

The Impact of Social Media in Promoting Healthy Behaviors Among Hajj Pilgrims in Saudi Arabia

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Abstract: One of the biggest annual religious gatherings is Hajj, which can have significant health risks to the pilgrims, including overcrowding, filth, and increased risks of acquiring diseases. Practicing social media is informative and can aid in promoting healthy practices among pilgrims. This study aims to examine the effect of social media on health behaviors during Hajj using Media System Dependency (MSD). A self-administered questionnaire was distributed to a census sample of 400 pilgrims to assess their utilization of social media for health information. These findings indicate that additional factors such as credibility, usability, and interest in health content influence the pilgrim's reliance on health social media. The use of social media following a pilgrimage trip depends upon age and education; older people search a lot on social media to find health information. Social media's role in public health communication in mass events is studied while offering guidelines to improve health promotion during Hajj and other international events.

Keywords: Hajj, Public Health, Social Media, Media Reliance Theory, Disease Prevention, Health Communication

Introduction

Hajj is one of the largest religious gatherings, attracting more than two million people yearly (Shafi et al., 2008). This huge congregation also presents chances of congregating, congestion, and pollution that make pilgrims more vulnerable to diseases than usual (Hoang et al., 2020). Hajj is one of the great pillars of the Islamic faith, and the movement is not only spiritually energetic but also a vigorous journey. During the Hajj period, health concerns become a significant factor affecting people's well-being (Jokhdar et al., 2021). First, the challenges become even more complex because pilgrims come from many cultural backgrounds and have varying understandings of health. As a result, they pay different levels of attention to staying healthy during the pilgrimage. Because this is such a diverse pilgrimage, it is important to integrate appropriate health communication strategies that improve regard and respect for public health measures to make the pilgrimage safer for all travelers (Goni et al., 2020).

The concept suggests that social media networks are helpful platforms that successfully promote healthy practices among pilgrims. Some of the most effective tools for mass socializing are websites like Facebook, Twitter, and YouTube, as they allow an audience to get to them quickly. Health directives and enhancing the practice and adherence to health-promoting behavior of the pilgrims are disseminated via these platforms during their pilgrimage (Khadijah et al., 2022). People see how social media networks can foment behavioral changes, especially in significant situations such as Hajj, where they need up-to-date updates, highly personalized messages, and peer support. Avery (2010) explained that social media's key features include real-time communication, coverage, and interactivity (Avery et al., 2010). These aspects make social media a powerful tool for delivering health information and motivating pilgrims to act. For instance, the effectiveness of social media campaigns on vaccines and disease prevention demonstrates the future potential of these media forms in enhancing health outcomes (Odone et al., 2015).

Social media also supports decision-making, helping users manage stress and increase health awareness. According to Maher et al. (2016), using social media to share health information is evident, and ensuring that the campaigns are relevant to the users is paramount (Maher et al., 2016). However, factors such as computer literacy level, content, and cultural differences, as highlighted below, diminish the effectiveness of these campaigns. According to Roberts et al. (2017), a lack of digital literacy limits one's ability to evaluate and scrutinize health information (Roberts et al., 2017), while according to Viswanath and Kreuter (2007), culturally appropriate messages are vital in communication. By directly addressing these limitations, this study aims to provide credible, relevant, and culturally sensitive content. This is essential for encouraging pilgrims to follow healthy practices during Hajj. (Viswanath & Kreuter, 2007).

Despite extensive literature on social media's role in promoting health awareness, there remains a significant gap in addressing the unique health risks and communication challenges associated with the Hajj pilgrimage. Existing studies often emphasize general health knowledge dissemination but overlook the complex task of driving meaningful behavior change in a diverse, high-density environment like the Hajj. Research on how social media can promote health-conscious behaviors during Hajj is scarce, particularly compared to other pilgrimage seasons or mass gatherings (Setiawan et al., 2020). Moreover, the lack of international references to health communication strategies in pilgrimage tourism further limits a comprehensive understanding of how to tailor health campaigns for diverse, multicultural audiences (Alnabulsi et al., 2020). This study addresses these gaps by moving beyond general observations to offer practical strategies for implementing effective, culturally sensitive, social media-based health communication during Hajj and other large-scale events worldwide.

Unlike prior studies that explore the broad application of social media in health promotion, this study focuses on the distinct challenges of health promotion in Hajj, a high-risk, multicultural mass gathering. For instance, Ghahramani et al. (2022) review the general effectiveness of social media campaigns. Hopkins and Reicher (2021) examine health risks in mass gatherings; neither study delves into the specific cultural, linguistic,

and logistical hurdles the Hajj presents (Ghahramani et al., 2022; Hopkins & Reicher, 2021). Similarly, Jaime Garcia-Iglesias et al. (2023) discuss the role of social media in public health crises like the mpox outbreak. However, they do not address the unique needs of transient, multicultural populations (Garcia-Iglesias et al., 2023). Memish et al. (2019) highlight health risks at religious and sporting events but do not explore the behavior change potential of social media platforms (Memish et al., 2019). This study advances the discourse by examining how trust in credible, culturally sensitive, and user-friendly content influences health behavior during Hajj. It underscores the importance of tailored, multilingual social media campaigns to effectively meet the health needs of pilgrims. It offers a framework for extending these strategies to other high-density gatherings globally.

To guide this investigation, the study applies Media System Dependency (MSD) Theory, which explains how people depend on credible media sources for health-related decisions, especially in high-risk, multicultural environments like the Hajj. The study also integrates Social Identity Theory (SIT) and Emergent Norm Theory (ENT) to further address collective behavior in such dense settings. These frameworks help explain how shared group identity and emerging norms influence health behavior change among pilgrims, a transient population navigating complex health communication needs. This study's novelty lies in its focus on promoting health behaviors within the high-risk, high-density setting of Hajj, using social media to drive real behavior change. Unlike general health awareness studies, this research focuses on changing health behaviors among people from different cultures. It specifically looks at pilgrims who travel temporarily for Hajj, a group known as a transient population. The study emphasizes the importance of culturally sensitive, multilingual campaigns that help build trust among religious participants. In this situation, changing people's behavior depends on how reliable the health information is. Previous research by Alqahtani et al. (2019) and Vance et al. (2019) showed that credible sources make people much more likely to stick to healthy habits (Alqahtani et al., 2020; Vance et al., 2009). This shows that staying in touch with reliable sources is important for following health rules during Hajj. Based on this rationale, this study's central research question is: How does social media influence health behaviors among Hajj pilgrims, particularly regarding information dissemination, engagement, and adherence to preventive health practices?

