Social Media Platforms and Health Education: The empirical evidence with the mediating effect of Health Awareness in Pakistan

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Submitted to: JMIR Human Factors
on: August 24, 2024

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Abstract

Background: Current health education methods in Pakistan utilize traditional media (e.g., TV, radio), community health workers, and printed materials, which often fall short in reach and engagement among most of the population. The health sector in Pakistan has not yet utilized social media effectively to raise awareness and provide education about diseases. Research on the impact social media can have on health education in Pakistan may expand current efforts, engage a wider audience, and reduce the disease burden on healthcare facilities.

Objective: This study evaluates the perceptions of health professionals and paramedic staff regarding using social media to raise awareness and educate people about diseases as a potential means of reducing the disease burden in Pakistan.

Methods: The study employed two-stage structural equation modeling (SEM). Data analysis used AMOS 26.0 software, adopting scales from previous literature. Four-item scales for social media usefulness and health awareness constructs and eight-item scales for health education constructs were adopted based on their higher loading in alignment with psychometric literature. A seven-point Likert scale was used to measure the items in the questionnaire. Data collection utilized convenience sampling, with questionnaires distributed to over 450 health professionals and paramedic staff from two private hospitals in Lahore, Pakistan. There were 389 responses received. However, 340 completed questionnaires were included in the analysis.

Results: The study found that all squared multiple correlation (SMC) values were greater than 0.30. Furthermore, Convergent validity was measured using (1) standardized factor loading (found greater than 0.5), (2) average variance explained (found greater than 0.5), and (3) composite reliability (found greater than 0.7). The Confirmatory factor analysis (CFA) of the measurement model indicated the fitness of the constructs (CMIN = 357.62; CMIN/DF = 1.80; GFI = 0.90; AGFI = 0.89; NFI = 0:915; CFI = 0:93; RMR = 0:075; RMSEA = 0:055). Moreover, the structural model fitness was also confirmed (CMIN = 488.6; CMIN/DF = 1.85; GFI = 0.861; AGFI = 0.893; NFI = 0.987; CFI = 0.945; RMR = 0:079; RMSEA = 0.053). Hence, the results indicated that social media usefulness has a positive and significant effect on health awareness (H1: ? = 0.669, $p < 0.001$), and health awareness has a positive and significant effect on health education in Pakistan (H2: ? = 0.557, $p < 0.001$).

Conclusions: This study concludes that health professionals and paramedic staff support using social media to raise awareness and provide education about diseases. They believe that social media can be an effective tool for reducing the disease burden in Pakistan. The study results also revealed that young healthcare professionals are more inclined towards social media usage. They expressed the need for legislation to support its usage and establish a monitoring process to avoid misinformation.

(JMIR Preprints 24/08/2024:65745)
DOI: https://doi.org/10.2196/preprints.65745

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Social Media Platforms and Health Education: The empirical evidence with the mediating effect of Health Awareness in Pakistan

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Keywords: Social Media, Health Awareness, Health Education, Innovation Diffusion Theory, Structural Equation Modeling

Introduction:

In Pakistan, the healthcare system is resource-strapped, leading to challenges in preventing infectious diseases. The country has a high maternal (186 deaths per 100,000 live births) and infant mortality (56 deaths per 1,000 live births) rate [1]. Many complications arise from a lack of awareness and education about prenatal care, safe delivery practices, and postnatal care [2]. Moreover, poor understanding of nutrition leads to widespread malnutrition among children and pregnant women in Pakistan [1,2]. Malnutrition in children leads to stunted growth, weakened immunity, and impaired cognitive development. The prevalence of stunting in Pakistan is among the highest in the world, affecting approximately 38% of children under five years of age [3].

In this context, health awareness and education campaigns potentially lead to behavioral changes and alleviate the burden on health facilities [4]. Public health campaigns, particularly those focused on preventive measures like vaccination, hygiene, and lifestyle changes, have substantially reduced the incidence of various diseases [5]. For example, handwashing campaigns alone have reduced respiratory infections by up to 23% [6]. Awareness campaigns aimed at managing chronic conditions such as diabetes and hypertension through education on medication adherence and lifestyle modifications reduced complications and hospital visits [7]. These interventions have been shown to improve health outcomes and reduce healthcare costs by up to 25% [8].

