'not at all' concerned with a particular health threat, was coded as '0' and concerned to 'some extent/great extent/very great extent' was coded as '1'. For the purposes of this paper only responses related to the first five are presented as this paper is concerned with presenting pilgrims' attitudes and health protective behavior at the individual level.

##### 3.2.5. Perceived barriers

to assess what were the perceived barriers that pilgrims encounter in taking health promoting actions, respondents were asked to rate the extent to which (1 = not at all, 2 = some extent, 3 = great extent, 4 = very great extent) the six listed challenges— not enough hospitals/clinics, accessing prescription medicines, no help from service providers, language barriers, trust in service providers and expensive, were impediments. Responses that were 'not at all' was coded '0', while 'some extent/great extent/very great extent' was coded '1'.

##### 3.2.6. Cues for Action

To assess what internal and external cues prompted pilgrims to take health-promoting actions, respondents were asked to rate the extent to which (1 = not at all, 2 = some extent, 3 = great extent, 4 = very great extent), five internal cues— shortness of breath, sweating, rash, cough and cold, and stomachache and five external cues— information from the newspapers/TV/Radio, people wearing mask, social media, overcrowding on roads, and overcrowding in tents, prompted their actions. Individual responses that said 'not at all' by a particular internal or external was coded as '0' while 'some extent/great extent/very great extent' was coded as '1'.

##### 3.2.7. Self-efficacy

To assess how can pilgrims' perceptions of self-capacity or capability influenced their willingness to take health-promoting actions a question that asked pilgrims how confident they were in their ability to take successful health protective actions was analyzed. The response was rated from (1 = not at all, 2 = some extent, 3 = great extent, 4 = very great extent).

## 4. Analyses and findings

The descriptive statistics suggest that the average age of respondents was 45 years and ranged between the youngest at 18 years and the oldest at 73 years of age. On average pilgrims spent 33 days in Saudi Arabia during their visit to perform the Hajj pilgrimage, with a minimum stay of 6 days and a maximum of 60 days. Of the pilgrims 25% had a post-

graduate degree, 35% had an undergraduate degree and others were lower or uneducated. Income level computed using a proxy of ‘accommodation type’ suggested that 52% stayed in Four Star or Five Star hotels in Makkah and 93% stayed in a regular tent in Mina an uninhabited village east of the city. Accommodation types vary because the Hajj pilgrimage spans over six days requiring pilgrims to visit a number of towns and cities in Saudi Arabia including the start in ‘Makkah on to Mina, Muzdalifah and Arafat (approximately nine miles from Makkah) and vice versa over the six day period [43].

4.1. Communication channels for health information

When there is trust in an information source, there is more acceptance of the health information provided by that source and greater rate of adoption of protective behavior, to reduce one’s health threat [4,5]. This led to the tabulation of the frequency of responses (see Table 1) for the various channels of communication that pilgrims received health information from, during their time in Saudi Arabia. Given the responses were on a Likert scale, the central tendency was measured by computing both mean and median measures. As both reportedly fall in the same response category, the mean values are discussed further.

The mean values indicate pilgrims sought information from face-to-face interactions the most (mean ranging from 2.1 to 2.3), followed by information from text messaging and billboards (mean of 2.1). Use of radio and Twitter reported the lowest means of 1.2 and 1.3 respectively. While face-to-face interactions with family, friends and other pilgrims within their tour group is inevitable and to be expected, it is worth noting that pilgrims depend on Hajj authorities, Mission authorities, and religious leaders in mosques to provide them with authentic information. Sharing this finding will be assuring to these agencies and the KSA who are expending resources annually to enhance these modes of communication. Highlighting the continued gaps created due to language barriers will likely focus attention on recruiting seasonal multilingual speakers [29] to ensure the information is not limited to only English and Arabic but covers other most commonly spoken language among pilgrims.

4.2. Protective actions

In response to RQ1, (What actions do pilgrims take or are willing to take to ensure their good health during the Hajj pilgrimage?), frequency responses were first tabulated (see Table 2). A majority of the respondents had taken at least one of the five actions listed—brought medicines from country of origin (75%), taken vaccination/s prior to travel for Hajj

Table 1 Descriptive statistics of health information communication channels.