The primary objectives of this study are:

1. To identify the role of social media platforms in promoting healthy behaviors among pilgrims during Hajj tourism.
2. To understand how social media platforms, disseminate health information and encourage healthy behaviors among pilgrims during Hajj tourism.

The findings of this study are valuable in understanding how social media can drive behavior change among pilgrims, who can be similarly leveraged for other large-scale events like the World Cup or Olympic Games, where a large transient and at-risk population exists. This shows how social media can enhance adherence to healthy practices, contribute to managing acute health needs, and inform on a scale that influences national public health strategy. Though this study focuses on using social media when engaging in religious events, it investigates how pilgrims can utilize social media to access health information relevant to their particular culture, such as the information they need from reputable sources. These findings provide new paradigms that reveal the potential of social media as a scalable communication channel with reach and specificity, especially in populous and diverse areas around the globe; moreover, these paradigms offer new avenues for public health practice.

Theoretical Framework:

The research questions aim to apply Media System Dependency (MSD) Theory to examine how the use of social media impacts health behaviors during the Hajj pilgrimage. Media System Dependency (MSD) Theory helps understand how people from different cultural and language backgrounds use media during events like the Hajj. This pilgrimage has many health risks, so pilgrims often rely on trusted media sources to help them stay informed

and safe. Reliance on spiritual and authoritative figures in religious contexts often complements media usage. However, in multicultural settings, the role of media as a trusted, culturally relevant source becomes even more critical. As theorized by Ball-Rokeach and DeFleur (1976), this reliance enhances engagement with and following health advice or guidelines (Ball-Rokeach & DeFleur, 1976). To evaluate its applicability, Media Reliance Theory is compared against other health behavior models, such as the Health Belief Model (HBM) and the Uses and Gratifications Theory, which are limited in explaining health behaviors in the specific context of Hajj.

The Health Belief Model (HBM) focuses on individual perceptions of susceptibility, severity, and benefits of health actions, making it particularly effective in small-scale or individualized health interventions (Rosenstock, 1974). However, it does not adequately capture the collective reliance on shared, credible media platforms observed during mass gatherings like Hajj, where individuals seek timely, culturally sensitive information. Research on mass gatherings highlights that health-related behavior during such events is influenced by a sense of belonging to a group (shared social identity) and how people behave together in groups, rather than purely individual factors (Memish et al., 2019). Although HBM primarily focuses on individual health perceptions, existing research also shows that it can be adapted to group settings. This is done through cues to action like social media alerts, increasing collective risk awareness, and peer behaviors that reinforce health practices in a group context (Jia et al., 2024). However, despite this adaptability, HBM cannot fully address the complex, collective, and dynamic behaviors seen in multicultural mass gatherings like Hajj, where Media System Dependency Theory (MSD), Social Identity Theory (SIT), and Emergent Norm Theory (ENT) offer a more holistic understanding. Furthermore, large gatherings like Hajj demand communication strategies incorporating cultural and linguistic relevance to cater to diverse populations, which exceeds the scope of HBM's focus on individual health perceptions (Hopkins & Reicher, 2021; Khazaie et al., 2021).

Similarly, the Uses and Gratifications Theory (UGT) offers insights into the motivations for media usage, such as seeking information, entertainment, or social connection (Katz et al., 1973). While UGT effectively explains why individuals engage with specific media platforms to satisfy personal needs, it does not account for the critical dependency on media for reliable information during emergencies or high-stakes environments like the Hajj. For example, UGT focuses on how individuals actively choose media to fulfill gratifications, such as information-seeking or social interaction. However, recent research highlights that UGT extends beyond individual motivations to include social engagement, peer influence, and collective information-sharing, particularly in mass gatherings like Hajj (Hossain, 2019; Wibowo, 2022). Despite this adaptability, UGT still falls short in fully capturing the complex, collective, and dynamic health behaviors observed in multicultural, high-risk environments such as Hajj, where the necessity-driven and group-oriented reliance on trusted media is more prominent. Therefore, while HBM and UGT offer valuable insights into individual health decisions and media motivations, they are less effective in addressing mass gatherings' collective, culturally diverse dynamics. In contrast, the combined use of Media System Dependency (MSD) Theory, Social Identity Theory (SIT), and Emergent Norm Theory (ENT) provides a more context-sensitive and holistic understanding of how pilgrims access, interpret, and act on health information in such complex environments. In contrast, Media System Dependency Theory directly address the dependency on media for accessing timely, accurate, and culturally appropriate information in environments where 'critical and timely information' is essential for decision-making and behavior change (Ball-Rokeach & DeFleur, 1976). It aligns with the study goals by conceptualizing the susceptibility of pilgrims to social media utilization and its effects on their cognitive, emotional, and behavioral responses. Lin et al. (2018) further support the theory's relevance by identifying demographic factors such as age, gender, and education as key determinants of media usage (Lin & Chang, 2018). Chen et al. (2021) extend this understanding by comparing the differential implications of media reliance for health behavior, particularly in diverse populations like those encountered during Hajj (Chen et al., 2021).