Among various tools and health interventions, social media has attained the most global attention to enhance health awareness and education to a wider population and discovered its significant impacts in addressing healthcare issues [9,10]. According to social media statistics, social media users worldwide reached 5.04 billion in January 2024, representing 63% of the world's population, with users growing 6 percent annually [11]. On average, social media users spend 2 hours and 23 minutes daily on social media platforms and see various content [11]. Social media tools such as Facebook, TikTok, Twitter, Instagram, and YouTube facilitate health professionals in educating and influencing perceptions, including networking, sharing ideas, disseminating information, demonstrating, coaching, consulting, and advertising [12,13]. Existing literature in the health sector has exhibited the transformative potential of social media and its usefulness in spreading health awareness and education [9,10,12,13].

Social Media Usefulness:

The global adoption of social media platforms has led to scalable public health treatments, increased precision and effectiveness, and improved resource mobilization [14]. Social media has encouraged healthy behaviors and enabled informed choices through sharing tips, challenges, and success stories [9]. Health professionals can provide accurate, evidence-based information as trusted sources [11]. Their involvement is vital due to their expertise, credibility, and ability to reach a wide audience. Campaigns through social media on vaccination, hygiene practices, mental health awareness, and other preventive measures have been helpful in countries like Germany and France [9,10].

Moreover, social media has been effectively used to combat the pandemic and other diseases during COVID-19 [15]. The social media data was instrumental in tracking the spread of the on COVID-19 virus and disseminating accurate information [16]. Campaigns on platforms like Facebook and Twitter have been used to promote vaccination, leading to increased uptake in various regions [12].

Tailored messaging on HIV prevention for at-risk populations has shown to be more effective than generalized campaigns [13]. Moreover, existing literature has shown examples of successful public health campaigns, such as;

- **#SmearForSmear Campaign**: This social media campaign aimed to raise awareness about cervical cancer screening and successfully increase screening rates by leveraging the reach of platforms like Twitter and Instagram [17].
- **Truth Initiative**: An anti-smoking campaign that effectively used social media to reduce teen smoking rates through engaging content and interactive platforms [18].

Health awareness:

Health awareness is termed as “Enhancing the ability of individuals to understand and use health information to make informed decisions about their health” [13]. Efforts for health awareness are varied and multifaceted, encompassing a wide range of activities aimed at educating the public about health issues, promoting healthy behaviors, and preventing diseases [16]. Health awareness campaigns lead to early detection and timely intervention, which benefits individuals by lowering their healthcare expenses and reducing the financial burden on the healthcare system [18]. Health awareness is generally performed using mass media, social media, posters, billboards, workshops, seminars, local outreach programs, influencers, and public figures [12]. However, social media is most useful in the current era due to its cost-effectiveness and wider audience engagement [17]. Social media allows targeted messaging based on demographics, interests, and online behavior [19]. This ensures that health messages reach the people most likely to benefit from them. Moreover, the effectiveness of health awareness through social media can be measured in a few easy ways, such as the number of impressions, likes, shares, comments, hashtag usage, etc [18,19]. Hence, medical professionals may analyze the efficacy of their awareness messages. There have been several successful health awareness campaigns conducted through social media that have achieved significant outcomes. For instance,

1. #ThisGirlCan (2015)

- Objective: Encourage women of all ages and backgrounds to be more physically active, regardless of their shape, size, or fitness level [20].
- Execution: The campaign featured real women participating in various physical activities, promoting the message that women should feel confident in being active regardless of societal pressures or body image concerns.
- Platforms Used: Instagram, Twitter, Facebook, and YouTube.
- Outcomes:
    - Widespread Engagement: The hashtag #ThisGirlCan was used millions of times, with significant engagement from women sharing their own stories and photos.
    - Behavioral Change: The campaign was credited with encouraging over 2.8 million women in the UK to become more active.
    - Long-Term Impact: The campaign continued beyond its initial phase, evolving into a broader movement that still influences public attitudes towards women and fitness