Source of Information about Health Issues	N	Median	Mean	Std. Dev.	Min.	Max.
Pamphlets	212	2	2.019	0.854	1	4
Television	207	2	1.841	0.892	1	4
Radio	200	1	1.225	0.613	1	4
Messages at Mosques	206	2	2.029	0.916	1	4
Public Events	205	1	1.415	0.663	1	4
Health Clinics	206	2	1.937	0.873	1	4
Facebook	207	1	1.691	0.909	1	4
Twitter	206	1	1.359	0.653	1	4
WhatsApp	208	1	1.707	0.898	1	4
Text Messaging	208	2	2.178	1.013	1	4
Billboards	202	2	2.119	0.820	1	4
Face-to-Face - Family/Friends	207	2	2.232	1.007	1	4
Face-to-Face - Hajj Authorities	210	2	2.138	1.069	1	4
Face-to-Face - Mission Authorities	211	2	2.360	1.084	1	4
Face-to-Face - Other Pilgrims	213	2	2.188	0.938	1	4

Table 2 Descriptive statistics health promoting behavior.

What actions did you take/will you take to ensure you don't get sick during Hajj?	Yes Freq. (%)	No Freq. (%)	Total n
1. Brought medicines from country of origin	178 (75)	60 (25)	238
2. Took vaccinations prior to travel	191 (80)	47 (20)	238
3. Maintain personal hygiene	224 (95)	11 (5)	235
4. Use hand sanitizer	185 (77)	54 (23)	239
5. Wash hands	234 (98)	6 (2)	240

(80%), were maintaining personal hygiene (95%), were using hand sanitizer (77%), and were washing their hands (98%). Upon cross-tabulating the responses it was found that 48% of the respondents had adopted all five health promoting behavior (i.e. health threat preventative measures).

Furthermore, statistically significant associations between the health information communication channels accessed and adoption of health promoting behavior was computed (see Table 3) Individuals who did not receive any information from the listed sources were coded ‘0’ and ‘1’ otherwise. Findings suggest that information received from Hajj and Mission authorities reported very strong associations with individuals bringing medicines from their country and taking vaccinations prior to travel. Other sources of information — billboards, twitter, health clinic, public events, and pamphlets reported strong association with bringing medicines from their country and taking vaccinations. Conversely, maintaining personal hygiene and washing hands reported almost no association with information sources, while information received through the radio or messages at mosques reported no association with any of the health promoting actions.

Table 3 Association (Cramér’s V) between health promoting behavior and health information communication channels.

Source of Information about Health Issues	Health Promoting Behavior				
	Medicine From Country	Vaccination	Personal Hygiene	Use Hand Sanitizer	Washing Hands
Pamphlets	0.148**	0.180***	0.067	0.184***	0.040
Television	0.069	0.235****	0.048	0.053	0.095
Radio	0.091	0.041	0.005	0.077	0.039
Messages at Mosques	0.101	0.045	0.097	0.070	0.060
Public Events	0.198***	0.200***	0.072	0.114	0.112
Health Clinics	0.218***	0.282****	0.032	0.218***	0.010
Facebook	0.010	0.034	0.057	0.177**	0.040
Twitter	0.226****	0.233****	0.011	0.082	0.022
WhatsApp	0.149**	0.221***	0.062	0.185**	0.013
Text Messaging	0.124*	0.026	0.053	0.109	0.014
Billboards	0.206***	0.226***	0.100	0.006	0.072
Friends/Family	0.059	0.138**	0.110	0.107	0.074
Hajj Authorities	0.274****	0.396****	0.004	0.090	0.016
Mission Authorities	0.289****	0.308****	0.117*	0.114	0.045
Other Pilgrims	0.021	0.122*	0.069	0.040	0.049

\*p < 0.10; \*\*p < 0.05; \*\*\*p < 0.01; \*\*\*\*p < 0.001. Note: Cramér’s V >0.25 = Very strong association; >0.15 = Strong association; >0.10 = Average association.