Media System Dependency (MSD) Theory, Social Identity Theory (SIT), and Emergent Norm Theory (ENT) collectively offer a holistic framework to understand health behavior change among Hajj pilgrims. MSD Theory explains how individuals, particularly in high-risk and multicultural environments like Hajj, rely on credible media sources to acquire essential health information. SIT further complements this by illustrating how group identity and belongingness among pilgrims influence their receptiveness to health messages shared on social media. Meanwhile, ENT emphasizes how new behavioral patterns emerge in response to observing others in unfamiliar, crowded settings like the Hajj. Together, these theories capture the dynamic interaction between media dependency, social influence, and evolving group norms, offering a comprehensive understanding of how pilgrims access, internalize, and act upon health information during large-scale mass gatherings. This interaction is visually represented in Figure 1, which illustrates how MSD, SIT, and ENT collectively influence pilgrims' cognitive, emotional, and behavioral health outcomes through social media engagement.

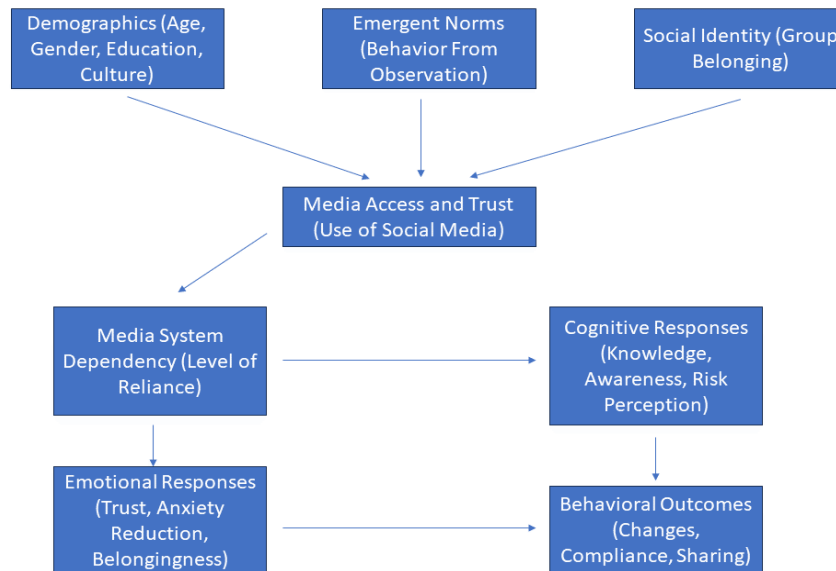


Figure 1: Framework illustrating the role of social media in shaping cognitive, emotional, and behavioral health outcomes among Hajj pilgrims.

Moreover, Media System Dependency Theory is uniquely suited to explain how social media serves as a sufficient motivator for behavior change, encompassing not only the dissemination of health-related guidelines but also the reinforcement of preventive measures (Ruggiero, 2000). By addressing the preparedness of different demographic groups to engage with social media for health information, the theory underscores its utility in examining the varied and dynamic needs of stakeholders involved in the Hajj pilgrimage (Riaz et al., 2023). Consequently, the theory provides a strong basis for analyzing how reliance on social media influences people's health actions or results, particularly in culturally diverse and crowded settings like Hajj (Wu et al., 2018). Media System Dependency Theory, Social Identity Theory, and Emergent Norm Theory offer a comprehensive framework to understand how pilgrims consume, internalize, and act upon health information. These theories collectively explain how trusted media, shared group identity, and emerging social norms shape behavior change during large-scale, multicultural events like Hajj.

Hypothesis development

Grounded in the Media System Dependency Theory proposed by Ball Rokeach (1976), the hypotheses developed for this study aim to rigorously assess the influence of social media on the health behaviors of Hajj pilgrims (Ball-Rokeach & DeFleur, 1976). As detailed in Table 1, these hypotheses align with key tenets of the theory, including the credibility of social media sources, the accessibility and timeliness of content, and demographic factors such as age, gender, and education that shape media usage. This theoretical framework provides a robust foundation for investigating how reliance on social media platforms impacts health behaviors during the Hajj pilgrimage. By focusing on the interplay between social media utilization and health promotion, the study's hypotheses are framed to encapsulate the essential mechanisms through which social media can effectively drive health-conscious practices among diverse populations of pilgrims.

Table 1: Hypotheses Development Based on Media System Dependency Theory

<i>Media System Dependency Theory Principle</i>	<i>Corresponding Hypothesis</i>
Individuals tend to depend more on media sources that they perceive as credible and trustworthy.	H1: There are statistically significant differences in the use of social media for health awareness during Hajj based on the confidence in its credibility and trustworthiness.
Media consumption is driven by individuals' specific needs or goals, which enhances their engagement with the content.	H2: A positive relationship exists between the motives of pilgrims for using social media and their level of engagement with health-related content during Hajj.
The likelihood of individuals relying on a media platform increases with the platform's accessibility and ease of use.	H3: The ease of use of social media platforms is positively related to the level of engagement with health-related content during Hajj.
Media is more likely to influence behavior when it provides content that matches the individual's interests and needs.	H4: There is a positive relationship between pilgrims' interest in health awareness content and their level of social media use for health information during Hajj.
Interaction with media content can intensify its cognitive, emotional, and behavioral impact on the audience.	H5: Pilgrims who interact more with health-related content on social media are more likely to use these platforms as a primary source of health information during Hajj.
The stronger the reliance on a particular media source, the greater its influence on an individual's decision-making and behavior.	H6: A positive correlation exists between the reliance on social media for health information and its influence on health behaviors during Hajj.
Demographic factors, such as age, gender, and education, shape media usage patterns and the degree of reliance on different media.	H7: Significant differences exist in the use of social media for health awareness during Hajj based on demographic variables such as gender, education, and age.
Individual characteristics, including demographic variables, influence the effectiveness of media in raising awareness and promoting behavior change.	H8: Significant differences exist in health awareness during Hajj based on demographic variables such as gender, education, and age.

Methodology

This study uses a cross-sectional survey approach to quantitatively examine the effectiveness of social media in encouraging healthier behaviors during the Hajj. The concern is to identify the extent to which pilgrims use social media to access health-related information and how this impacts their health practices during the journey.

Study Design

Based on the research questions and objectives, a cross-sectional survey design was used to obtain quantitative data from Hajj pilgrims. This design ensured that data was collected at a specific point in time, which gives information concerning the diversity of pilgrims' experiences and behaviours during Hajj.