2. #BellLetsTalk (Ongoing)

- Objective: Raise awareness about mental health issues and reduce stigma around mental illness in Canada [21].
- Execution: For every tweet using the hashtag #BellLetsTalk, every text message sent by Bell customers, and every Facebook video view, Bell Canada donates 5 cents to mental health initiatives.
- Platforms Used: Twitter, Facebook, Instagram, and Snapchat.
- Outcomes:
    - Record Participation: The 2021 campaign saw 159 million interactions, raising nearly $8 million in a single day.
    - Sustained Impact: Since its inception, the campaign has raised over $121 million for mental health initiatives.
    - Increased Conversations: The campaign has significantly increased public dialogue about mental health in Canada, contributing to reducing stigma and promoting mental wellness.

Health Education:

Health education refers to a deeper understanding of specific health topics, including the causes, symptoms, prevention, and treatment of diseases and how to maintain or improve health [20]. It involves having factual information and comprehension of health-related subjects [17]. Health education encourages regular check-ups, screenings, and vaccinations, leading to early detection of diseases and more effective prevention strategies [19]. For those with chronic conditions like diabetes, hypertension, or asthma, health education is essential for managing symptoms, adhering to treatment plans, and avoiding complications [13].

In developing economies, insufficient health education has been reported among the population, which impedes individuals' ability to understand, access, and apply health information effectively [21]. Moreover, low-income individuals may have less access to health resources, education, and information, which hinders their ability to acquire and apply health education [22]. Addressing these barriers in developing countries requires targeted strategies such as improving health literacy, offering culturally sensitive health education, increasing access to technology, and combating misinformation [21].

Among these targeted strategies, social media has gained the most attention in the developed world [20]. Health education through social media has become an increasingly effective method for reaching diverse audiences with health information. Studies suggest that health education campaigns on social media can achieve behavioral change success rates ranging from 20% to 40% [16,17]. For instance, social media campaigns promoting COVID-19 vaccination have seen varied success, with some countries reporting a 15% to 25% increase in vaccine uptake attributable to social media efforts [15]. Moreover, some campaigns that promote health services (e.g., vaccination drives or mental health counseling) report conversion rates (actual service uptake) of 5% to 20%, depending on the call to action and the ease of access to the service [18]. The existing literature has argued a few notable health education campaigns executed through social media and validated their impact. One

such campaign for spreading health education is;

1. The ALS Ice Bucket Challenge (2014)

- Overview: Participants dumped buckets of ice water over their heads, shared videos on social media, and nominated others to do the same, all to raise awareness and funds for Amyotrophic Lateral Sclerosis (ALS) research [23].
- Impact:
    - Financial: Raised over $115 million for the ALS Association in just a few months.
    - Awareness: Dramatically increased global awareness of ALS, with millions participating worldwide.
    - Research Advancement: Funds contributed to significant research advancements, including the discovery of new ALS genes

Pakistan Context:

In Pakistan, the Federal and provincial governments jointly administer 60 percent of the healthcare system, with the private sector contributing 30 percent. Autonomous bodies support the remaining 10 percent [24]. The diverse structure and the country's economic challenges pose unique obstacles to effective healthcare delivery. The country's healthcare spending is at 2.95% of its GDP, and the Pakistani government always disregarded the economic survey data and faced criticism from the apex medical organization as they necessitated health allocations in line with global guidelines [25]. To provide quality healthcare, the Pakistan Medical Association (PMA) expressed the need for 6 percent of the country's GDP allocation, as recommended by WHO [17], which the country is unable to meet due to economic challenges [26].