### 4.3. Perceived health threat

In response to RQ2, “Which health threats—whether pre-existing or new during Hajj— did pilgrims perceive to be a serious concern and requiring the adoption of health promoting actions?”, a majority of the respondents i.e. 78% noted their concerns related to getting a heatstroke, which is not surprising considering that in 2017 the Hajj pilgrimage during the unforgiving summer months (began on the evening of Wednesday, 30 August and ended the evening of Monday, 4 September) with very high temperatures. In Saudi Arabia which is a desert country the temperatures range between lows of 13 °C (55 °F) in January and highs of 43 °C (110 °F) starting from June to October. Pre-existing conditions was reported as a threat by just over 50% respondents, while vomiting was reported by 44% respondents as shown in Fig. 2.

Table 4, presents statistically significant associations between the respondents’ concerns related to various health threats and the likelihood of adopting health-promoting behavior. The argument is that those who perceive the seriousness of a threat as well as the negative consequences of that threat, are far more likely to take preventative measures to enhance their good health. Perception of threats such as vomiting, diarrhea, pre-existing conditions and epidemics are strongly to very strongly related to individual’s behavior of bringing their own medicines, and getting vaccinated ( $0.000 < p < 0.05$ ); threats from heatstroke and pre-existing conditions are strongly associated with maintaining personal hygiene and washing hands. It can also be inferred that most pilgrims are likely planning ahead by taking appropriate vaccinations and bringing their own medications because they are well aware of the probable health threats associated with overcrowding at the various shrine sites.

### 4.4. Perceived barriers

In response to RQ3, (“What are the barriers/perceived challenges that Hajj pilgrims encounter when attempting to prevent or reduce the health risks during Hajj?”) a Chi-square analysis was performed and associations (Cramér’s V) computed between health promoting behavior and perceived obstacles as shown in Table 5. Obstacles of language barrier and not being able to receive help from service providers reported a strong association with the use of hand sanitizers. Access to prescription medicines, language barrier, and trust in service providers reported average associations with personal hygiene, while not enough hospitals and access to prescription medicines reported average association with respondents choosing to bring medicines from their own country. As

Hajj is a destination for Muslims of various nationalities, direction and information about medical facilities and pharmacists in multiple languages, or an e-Helpline providing translation services may help mitigate some of these obstacles.

### 4.5. Cues to action

In response to RQ4, (“What are the internal and external cues that trigger pilgrims to take health-promoting actions to reduce the potential of health risks during Hajj?”), two questions related to cues or signals that Hajj pilgrims watched out for were analyzed. The internal cues included body ache and pain or physiological symptoms, while the external cues were receiving risk information from various channels, or watching the crowds grow or swell in numbers making them wary of crowd crush. This was with the notion that individuals heightened perceptions of a health threat would influence their protective actions adoption. Subsequently, a Chi-square analysis was performed to determine if pilgrims’ health promoting behavior were associated with each of their internal and external cues and adoption of health promoting behavior.

Table 6 summarizes these findings providing evidence that there is strong association between individuals’ perceptions of internal and external cues indicating the onset of a health threat, and thereby motivating an associated behavioral change to prevent or reduce the risk of that threat. Individuals with shortness of breath and stomachache take or plan to take preventive actions such as bringing their own medications (very strong association) and taking appropriate vaccinations (strong association). Personal hygiene and use of hand sanitizers were health behavior actions in response to internal cues of sweating (strong association) and stomachache (very strong association) respectively. Very strong association was also noted for the use of hand sanitizers during overcrowding on roads and in tents while other external cues related to news in the media and use of masks reported moderate to strong association with bringing medication from home and personal hygiene.

### 4.6. Self-efficacy

The level of self-confidence or perception of self-capacity that individuals have in their ability to take a successful action either due to their youth, experience or financial status, may likely influence the likelihood of an individual’s adoption of protective actions. In response to RQ5, (“How can pilgrims perceptions of self-capacity or capability influence their willingness to take health promoting actions?”), cross-tabulation was performed for responses to two inquiries. (1) What