Sample Population

In this study, the target respondents were 400 Hajj pilgrims in Saudi Arabia who occasionally or actively use social media during the Hajj exercise. A sample size of 400 was deemed adequate based on Krejcie and Morgan's (1970) guidelines, which recommend a minimum of 384 participants for populations exceeding 1 million, ensuring a 95% confidence level with a $\pm 5\%$ margin of error (Krejcie, 1970). Given the Hajj's annual attendance of over 2 million pilgrims, this sample size provides sufficient representation and statistical reliability. The sample size was sufficient to ensure statistical strength and meaningful results, allowing for the Hajj pilgrimage population to be generalised. The participants included both males and females of varying ages and educational backgrounds to provide a comprehensive understanding of the effects of social media on health risk awareness among pilgrims.

Data Collection

Paper and online self-administered questionnaires with closed-ended items were used to gather information on the types of social media that the Hajj pilgrim users turn to for health information during the pilgrimage. Demographic data, including age, gender, education level, and region of the respondent, their social network profile usage pattern, frequency of active participation in the social network, and credibility of health-related content obtained from social networks, were also captured in the survey. While this dual method ensured inclusivity, it posed challenges such as potential inconsistencies between paper and online responses and excluded individuals with limited digital access. This approach nevertheless provided a broad examination of social media's role in raising health awareness among pilgrims.

Data Analysis

The quantitative data from the surveys was analyzed using descriptive statistics, correlation analysis, and inferential statistics, such as one-way ANOVA and t-tests. These analyses were conducted to compare social media use across different demographic groups and to test the hypotheses regarding the relationship between social media use, engagement with health-related content, and the impact on health behaviors during Hajj.

Ethical Considerations

All participants voluntarily participated and provided their informed consent. Data confidentiality was maintained throughout the research process. Given the religious context of Hajj, the study took special care to respect participants' cultural and spiritual practices. Data collection was conducted sensitively to religious observances, and all team members were trained to ensure culturally respectful interactions.

Results:

Demographics

The demographic of the 400 Hajj pilgrims who responded to this study is diverse and appropriate for exploring the importance of social media for raising health awareness during the Hajj pilgrimage, as presented in Table 2. Men constituted the most significant % of the sample at 55%, while women comprised the remaining 45%. The pilgrims' wide age range showed that 52% were between 31 and 50, 28% were between 18 and 30, and the remaining 20% were over 50. Regarding educational background, 60% of the respondents had a bachelor's degree or higher, significantly reducing the probability of encountering individuals with low digital literacy.

The regional distribution of the respondents corresponds to the nature of Hajj and indicates South Asian 30%, Middle Eastern 25%, South-East Asian 20%, African 15%, and other respondents 10%. This diversity is valuable in considering the cultural and linguistic differences in using social media for disseminating health information during the Hajj. Furthermore, 60% of the respondents were first-time pilgrims, highlighting the potential reliance on social media for health information.

Table 2: Demographic Characteristics of the Study Sample

<i>Characteristic</i>	<i>Category</i>	<i>Frequency (n=400)</i>	<i>Percentage (%)</i>
Gender	Male	220	55
	Female	180	45
Age Group	18-30	112	28
	31-50	208	52
	51+	80	20
Educational Background	Primary Education or Less	60	15
	Secondary Education	100	25
	Bachelor's Degree or Higher	240	60
Geographic Distribution	South Asia	120	30
	Middle East	100	25
	Southeast Asia	80	20
	Africa	60	15
	Other	40	10
Frequency of Hajj Participation	First Time	240	60
	2-3 Times	120	30
	More than 3 Times	40	10
Primary Language	Arabic	160	40
	English	120	30
	Urdu	80	20
	Other	40	10

Most Used Social Media Platforms for Health Awareness during Hajj

This study identifies the preferred social media sites for obtaining health information among the Hajj pilgrims, with significant implications for health campaigns. 88% of the respondents used Facebook as their primary platform, with males using it more frequently (90.91%) than females (84.44%), indicating a statistically significant difference. WhatsApp was popular with 72% of pilgrims, regardless of gender. There was no significant difference in active usage for all other platforms between male and female students: YouTube and Twitter (X) were nearly identical. At the same time, Telegram was significantly more popular among females (31.11%) than males (20.00%), with a factorial chi² value of 9.

These observations highlight the need for gender mainstreaming in health communication interventions, particularly on platforms like Telegram, to effectively reach female pilgrims. In conclusion, the findings emphasize the importance of user platform distribution and demographic targeting to enhance the effectiveness of health education during the Hajj. Table 3 below provides a detailed breakdown of social media platform usage by gender.

Table 3: Social Media Platform Usage by Gender During Hajj

<i>Platform</i>	<i>Males (N=220)</i>	<i>% Males</i>	<i>Females (N=180)</i>	<i>% Females</i>	<i>Total (N=400)</i>	<i>% Total</i>	<i>Z- Value</i>	<i>Significa nce</i>	<i>Ranki ng</i>
Facebook	200	0.9091	152	0.8444	352	0.88	1.977	Positive	1

WhatsApp	160	0.7273	128	0.7111	288	0.72	0.358	Negative	2
YouTube	136	0.6182	100	0.5556	236	0.59	1.265	Negative	3
Twitter (X)	96	0.4364	84	0.4667	180	0.45	0.605	Negative	4
LinkedIn	76	0.3455	64	0.3556	140	0.35	0.21	Negative	5
Telegram	44	0.2	56	0.3111	100	0.25	2.55	Positive	6
MySpace	60	0.2727	40	0.2222	100	0.25	1.159	Negative	7
Google Plus	52	0.2364	44	0.2444	96	0.24	0.188	Negative	8
Instagram	44	0.2	48	0.2667	92	0.23	1.572	Negative	9

Overview of Hypothesis Testing

H1: There are statistically significant differences in the use of social media for health awareness during Hajj based on the confidence in its credibility and objectivity.