Due to these financial limitations, there are reported disparities in health awareness, with urban areas generally having better access than rural regions [2]. Due to this, communicable diseases, such as waterborne diseases and vector-borne diseases, remain a more significant concern in rural regions [1,3]. Moreover, with limited access to quality maternal healthcare and family planning services, Pakistan witnesses high maternal and child mortality rates [2]. Diseases like malaria, tuberculosis, and hepatitis are prevalent, which exacerbates the situation [24]. Moreover, stigma about sexually transmitted infections (STIs) results in inadequate prevention and treatment efforts that result in a psychological attack on the patients [25]. Poor sanitation and hygiene contribute to outbreaks of diseases like cholera and dysentery in Pakistan and many preventable diseases, like polio and measles, persist due to low vaccination rates [23].

Amid financial crises, healthcare awareness and education are known to be effective in reducing the disease burden rate [8]. There are several traditional efforts made by the government of Pakistan/Ministry of Health in the past to improve disease awareness and reduce the patient burden [24]. These include;

- Engaging Community Health Workers (CHWs) in disseminating health information, especially in rural areas. However, the number of CHWs to cover the target population is very limited and requires substantial spending [24].
- Use of radio and television for health awareness programs, public service announcements, and talk shows but requires financial resources [27].
- Newspapers, magazines, and pamphlets are also used to spread health information, but considering the low literacy rate and cost of print media, these are not found much effective for the target population [27].

However, among the modern techniques, social media has gained much attention from health

communities globally [7,10]. Pakistan has also witnessed the widespread of social media but in academics, e-commerce, entertainment, media, politics, sports, and religious sectors. In Pakistan, 29.5 percent of the population is on social media, whereas 77.8 percent has active mobile connections, meaning these users also have access to social media platforms [28].

The health sector is structured to depend on government approval for any initiative [29]. The government has not devised any legislation to promote the use of social media for awareness [24,27]. This mainly restricts the government's health departments and health professionals from using this tool to publicize health messages. Some efforts have been made to digitalize the health sector using the eHealth concept and implement a few apps to initiate telehealth and telemedicine [30]. Also, mobile messaging and caller voice tunes are found significant in healthcare services awareness [30]. However, the interpretation and usage of social media tools are still scarce [31]. For this reason, it is imperative to investigate the social media usefulness among health professionals in Pakistan and to identify whether these health professionals support the usage of social media for health awareness and education.

Theoretical Foundation:

A few theories explain the behaviors toward acceptance of any new digitalized tool and address their attitude [32]. For instance, the innovation diffusion theory proposed by Rogers (1962), the Theory of Reasoned Action proposed by Fishbein and Ajzen (1967), the Self-Efficacy Theory proposed by Bandura (1977), the Theory of Planned Behavior proposed by Ajzen (1985), the Social Cognitive Theory proposed by Bandura (1986), and the Technology Acceptance Model proposed by Davis (1986) [33]. Among these various behavioral theories, the Innovation diffusion theory (IDT) offers a framework for understanding how new ideas, behaviors, or innovations spread within a population [34].

In public health, innovation diffusion theory helps explain how new health interventions, practices, or policies are adopted and disseminated within communities [34]. The theory identifies five stages individuals and communities pass when adopting an innovation: knowledge, persuasion, decision, implementation, and Confirmation [35]. Figure 01 explains these five stages of the innovation-decision process.

To understand social media acceptance for health awareness and education, the theory has categorized individuals within a population into subgroups based on their readiness to adopt innovations. Innovators and early adopters are likelier to adopt innovations early, while most of the population follows suit over time. Laggards are the last to adopt [34]. Figure 02 explains these subgroups of individuals.

In health education and awareness, the diffusion of innovation is used to fast-track the acceptance of crucial public health digitalized interventions that ordinarily intend to influence the behavior of a social system [35]. Thus, this theory provides the foundation for understanding social media usage and its adoption attitude in a particular community.

In Pakistan, the ineffective innovation management approaches and deprived diffusion of innovation strategies are hurdles to realizing the importance of social media and its usage for health education [24,25]. The deprived diffusion of innovation is a significant factor in the inability to attain the desired output. Even for digitalized hospital tools other than social media, the country needs more innovative and user-friendly equipment in the hospital sector [25]. The notion of consistent healthcare challenges and inadequate health resources in Pakistan is also evident from the recent JEE (Joint External Evaluation) report [24].