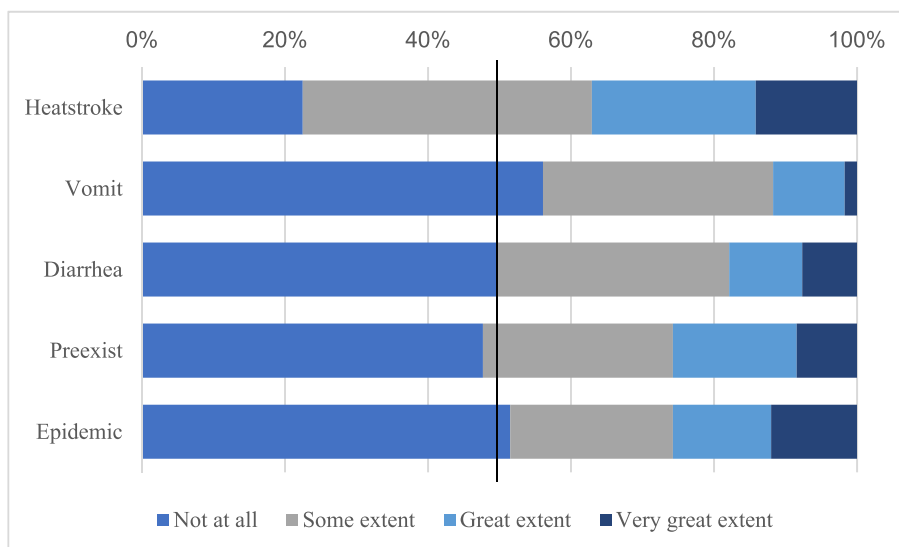


Fig. 2. Perceived severity of health threats.

**Table 4**  
Association (Cramér's V) between adoption of health promoting behavior and pilgrims' perceived health threats.

Health threats during pilgrimage	Health Behavior				
	Medicine From Country	Vaccination	Personal Hygiene	Use Hand Sanitizer	Washing Hands
Heatstroke	0.172***	0.064	0.169***	0.174***	0.308***
Vomiting	0.423*****	0.259****	0.118**	0.037	0.064
Diarrhea	0.261****	0.145**	0.022	0.056	0.012
Pre-existing condition	0.266****	0.278****	0.153**	0.064	0.161**
Epidemic	0.238****	0.227****	0.079	0.059	0.047

\*p < 0.10; \*\*p < 0.05; \*\*\*p < 0.01; \*\*\*\*p < 0.001.

Note: Cramér's V >0.25 = Very strong association; >0.15 = Strong association.

**Table 5**  
Association (Cramér's V) between health promoting behavior and perceived obstacles faced by pilgrims'.

Obstacles to prevent or treat health risks	Health Behavior				
	Medicine From Country	Vaccination	Personal Hygiene	Use Hand Sanitizer	Washing Hands
Not enough hospital/clinic	0.140**	0.076	0.091	0.004	0.059
Accessing Prescription medicines	0.130*	0.077	0.122*	0.126	0.079
No help from service providers	0.050	0.053	0.031	0.157*	0.067
Language barriers	0.086	0.102	0.119*	0.241****	0.057
Trust service providers	0.016	0.102	0.125*	0.137	0.029
Expensive	0.043	0.017	0.023	0.072	0.020

\*p < 0.10; \*\*p < 0.05; \*\*\*p < 0.01; \*\*\*\*p < 0.001.

Note: Cramér's V >0.25 = Very strong association; >0.15 = Strong association; >0.10 = Average association.

**Table 6**  
Association (Cramér's V) between health promotion behavior and pilgrims' cues for action.

Cues that indicate proneness to health hazard	Health Behavior				
	Medicine From Country	Vaccination	Personal Hygiene	Use Hand Sanitizer	Washing Hands
<b>Internal Cues</b>					
Shortness of breath	0.212****	0.194***	0.161**	0.100	0.070
Sweating	0.125*	0.083	0.227****	0.177**	0.097
Rash	0.086	0.100	0.069	0.136	0.061
Cough and Cold	0.101	0.002	0.007	0.069	0.049
Stomach ache	0.223****	0.181***	0.040	0.260****	0.093
<b>External Cues</b>					
Information Newspaper/TV/Radio	0.161**	0.075	0.062	0.095	0.096
People wearing masks	0.114*	0.053	0.013	0.196**	0.094
Messages through social media	0.034	0.048	0.131**	0.128	0.008
Overcrowding on the roads	0.084	0.106	0.101	0.242****	0.047
Overcrowding in tents	0.071	0.085	0.113*	0.275****	0.041

\*p < 0.10; \*\*p < 0.05; \*\*\*p < 0.01; \*\*\*\*p < 0.001.