The first hypothesis proposed that social media usage for health awareness during Hajj varies according to participants' confidence in the credibility and objectivity of these platforms. A one-way ANOVA test confirmed this, revealing a statistically significant difference between groups, with an F-value of 12.838 and a p-value of less than 0.001, as shown in Table 4. The effect size ($\eta^2 = 0.061$) further underscores the practical significance of these findings, indicating that confidence in credibility and objectivity explains a moderate proportion of the variation in social media use.

This moderate effect size highlights that while other factors may also influence social media usage, the perceived reliability and trustworthiness of the information play a pivotal role in shaping behavior. These findings validate Hypothesis 1, demonstrating that higher confidence in the credibility and objectivity of social media significantly increases its use for health information. This underscores the critical importance of reliable health-related content on social media, as it significantly influences user engagement and trust during events like the Hajj.

Table 4: Social Media Use for Health Awareness by Confidence Level

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Value	p-value	Effect Size (η^2)
Between Groups	12.985	2	6.492	12.838	***	0.061
Within Groups	200.775	397	0.506			
Total	213.76	399				

H2: There is a positive relationship between pilgrims' motives for using social media and their level of engagement with health-related content during the Hajj.

Hypothesis 2 posited a positive relationship between pilgrims' motives for using social media and their level of engagement with health-related content during the Hajj. This hypothesis was tested using the Pearson correlation coefficient, a measure of the strength and direction of the relationship between two variables.

As indicated in Table 5, the Pearson correlation coefficient between the motivations for using social media and the level of engagement with health-related content was 0.652, statistically significant at the 0.001 level. The effect

size ($r^2 = 0.425$) reveals that approximately 42.5% of the variance in engagement with health-related content is explained by pilgrims' motivations for using social media.

This significant effect size underscores the substantial influence of motivation on engagement, indicating that the stronger the motivation to seek health information, the greater the likelihood of engaging deeply with such content. This provides practical insight into pilgrims who are more motivated toward seeking health information through social media during Hajj, because if they account for such motivations when designing their health communication strategies, they will be more likely to engage in depth with such content.

Table 5: Motivations and Social Media Use for Health Awareness During Hajj

<i>Variable</i>	<i>N</i>	<i>Pearson Value</i>	<i>p-value</i>	<i>Level of Pilgrims' Use of Social Media</i>	<i>Effect size (r^2)</i>
Motivation for Using Social Media for Health	400	0.652	0.001	High	0.425

H3: The ease of use of social media platforms is positively related to the level of engagement with health-related content during Hajj.

Hypothesis 3 posited a positive correlation between the ease of use of social media platforms and the level of engagement with health-related content during the Hajj. The Pearson correlation coefficient was used to test this hypothesis, assessing the relationship between pilgrims' ease of use of social media platforms and their engagement with health-related content.

Table 6 shows a statistically significant correlation between the ease of use of social media platforms and the level of engagement with health-related content, with a Pearson's correlation coefficient of 0.582 at the 0.001 level. The effect size ($r^2 = 0.339$) reveals that approximately 33.9% of the variance in engagement with health-related content can be explained by the ease of use of social media platforms. This positive and statistically significant relationship indicates that as social media platforms become more usable, the engagement with health-related content related to Hajj increases.

In a practical context, more pilgrims will interact with health-related content if they find social media easier to navigate and use. Therefore, this points to the importance of a user-friendly interface in health messages during large-scale events like the Hajj. This finding aligns with Hypothesis 3, which suggests that enhancing the usability of social media platforms significantly boosts pilgrims' engagement with crucial health information.

Table 6: Ease of Social Media Use and Usage for Health Awareness During Hajj

<i>Variable</i>	<i>N</i>	<i>Pearson Value</i>	<i>p-value</i>	<i>Level of Pilgrims' Use of Social Media</i>	<i>Effect size (r^2)</i>
Ease of Use of Social Media for Health	400	0.582	0.001	High	0.339

H4: There is a positive relationship between pilgrims' interest in health awareness content and their level of social media use for health information during Hajj.

According to Hypothesis 4, pilgrims' interest in health awareness content increases as their interest in social media for health information increases. To test this hypothesis, the correlation between pilgrims' interest in health awareness content and their use of social media as a source of health information during the Hajj season was analyzed.

In addition, the level of interest in health awareness content showed a correlation with the use of social media platforms, with a Pearson correlation coefficient of 0.684 ($p < 0.001$), as presented in Table 7. The effect size ($r^2 = 0.468$) reveals that approximately 46.8% of the variance in the use of social media for health information can be explained by the level of interest in health awareness content. This strong positive correlation indicates that pilgrims' use of social media for health information increases when their interest in health awareness content

increases during their Hajj travels. In short, pilgrims who are more interested in health-related content are more likely to turn to social media to find such information.

Table 7: Health Awareness Content and Social Media Use During Hajj

<i>Variable</i>	<i>N</i>	<i>Pearson Value</i>	<i>p-value</i>	<i>Level of Pilgrims' Use of social media</i>	<i>Effect size (r²)</i>
Social Media Use for Health Awareness	400	0.684	0.001	High	0.468

The results support Hypothesis 4 and show the importance of inducing interest in health awareness to increase the display of health information through social media during the Hajj. This finding suggests that generating greater interest in health-related topics among pilgrims could lead to increased use of social media for health information, thereby improving public health outcomes during the pilgrimage.

H5: Pilgrims who interact more with health-related content on social media are more likely to use these platforms as a primary source of health information during Hajj.

Hypothesis 5 posited that pilgrims who engage more with health-related content on social media are more inclined to utilize these platforms as their primary sources of health information during the Hajj season. The hypothesis was tested by analyzing the correlation between the level of interaction with health awareness content on social media and the level of interaction with health sources through social media during the Hajj season.

According to Table 8, the Pearson correlation coefficient between the degree of interaction with health awareness content and use of social media platforms was 0.524 ($p < 0.001$). The effect size ($r^2 = 0.275$) reveals that approximately 27.5% of the variance in using social media as a primary source of health information can be explained by the degree of interaction with health awareness content.