For this reason, it is imperative to investigate the impact of social media's effective use on health awareness and health education in Pakistan using IDT. This may result in highlighting and understanding the effectiveness of social media tools in reducing the disease burden in the country.

Figure 03 explains the theoretical framework of the present study.

Hence, the present study hypotheses are.

H_1: Social media usefulness positively and significantly impacts Health awareness in Pakistan.

H_2: Health awareness has a significant positive impact on health education in Pakistan.

Methodology:

Instrument development:

A quantitative technique was applied to test the study hypothesis and validate the proposed model using the structural equation modeling (SEM) technique [36]. Data analysis was carried out using AMOS 26.0 software [37]. Since the study aims to identify social media's impact on health awareness leading to health education and uses the innovation diffusion theory as a theoretical foundation, scales from previous literature have been adopted. The main advantage of adopting these scales is that they have already been validated in new technological tools acceptance in the health industry. For Instance, the measurement scale for Innovative Technology (social media) usefulness has been adopted from Venkatesh and Davis [38] study. Furthermore, measurement scales for health awareness have been adopted from the Venkatesh [39] study. Aligning with the psychometric literature, four-item scales for each construct based on their higher loadings have been adopted [38]. The modified eight-item scale for measuring health education was adopted based on the questionnaire of Ho, Ho, and Chung [40]. For the measurement of each item, a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) was used [39].

Data Collection:

A questionnaire was developed according to the variables of the present study using the above-mentioned scales. A personally administered questionnaire was used for data collection [41]. For data collection, the current research has targeted health professionals and paramedic staff of 02 x private hospitals in Lahore, Pakistan. The questionnaire was distributed to over 450 health professionals and paramedic staff using convenience sampling and requested their valuable feedback. However, only 389 useful responses were received. As a matter of ethical concerns, prior permission from the hospital management was obtained, and the purpose of the study was explained to all respondents through ‘informed consent.’ It was assured that respondents’ privacy would be ensured through confidentiality.

Primary Data Screening:

Initial screening was carried out among 389 useful responses to eliminate the unusual responses, mainly incomplete questionnaires and respondents who marked similar scores in all items. Furthermore, questionnaires with more than four missing values were also excluded. The remaining missing values were replaced with series mean/average for the rest of the responses. Therefore, the final useful sample was reduced to 340.

Table 01 provides the demographics of the study respondents. Among 340 respondents, 58 percent were males, and the rest were female. 91 percent of the respondents were between 25 and 35 years of age, which may lead to the fact that most health professionals and paramedic staff in private hospitals in Lahore are young. However, we may be unable to neglect the 6 percent of the population under 25 years old and more eager to start their career in the health sector. The remaining 3 percent were more than 35 years of age and had extensive health industry work experience.

Table 1. Sociodemographic characteristics of Study Respondents (N=340)

Characteristics	n	%
Gender		
Male	197	58.00
Female	143	42.00
Age		
Less than 25 years	21	6.00
25 to 35 years	309	91.00
More than 35 years	10	3.00
Social Media Experience		
Less than 01 year	34	10.00
02 to 05 years	207	61.00
More than 05 years	99	29.00
Monthly Income (PKR)*		
Less than 40,000	101	30.00
40,000 to 80,000	197	58.00
More than 80,000	42	12.00
Education		
Less than Secondary School	63	18.00
Secondary School to Graduation	259	76.00
Medical Degree (MBBS/BDS) or Masters	18	6.00
Health Services Experience		
Less than 03 years	21	6.00
03 to 06 years	225	66.00
More than 06 years	94	28.00

* 01 USD = 280.00 PKR

Data analysis:

An exploratory factor analysis (EFA) was initially performed on the 16 measurement items to confirm the underlying relationships [37]. For sample adequacy, the KMO value (0.850) was greater than the recommended value (0.60), and the significance value of p: 0.001 confirms Bartlett's test of sphericity, as shown in Table 02. All those factors were retained for data analysis, with Factors factor loading greater than 0.50 and Eigenvalue greater than 1.0. Hence, this technique provided three (03) factors, which explained 72.20 percent of the variance after varimax rotation. Furthermore, scale reliability coefficients were greater than the acceptable value (0.70) [42].