Note: Cramér's V >0.25 = Very strong association; >0.15 = Strong association; >0.10 = Average association.

actions did you take or will you take to ensure you don't get sick during Hajj? (measured as 1 = Yes and 0 = No) and (2) How confident are you about your ability to take a successful protective health action? With responses ranging from taking no action i.e. not at all = 1 to taking a protective action to some extent = 2, great extent = 3 and very great extent = 4. The percentages represent the self-capacity or capability to take an action in comparison to not taking the action. For instance, 95% of individuals who were confident to take a protective action to 'very great extent' reported maintaining personal hygiene. Findings suggest that personal hygiene and washing hands are the most common health behavior actions (see Table 7). While no pattern of increase in extent of confidence to health behavior could be observed, behavior of bringing medication from their own country and use of hand sanitizers reported lower percent of health behavior actions taken even with individual reporting great to very great extent of self-efficacy.

**5. Discussion**

The answers to the five research questions have implications for theory and practice. Findings extend the use and applicability of the HBM to health promotion and education for religious crowds. It has

**Table 7**  
Pilgrim's ability to successfully take health promoting behavior.

Confidence to take Protective Action	Health Promoting Behavior Taken				
	Medicine From Country	Vaccination	Personal Hygiene	Use Hand Sanitizer	Washing Hands
Not At All	79.17%	66.67%	95.83%	75.00%	91.67%
Some Extent	82.05%	82.50%	95.00%	83.54%	97.47%
Great Extent	71.88%	82.65%	95.96%	75.76%	99.01%
Very Great Extent	69.57%	75.00%	95.00%	68.18%	95.65%
Average	75.66%	76.71%	95.45%	75.62%	95.95%

practical implications for Hajj authorities and mission authorities, tour operators, healthcare providers and emergency managers in Saudi Arabia and sending countries about pilgrims' preferences for receiving health information and their patterns of adoption.

First, this study enabled evaluating five health threats and found that heatstroke, vomiting, diarrhea, pre-existing health problems and epidemics, were all perceived as serious health threats by the pilgrims for

which they were more likely to bring medicines from their home country and being vaccinated pre-travel. The finding is similar to other HBM studies which have documented that perceived seriousness of a threat and perceived susceptibility [22,23,25] can explain the likelihood of a person engaging in healthy behavior. In the post COVID-19 environment, the perceived risk from infectious diseases will definitely rise, requiring additional solutions by government agencies, mass gatherings event managers and the participants alike. With the need to maintain safe distancing to prevent the spread of infections, the KSA authorities will need to call for a more active role of transportation professionals along with other safety and security management sectors. In recent years scholars have documented the valuable role that these professionals have played in the planning, management and evacuation operations following other disasters like hurricanes [44,45]. Better policies by Hajj authorities to ameliorate vehicular and pedestrian traffic congestion and gridlock at the various ports of entry into the country and the shrine sites will help reduce the perceived threat from epidemics.

Second, on average an overwhelming majority of pilgrims (95%) had taken or were willing to adopt at least three of the five health promoting actions which were—bringing medicines from country of origin, taking vaccinations prior to travel, using hand sanitizer, maintaining personal hygiene, and washing hands. Pilgrims with chronic pre-medical conditions especially the elderly are likely to bring prescribed medications. However, during pre-travel advisories provided by country missions, pilgrims should also be encouraged to bring generic medicines for common ailments such as headache, cough, cold, body ache, fever, insect bites, heat rash etc., so as to mitigate the challenges of acquiring them in Mecca or Mina.

Pilgrims being vaccinated may not be a matter of choice because the KSA mandates that every pilgrim must be vaccinated with the Meningococcal quadruple vaccine (meningitis A, C, W, Y) and produce a certificate issued not less than ten days prior to travel and no more than three years prior, if they are to enter the country. They also recommend the seasonal influenza (flu) vaccine and the Pneumococcal vaccine, but do not require it [39]. It may be worthwhile to see if there are differences in willingness of pilgrims from certain regions of the world to take these additionally recommended vaccines. In light of the Covid-19 Pandemic, vaccination requirements are likely to be even more stringent such that vaccines earlier recommended may be mandated and others added to the list.