Table 8: Interaction with Health Content and Social Media Use During Hajj

<i>Variable</i>	<i>N</i>	<i>Pearson Value</i>	<i>p-value</i>	<i>Level of Respondents' Interaction with Health Awareness Content</i>	<i>Effect size (r²)</i>
Social Media Use for Health Awareness	400	0.684	0.001	High	0.275

There was a positive and statistically significant correlation between how actively pilgrims engaged with health-related content on social media and their likelihood to use these platforms as a primary source of health information during Hajj. The results confirm Hypothesis 5, showing that greater health-related content use on social media is linked to more reliance on these platforms for health information during the pilgrimage. Given that active engagement with health content on social media also facilitates pilgrims' adoption of these platforms as reliable channels for accessing health information during the Hajj, addressing this issue is imperative.

H6: A positive correlation exists between the reliance on social media for health information and its influence on health behaviors during Hajj.

Hypothesis 6 posited that pilgrims who rely more on social media for health information are more susceptible to its influence, potentially leading to changes in their Hajj-related health behaviors. The hypothesis was tested by examining the correlation between pilgrims' use of social media as a source of health information and their cognitive, emotional, and behavioral outcomes.

As Table 9 shows, there were positive and statistically significant relationships across all three areas of influence. The correlation coefficient for cognitive effects was 0.582 (statistically significant at 0.001). The effect size ($r^2 = 0.339$) reveals that reliance on social media for health information explains approximately 33.9% of the variance in cognitive effects. Consequently, a greater reliance on social media for health information appears to be associated with more significant cognitive effects, such as a better appreciation and understanding of health matters during Hajj. Additionally, the correlation coefficient for emotional effects was 0.612 and statistically

significant at the 0.001 level. The effect size ($r^2 = 0.375$) indicates that reliance on social media explains 37.5% of the variance in emotional effects. This indicates that individuals who relied more on social media during the pilgrimage experienced more substantial emotional effects.

Table 9: Correlation Between Social Media Use for Health Awareness and Its Effects

<i>Effect</i>	<i>N</i>	<i>Pearson Value</i>	<i>p-value</i>	<i>Level of Using Social Media Sites for Health Awareness</i>	<i>Effect size (r²)</i>
Cognitive Effects	40	0.582	0.001	High	0.339
Emotional Effects	40	0.612	0.001	High	0.375
Behavioral Effects	40	0.712	0.001	High	0.507

The field of behavioral effects exhibits the highest correlation, with a Pearson correlation coefficient of 0.712, which is significant at the 0.001 level. The effect size ($r^2 = 0.507$) reveals that reliance on social media for health information explains 50.7% of the variance in behavioral effects. Therefore, the result indicates that the reliance of pilgrims on social media for health information has a significant positive effect, leading to more proactive and informed actions during Hajj. Thus, the findings support Hypothesis 6: There is a strong correlation between pilgrims' increased use of social media as a health information source during Hajj and increases in their cognitive, emotional, and behavioral effects. This underscores the role of social media as a key tool that influences health behaviors in the Hajj and other large-scale events.

H7: Significant differences exist in the use of social media for health awareness during Hajj based on demographic variables such as gender, education, and age.

Hypothesis 7 suggested that the use of social media for health awareness during Hajj significantly differs based on demographic factors such as gender, education, and age. This hypothesis was tested using a t-test for gender differences and a one-way ANOVA for education and age. Table 10 presents no significant statistical difference in the use of social media for health awareness by males and females during Hajj. These findings were confirmed with a t-test, yielding a non-significant t-value of 1.762 and an effect size of Cohen's $d = 0.18$, which indicates a slight difference in the mean scores between male and female pilgrims.

Table 10: Summary of Statistical Differences in Social Media Use for Health Awareness During Hajj

<i>Demographic Variable</i>	<i>Group</i>	<i>Mean</i>	<i>Statistical Test</i>	<i>F/T-value</i>	<i>p-value</i>	<i>Effect size</i>
Gender	Males	2.22	t-test	1.762	Not significant	Cohen's $d: 0.18$
	Females	2.08				
Education	Less than a University	1.98	One-way ANOVA	5.079	Significant at 0.01	$\eta^2=0.013$
	University	2.22	LSD post-hoc	0.2664**		
	Higher than University	2.23		0.2673*		

Age	Less than 30	1.91	One-way ANOVA	7.238	Significant at 0.001	$\eta^2=0.018$
	30 to 45	2.2	LSD post-hoc	0.0554	Not significant	
	45 and above	2.26		0.3517***		

In contrast, significant differences in social media use between educational levels were found in one-way ANOVA at an F-value of 5.079, which was significant at 0.01. The effect size for education, η^2 of 0.013, indicates a small effect, suggesting that while significant, the differences between educational groups account for a small proportion of the variance in social media use. Further, post hoc LSD tests showed that individuals with a university level of education or higher use social media more frequently for health awareness compared to those with less than a university level of education. The study found significant differences between individuals with higher than university education and those with lower levels of education, highlighting the critical role of education in social media usage for health information during Hajj.

Significant differences were also demonstrated in the use of social media between different age groups, as indicated by ANOVA with an F-value of 7.238 and a p-value less than 0.001. The effect size for age, η^2 of 0.018, reflects a small but meaningful effect. A post-hoc analysis showed that older pilgrims aged 45 and above use social media more for health awareness than younger participants, with significant differences between those aged 45 and above, 30 and under, and 30 to 45. These results suggest that older individuals rely more on social media for health information during the pilgrimage, further emphasizing the importance of tailoring social media health campaigns to demographic characteristics.

H8: Significant differences exist in health awareness during Hajj based on demographic variables such as gender, education, and age.