Table 02: *Keyser-Meyer-Olkin (KMO) and Bartlett's Test*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.850

Bartlett's Test of Sphericity	Approx. Chi-Square	19674.23
	Df	340
	Sig.	0.001

Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted to check the data normality [42], as shown in Table 03. The results of both tests were significant, meaning there was no normality issue in the data.

Table 03: Latent Constructs Kolmogorov-Smirnov and Shapiro-Wilk test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Social Media Usefulness	0.098	340	0.000	0.901	340	0.000
Health Awareness	0.109	340	0.000	0.923	340	0.000
Health Education	0.126	340	0.000	0.966	340	0.000

a. Lilliefors Significance Correction

For further data analysis, a two-stage structure equation modeling (SEM) technique was used [37,38,39]. This approach allows researchers to evaluate the measurement and structural models separately using two dissimilar sub-samples. For this reason, a sample of 340 was divided into two parts: a sample of 170 was used for the measurement model, and a similar sample size was used for structural model assessment to attain impartial results.

Reliability and Validity Measures:

According to Hair et al [36], finding the reliability of each item and construct in the research study is essential. Therefore, squared multiple correlation (SMC) was used to find the reliability of each Reliability of each measurement item. SMC represents “the amount of variance explained by an individual indicator/construct of its respective factor; and measured by square of its (indicator's) standardized factor loading” [42].

Hair [36] indicated that the cut-off value of SMC is 0.30. Hence, it is evident from Table 04 that all SMC values are greater than 0.30. For measuring the reliability of each variable, the Cronbach alpha value was used. As suggested in the literature, the cut-off value of Cronbach alpha is 0.70 [37,38]; it is evident from Table 04 that all variable's Cronbach alpha values are more than 0.70. Furthermore, Hair et al [36] also highlighted that for measuring the convergent validity, there are three common approaches: (1) standardized factor loading (0.5 or greater), (2) average variance explained (0.5 or higher), and (3) composite reliability (0.7 or above).

Table 04: Measurement of Reliability and Validity

Construct	*Item*	*Mean*	*Standard Deviation*	*Standardized Factor Loading*	*Squared Multiple Correlation*	*Reliability Composite*	*Cronbach Alpha*	*Average Variance Explained*
Social Media Usefulness	SMU 1	5.19	1.65	0.781	0.607	0.788	0.774	0.589
	SMU 2	5.33	1.71	0.780	0.687			
	SMU 3	5.01	1.12	0.777	0.671			
	SMU 4	5.05	1.32	0.787	0.646			
Health Awareness	HA1	5.45	1.56	0.859	0.677	0.769	0.773	0.592
	HA2	5.98	1.45	0.874	0.681			
	HA3	5.39	1.43	0.881	0.675			
	HA4	5.51	1.39	0.867	0.654			
Health Education	HED 1	5.23	1.77	0.719	0.651	0.783	0.789	0.678
	HED 2	5.22	1.74	0.775	0.629			
	HED 3	5.60	1.64	0.721	0.622			
	HED 4	5.41	1.49	0.739	0.637			
	HED 5	5.22	1.15	0.787	0.663			
	HED 6	5.11	1.23	0.772	0.654			
	HED 7	5.09	1.43	0.759	0.691			
	HED 8	5.32	1.59	0.768	0.609			

Hence, each standardized factor loading was statistically significant (p , 0.001), and values ranged from 0.719 to 0.881, thus validating adequate convergent validity as shown in Table 04. In addition, the average value explained (AVE) values and construct reliability were also more than their cut-off level of 0.5 and 0.7, respectively, and statistically significant. Therefore, these measures confirm the sufficient convergent validity.