Maintaining personal hygiene and washing hands come easily to Muslim pilgrims because it is a common Islamic purification ritual called 'Wudu', of washing the face, arms, hands, feet and mouth performed before prayer five times a day. This ablution practice is considered as preparing for "an appointment before God" [36]. Future studies could also compare such protective actions with believers of other religions on a pilgrimage to understand if this is a common practice with them and if they perceive it to be of importance to reduce health threats.

Third, a majority of the Hajj pilgrims accessed health information face-to-face from mission authorities and Hajj authorities, and at mosques. This is likely because Hajj pilgrims converge from different regions of the world and speak different languages. Hence, as visitors they are likely to trust the information received in their language from mission authorities representing their home countries and helping them with various arrangements, and Hajj authorities and revered religious cleric in mosques. This is similar to other studies that have found that where there are language barriers, people prefer to receive risk information face-to-face from trustworthy sources [38]. Additionally, pilgrims receiving information from billboards and Twitter were associated with taking protective actions. This suggests that the investments made by the Saudi government to set up billboards along the routes to the various sacred shrines in different languages is working to increase health awareness and is laudable and can be continued. Various Saudi government agencies related to the Hajj pilgrims' requirements can create excluding agency specific Twitter handles and put out regular Tweets in multiple languages about health and weather updates for pilgrims' as it

is a popular medium.

Fourth, as with prior studies this study found that access barriers prevented adoption of healthy actions. Pilgrims expressed difficulties in acquiring prescription medications, getting information from service providers, and language barriers. These challenges may emerge because on average respondents stayed in the holy city for a month during the pilgrimage. It is likely that elderly pilgrims run out of medications or need medications for newly emerging health conditions during Hajj. The KSA initiated the National eHealth program in 2011 to provide the highest standards of health services and information to the Saudi population [30,31]. In 2018, in an effort to make eHealth adoption easier and more accessible, the government launched the 'Seha' mobile app to provide virtual health consultations for over million patients, thereby reducing doctor waiting times and human related errors [32,33].

The eHealth program is also set up with reliable translation services and visual media to reduce language barriers. Other apps like Mawid, Ashanak and Mawared are also available for booking patient appointments and manage healthcare employees. However, it is unclear whether these and other apps are available to international pilgrims. This needs further investigation as these have potential to reduce the access barriers that pilgrims expressed in the current study. Training and increasing the number of multi-lingual staff at healthcare clinics and mobile health units and pharmacies will also be a worthwhile effort during the Hajj pilgrimage season.

Fifth, similar to other HBM studies which found cues to action triggering healthy action adoption [19,26], two internal (shortness of breath and stomachache) and two external cues (overcrowding on roads and overcrowding in tents), influenced respondents intentions to take protective actions. In the future various channels of communication by the Hajj authorities [4,5,10,30] can be emphasize real time information related to hazards of overcrowding and suggest mitigation measures. They can ensure that a larger audience of believers will be reached and take timely health protective actions as advised by various information sources [24]. These communication channels should also include pre-travel health advice before pilgrims embark on their journey about existing and emerging health problems.

Sixth, this study found a seemingly paradoxical effect. Pilgrims with greater self-efficacy or self-confidence in their ability were less likely to take protective actions. This is unlike previous studies [27] which suggests that self-efficacy leads to a positive change and more adoption of healthy behavior. This warrants further investigation along lines of social class or age differentials.

### 5.1. Limitations

As with any study, this study has its limitations.

- 1 The sample size of 245 is small considering that the number of annual Hajj pilgrims is close to two million. Thus the generalizability of the findings is not possible. Yet, it is valuable as a starting point to study the attitude of this unique population.
- 2 Only English and Arabic speaking pilgrims who could be conveniently accessed and interviewed were included due to the bilingual capacity of the surveyors. Thus, pilgrims speaking other languages, including Urdu, Hindi, Malay, Turkish, Farsi, French, were missed. Future studies should be aimed at interviewing people speaking more languages.
- 3 The team encountered difficulties in reflecting upon the opinions of female pilgrims since the team consisted of all men and the Middle Eastern culture limits their interactions with the opposite gender in public. Only (11.4%) of the total number of participants were females. Future studies need to have female surveyors on the team, to capture the unique health related challenges that women in various stages of their life cycle face.
- 4 The HBM fails to account for factors such as environmental components and personal emotions [25], or message content that are likely



to influence health promoting actions selection. Future studies could use a modification of the model to focus on these additional factors.