Hypothesis 8 stated that health awareness during Hajj, based on the demographics—gender, education, and age—would be significantly different. This hypothesis was tested through a series of statistical analyses, using a t-test for gender difference and a one-way ANOVA for education and age. Table 11 displays the statistically significant differences in health awareness based on gender during the Hajj. The t-value, 2.698, was significant at $p < 0.01$, with an effect size of Cohen's d equal to 0.27, indicating a small to medium difference in health awareness scores between males and females. Males had a mean health awareness score of 2.44, while females had a mean score of 2.24, suggesting that men were slightly more aware of health matters during the pilgrimage.

Table 11: Summary of Statistical Differences in Health Awareness During Hajj

<i>Demographic Variable</i>	<i>Group</i>	<i>Mean</i>	<i>Statistical Test</i>	<i>F/T-value</i>	<i>p-value</i>	<i>Effect size</i>
Gender	Males	2.44	t-test	2.698	Significant t at 0.01	Cohen's d: 0.27
	Females	2.24				
Education	Less than a University	2.16	One-way ANOVA	5.785	Significant t at 0.01	$\eta^2=0.013$
	University	2.37	LSD post-hoc	0.2174*		
	Higher than University	2.5		0.3400***		

Age	Less than 30	2	One-way ANOVA	51.659	Significant at 0.001	$\eta^2=0.018$
	30 to 45	2.43	LSD post-hoc	0.4348***		
	45 and above	2.73		0.7353***		

Results of the one-way ANOVA indicated significant differences in health awareness caused by education level, with an F-value of 5.785, significant at $p < 0.01$. The effect size for education, η^2 , was 0.013, suggesting a small but significant effect of education on health awareness. Post-hoc LSD tests showed that individuals with a university education, with a mean score of 2.37, as well as individuals with higher education, with a mean score of 2.50, had significantly higher health awareness compared to those with less education, whose mean score was 2.16. The university versus higher education levels did not significantly differ, indicating a plateau in health awareness with increasing education.

Similarly, ANOVA indicated significant differences in health awareness between age groups with an F-value of 51.659 and a p-value less than 0.001. The effect size for age, eta squared equal to 0.018, reflects a slight but notable effect of age on health awareness. Post-hoc analysis indicated that older participants aged 45 and above, with a mean score of 2.73, demonstrated significantly greater health awareness compared to participants aged 30 to 45, with a mean score of 2.43, and those under 30, with a mean score of 2.00. These results suggest that older individuals are more aware of health matters during Hajj, emphasizing the need for targeted health communication strategies based on demographic characteristics.

Discussion:

This study aimed to identify the channels most utilized by pilgrims for health information and how social media can influence healthy behaviors during the Hajj with Media System Dependency Theory and . The study revealed how social media influenced health-related behaviors as people engaged in immense gatherings to embrace their religion. Because of its credibility, ease of use, and ability to engage users, this study encourages using social media as an effective way to share public health information during large gatherings or emergencies. This study corroborates and enriches prior works to social media and health promotion on religious occasions. This study's findings align with Khadijah et al. (2022), underscoring the significance of Facebook in disseminating health information among Hajj pilgrims (Khadijah et al., 2022). Notably, males favored Facebook while females favored Telegram. These trends, as asserted by Maher et al. (2016), compare two online processes and suggest that health campaigns could be more effective if they align with the platform preference (Maher et al., 2016). Moreover, the results presented in this study align with those of Latha et al. (2020), who emphasized the broad use and measurably high level of Facebook participation in health promotion (Latha et al., 2020). Tailoring health communication strategies to account for differences between men and women can help improve the effectiveness of health campaigns during events such as the Hajj.

These findings align with previous research that highlights credibility as a crucial factor influencing the use of social media for health information. This study found that pilgrims who trusted the authenticity of the information on these platforms were likely to rely on the health information during Hajj. This confirms the findings of Jin et al.'s (2021) research, which shows that trust plays a key role in using social media to share health knowledge (Jin et al., 2021). Likewise, Huo et al. (2018) established that perceived trust in the quality and source of health information significantly impacts usage behaviors, especially in health communication; hence, credibility is a critical determinant of healthy uses (Huo et al., 2018).

However, the convenience of social media platforms also significantly boosted the interaction with health-related information and content. This is consistent with Jiang et al. (2024), where user-friendly platforms promote sharing health information with the general population (Jiang et al., 2024). Ruggiero (2000) has also

pointed out how reliance on the media is a function of its easy use and interesting appeals, especially where stress is high, as in the case of Hajj (Ruggiero, 2000). In this regard, social media's content and ease of use make it more helpful in encouraging healthy habits.

The study further revealed that the pilgrims' engagement with health information greatly influences their motivation and level of interest. Perrault et al. (2019) also prove that health campaigns elicit higher response rates if the user is more interested in the campaign's content. Due to the higher engagement, they concluded that personal investment in different content would increase the adoption of healthy behaviors. The study also found that pilgrims who engaged with health content on social media were more likely to use these platforms as their primary health information source (Perrault et al., 2019). This aligns with Avery (2010), who emphasized social media as a relatable tool in propagating healthy bodies in significant events (Avery et al., 2010). Similarly, Breza et al. noted that social media campaigns can boost vaccination rates and disease prevention (Breza et al., 2021), suggesting that people can leverage social media's potential to drive behavioral change during mass gatherings.

The impact of relying on social media for health information correlates with changes in cognitive, emotional, and behavioral outcomes. Like Laranjo et al. (2015), this study found the strongest correlation in behavioral changes, with pilgrims who accessed social media more likely to engage in preventive health behaviors (Laranjo et al., 2015). Lin and Chang (2018) found that social media can encourage proactive health measures and improve health outcomes. Their study showed that older, more educated people are more likely to use social media for health information, in contrast to younger individuals, as noted by Viswanath and Kreuter (2007), who tend to engage more with digital health campaigns (Lin & Chang, 2018; Viswanath & Kreuter, 2007). The physical demands faced by older pilgrims during Hajj might explain their higher engagement. These findings emphasize the importance of considering demographics when designing health campaigns to tailor messages to different groups better.