A comparison of shared variance between factors with the average variance explained by individual factors was ensured for measuring the discriminant validity. The diagonal value should be greater than the non-diagonal value to confirm adequate discriminant validity [42]. Hence, Table 05 indicates the correlation matrix of constructs, where non-diagonal elements are correlated among constructs and diagonal elements are the square root of average variance explained (AVE) by that construct and clearly explain that all three constructs differ.

Table 05: Measurement of Discriminant Validity

Construct	***SMU***	***HA***	***HED***
SMU	0.791		
HA	0.663	0.701	
HED	0.423	0.523	0.711

Measurement Model:

Using statistical software AMOS 26.0, the measurement model's confirmatory factor analysis (CFA) was performed [42,43]. This provided a passable model fit for the primary measurement model (CMIN = 1220.23; CMIN/DF = 1.98; GFI = 0.72; AGFI = 0.80; NFI = 0.81; CFI = 0.826; RMR = 0.089; RMSEA = 0.082), however, number of indicators per item was large for instance, number of indicators for health education were eight (08). Consequently, two items were deleted for further refinement to obtain the adequate model fit through the CFA of the measurement model. This refinement was conducted by deleting items one by one, based on their standardized residual; that is, that item was first deleted, which had a larger error variance than their measurement items. Each item was carefully reviewed before deleting it to ensure that, from a theoretical viewpoint, its error variance also seems rational. The refinement and assessment process for every construct was first evident by Churchill [43]. Churchill defined this process as; “Though this application may be satisfactory during the early stages of research on a construct, the use of factor analysis in a confirmatory fashion would seem better at later stages”. Furthermore, Gerbing and Anderson’s [44] study also provided support to Churchill's argument and stated that; “to demonstrate that an explicit evaluation of Unidimensionality is accomplished with a confirmatory factor analysis of the individual measures as specified by a multiple-indicator measurement model. Coefficient alpha is important in assessing reliability but does not assess dimensionality. Although item-total correlations and exploratory factor analysis can provide useful preliminary analyses, particularly in the absence of sufficiently detailed theory, they do not directly assess Unidimensionality. The reason is that a confirmatory factor analysis assesses the internal consistency and external consistency criteria of Unidimensionality implied by the multiple-indicator measurement model.

Hence, this refinement process provided the adequate model fit (CMIN = 357.62; the ratio of Chi-square to degree of freedom value (1.80) is remarkably less than its recommended value (5.0). CMIN/DF = 1.80; GFI = 0.90; AGFI = 0.89; NFI = 0:915; CFI = 0:93; RMR = 0:075; RMSEA = 0:055) as shown in Table 06.

Table 06: *Structural Equation Modeling (SEM) Fit Indices for Confirmatory Factor Analysis (CFA) Model*

Fit Index	Cut-off Criteria	Results Obtained
Absolute Fit Indices		
Chi-square (χ2)		357.62
Degree of freedom (df)		170
χ2/df (CMIN/DF)	< 5.00	1.800
Root Mean Square Error of Approximation (RMSEA)	< 0.06	0.055
Goodness of Fit Index (GFI)	> 0.85	0.900
Adjusted Goodness of Fit Index (AGFI)	> 0.85	0.890
Incremental Fit Indices		
Buntler-Bonett Normed Fit Index (NFI)	> 0.90	0.915
Comparative Fit Index (CFI)	> 0.93	0.930
Tucker Lewis Index (TLI)	> 0.90	0.941
Incremental Fit Index (IFI)	> 0.90	0.932
Parsimonious Fit Indices		
Parsimony Goodness-Fit Index (PGFI)	> 0.50	0.798
Parsimony Normed Fit Index (PNFI)	> 0.50	0.848

Structural Model:

The research hypotheses were tested through structural model estimation [42]. Therefore, 2nd sub-sample (170) was used and provided the adequate structural model fit (CMIN = 488.6; CMIN/DF = 1.85; GFI = 0.861; AGFI = 0.893; NFI = 0.987; CFI = 0.945; RMR = 0:079; RMSEA = 0.053) as shown in Table 07.