5 The study was not designed to collect information on specific threats and their associated protective actions, but rather we collected data on a set of threats and compiled a set of loosely associated protective actions and aggregated the measure to a '1' or '0' variable. Future studies would merit from a categorization of health threats such as infectious diseases, non-infectious causes, physical injury and trauma and specific protective actions to be adopted for each one to reduce the threat at, the individual/pilgrim level. Furthermore, studies that measure the impacts of improvements to environmental conditions to protect crowds from stampedes or physical injuries at various entry and egress points, and maintaining safety and security measures by strict ticketing, counting, deploying security officers and installing CCTV cameras etc. at the various shrines sites, hotels, lodges and ports of entry will be useful.

Despite these limitations, this study makes a unique contribution and is a timely topic as the world faces the Covid-19 pandemic crisis and the roles of engagement and holding mass gatherings for recreation and religious purposes change.

## 6. Conclusion

Over two million religious tourists have been traveling annually to Saudi Arabia to attend the holy pilgrimage of Hajj. Keeping these pilgrims safe from crowd crush and health threats like sunstroke, skin infections, recurrences of prior medical problems, and the spread of contagious diseases is a challenging endeavor for the KSA. The government has allocated huge investments for health communication and prevention programs to ensure that local and visiting pilgrims are aware of various health threats and how to mitigate them. This research used the Health Belief Model (HBM) to evaluate the 2017 Hajj pilgrims' perceptions of health risks, their patterns of receiving health information from various traditional and new media channels and their adoptions or intentions to take health-promoting behavior in light of various challenges.

Similar to other studies that looked at what increased the adoption of early screening and testing for cervical cancer [20] or safe driving behavior [22] following health education campaigns, this study found the HBM to be of value. Factors including seriousness of threat and perceived consequences, impressed upon by familiar respected sources through face-face methods, social media such as tweeter and Facebook or billboards and at mosques were strongly associated with taking health promoting actions; while access barriers such as difficulties in purchasing prescription medicines, talking to providers, language and expense barriers were detrimental to adopting healthy behavior.

This year due to the COVID-19 pandemic crisis, the Saudi officials have drastically limited the number of pilgrims who can perform the 2020 Haj (28th July–August 2) for the first time since the kingdom was established in 1932. Only 1000 pilgrims who are already residing in Saudi Arabia will be permitted to complete the pilgrimage. The World Health Organization (WHO) welcomed this decision as it will curb the likely spread of COVID in KSA and also in home countries where the pilgrims returning to. Our findings indicate that there are opportunities for practitioners in the government, for profit and nonprofit sectors including faith-based groups to better prepare vulnerable future Hajj travelers through more robust pre-travel protection against increased health risks [29,37].

The Covid-19 pandemic underscores the importance of trend analysis and forecasting and sharing of data globally between developed, developing and under developed countries as we are all in this together. Different relevant agencies in KSA and the sending countries need to serve as sentinels to identify, track and monitor these pilgrims through their various stages of travel – pre-travel, during Hajj and post-travel as they can be carriers of deadly infections through any of these stages.

Many Hajj travelers from poorer countries may not seek pre-Hajj travel advice or care and due to weak laws and monitoring mechanisms not take any protective actions. This is an opportunity for NGOs in the host country to provide support.

Finally, the Saudi Hajj authorities and foreign governments and missions, need to acknowledge that pilgrims are responsible parties as by their very nature of embarking on this pilgrim form a disciplined and cautious crowd that can be trusted to participate in healthcare activities. Hence, programs in host and sending countries should enable these pilgrims to act collectively to educate and monitor their own groups (i.e. from specific country missions). They can also plan for incidents and emergencies to increase their health awareness and ensure safety in risky situations.

## Data availability statement

The data that support the findings of this study are available from the first author Dr. Hassan Taibah, upon request.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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