While this study identifies a strong association between social media engagement and health awareness during Hajj, it does not account for other variables that may influence this relationship. Factors such as pre-existing health knowledge, cultural norms, and offline interpersonal interactions, particularly those with family, peers, or religious leaders, may also contribute to individuals' awareness and behaviors. These unmeasured elements could either reinforce or counteract messages received through social media. Future research should include these dimensions to provide a more nuanced understanding of the diverse influences shaping health behavior during mass gatherings.

Implications for Public Health Practices

This study highlights the significant role of social media in supporting public health communication during mass gatherings like the Hajj, while offering broader implications for similar large-scale events worldwide. The findings show that social media can be a flexible and culturally appropriate way to share health messages with large groups of people. In addition to its relevance to religious gatherings, these insights can be applied to global events such as the Olympics, the World Cup, and other international festivals or crisis scenarios. Social media's capacity for real-time updates and interactive communication provides a critical advantage in addressing health challenges in diverse and transient populations.

The findings suggest that health authorities should prioritize culturally sensitive and linguistically appropriate health campaigns to foster trust and compliance. Collaborating with religious or community leaders can enhance the credibility of public health messaging, ensuring better acceptance and adherence. Real-time communication strategies like live updates, emergency alerts, and interactive sessions can help reduce the spread of false information. These methods also ensure that accurate health messages reach people quickly. Furthermore, leveraging platform-specific preferences based on demographic insights, such as Facebook for male audiences and Telegram for females, can improve the reach and effectiveness of these campaigns.

From a policy perspective, these strategies should be integrated into broader public health preparedness plans for mass gatherings. Policymakers should develop frameworks for using social media to address public health needs, including setting up dedicated teams for real-time information management and feedback collection. These teams should include social media analysts, health communication experts, and translators to ensure multilingual content delivery and cultural sensitivity. The lessons from this study could inform global guidelines for using digital platforms in health promotion during mass events, ensuring that campaigns are both targeted and scalable. Specifically, policy frameworks should outline clear roles and responsibilities of health authorities, social media managers, and local community leaders in executing health campaigns. Finally, investing in research to assess the long-term behavioral impact of social media health campaigns will provide deeper insights for refining future public health strategies. Such research should be conducted through regular surveys, feedback mechanisms, and analytics tools to measure pilgrims' reach, engagement, and behavior change indicators.

To provide more actionable guidance, this study recommends that health authorities create multilingual digital toolkits tailored for diverse cultural groups attending Hajj, including ready-to-use infographics, short videos, and platform-specific health messages. Dedicated response teams should monitor social media channels in real time to counter misinformation and provide verified updates. These teams should also collaborate with IT departments to establish precise reporting mechanisms for misinformation or health emergencies on social platforms. Moreover, formal partnerships between public health agencies and social media influencers or community leaders should be institutionalized to improve the reach and credibility of messages. Training workshops for influencers and religious leaders should be conducted to ensure message accuracy and alignment with health guidelines. These initiatives should be integrated into national health emergency preparedness plans and tested during simulation exercises to ensure operational readiness. Additionally, periodic evaluations should be implemented to assess the effectiveness of these strategies and update them based on changing communication trends.

Limitations

Despite the insights provided by this study on using social media to promote health behaviors during Hajj, it is crucial to acknowledge the study's limitations. First, because the cross-sectional survey design collects data from one point in time, it can only say something about the state of things during the identified phase of the pilgrimage process and not about changes in behavior or interest in the long term. Second, because the data is self-reported, it may contain socially desirable or recall bias. A significant limitation lies in pilgrims' varying cultural and digital literacy levels.

Cultural differences may shape the interpretation of health information and the willingness and ability to engage with it. Diverse beliefs, traditions, and languages among pilgrims can lead to misunderstandings or selective acceptance of health messages. Differences in people's ability to use digital tools make this problem even worse. Pilgrims with limited access to or familiarity with social media platforms may find it to navigate and utilize the available health information, potentially excluding vulnerable groups. These challenges show that health campaigns should be designed to respect different cultures and ensure everyone can access and understand digital tools. Moreover, cultural differences among pilgrims could potentially affect the interpretation of health information due to differences in background and beliefs about the received information.

Recommendations for Future Research

To address this study's limitations, future research could employ a longitudinal study design to evaluate changes in health behaviors and social media activities at different stages of the pilgrimage. Furthermore, using specific indicators, such as the level of activity on social media platforms or the use of a Fitbit, may reduce reliance on self-reports, reducing the influence of social desirability and recall bias.

A possible solution in future research could be using culturally appropriate and multilingual questionnaires to minimize the discrepancies between various cultural perceptions of health information. Also, exploring focus groups or in-depth interviews with pilgrims from different cultures can give deeper insight into the cultural factors affecting health behaviors and social media use, resulting in more accurate and generalizable findings.

Conclusion

By highlighting the vast role of social media in supporting public health during Hajj, this study points out its ability to influence health behavior in diverse high-density populations. Through the Media System Dependency Theory lens, the research emphasizes that credible, usable social media information regarding healthy behaviors is one key motivation to encourage pilgrims to adopt healthier behaviors. Additionally, age and education turned out to be determining factors for engagement, with older and more educated pilgrims being more dependent on digital health resources. Research demonstrates that social media's real-time communication can enhance health outcomes by disseminating information quickly, controlling rumors, and bolstering emergency response measures.

However, this study does not fully explore the broader implications of these findings, such as their relevance to other mass-gathering events like the Olympics or the World Cup. Policymakers could benefit from detailed recommendations on how to adapt these strategies to similar high-density, multicultural events. Beyond the Hajj context, these insights offer a viable framework for global health authorities to utilize social media for health messages during mass gatherings, effectively communicating with diverse audiences.

Public health authorities can foster proactive health behaviors, improve safety, and use social media as an essential large-scale health promotion and crisis management tool by prioritizing accessible, credible, and culturally appropriate health communication on social media. Providing targeted guidelines for implementing these strategies in specific contexts could enhance their practical utility for policymakers and health practitioners.

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Informed Consent

The authors have obtained informed consent from all participants.

Conflict of Interest

The authors declare that there is no conflict of interest to declare.

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