Table 07: *Hypothesized Structural Model Fit Indices*

Fit Index	Cut-off Criteria	Results Obtained
Absolute Fit Indices		
Chi-square (χ2)		488.60
Degree of freedom (df)		170
χ2/df (CMIN/DF)	< 5.00	1.850
Root Mean Square Error of Approximation (RMSEA)	< 0.06	0.053
Goodness of Fit Index (GFI)	> 0.85	0.861
Adjusted Goodness of Fit Index (AGFI)	> 0.85	0.893

Incremental Fit Indices		
Buntler-Bonett Normed Fit Index (NFI)	> 0.90	0.987
Comparative Fit Index (CFI)	> 0.93	0.945
Tucker Lewis Index (TLI)	> 0.90	0.976
Incremental Fit Index (IFI)	> 0.90	0.943
Parsimonious Fit Indices		
Parsimony Goodness-Fit Index (PGFI)	> 0.50	0.680
Parsimony Normed Fit Index (PNFI)	> 0.50	0.609

Moreover, the significance of the hypothesis is shown in Table 08. Testing of H1 revealed that social media usefulness has a significant effect on health awareness (H1: $\beta = 0.669$, $p < 0.001$), supporting the Innovation Diffusion Theory proposed by Rogers. Testing of H2 also supplied similar significant outcomes to the present research model (H2: $\beta = 0.557$, $p < 0.001$), confirming the finding of prior work.

Table 08: Hypothesis testing results

S.No.	***Impact of***	***Impact On***	***Hypothesis***	***Path Coefficient***	***p-Value***	***Outcome***
1	SMU	HA	*H1*	0.669**	0.001	Significant Impact
2	HA	HED	*H2*	0.557**	0.001	Significant Impact

Notes: * $p < 0.01$, ** $p < 0.001$

Discussion:

This study aimed to identify social media's impact on health awareness, leading to health education and used the innovation diffusion theory as a theoretical foundation in Pakistan. Hence, a conceptual framework was developed to achieve the study objectives and testify to the relationship of social media usefulness in health education with health awareness's medicating effect. Based upon the responses from health professionals and paramedic staff, the study has identified empirically through H_1 and H_2 that social media can significantly impact health education in Pakistan if it is used by medical practitioners and stakeholders to spread health awareness and education. Also, it has been documented that social media can be a highly effective tool for health education, particularly when leveraged alongside efforts to increase health awareness. The mediating effect of health awareness enhances the impact of social media by enabling individuals to understand, engage with, and act on the health information they receive. Consequently, both hypotheses are positive and significant and support the established conceptual framework. The study also identified the correlation of young and educated health staff being more inclined to use social media. Aged groups consider it useful, but they do not spend much time navigating it. So, their responses are quite neutral but support its usage.

The literature has shown that health awareness initiatives through social media could increase the exposure, rate of reach, and impact on health education and enhance the effectiveness of health

promotion programs [7,10,11,12]. Few types of research have addressed specific approaches and interventions and used differentiated target populations, delivery modes, usability, focus, theoretical foundations, and functionality [13,14]. Therefore, it was difficult to conclude the impact of health awareness through social media campaigns on health education for health professionals and paramedic staff in developing countries. Aligned with recent reviews of social media interventions for health education, the present study has also concluded that this intervention can significantly affect health awareness. Developing countries like Pakistan have been found to have low participant engagement in social media in the health sector, which is a critical obstacle to improving healthcare outcomes.

A few researchers in developed countries have proved that health awareness through social media can significantly affect the country's health education and reduce the cost burden [20,21,22]. However, using innovation diffusion theory and testing it on health professionals, this relationship is still rare in developing countries like Pakistan. Moreover, it was important to explore cost-effective solutions to the deprived healthcare system in Pakistan, and healthcare professionals' participation has affirmed the study relationship. The standardized direct effect of 0.669 and 0.557 with P values <.001 supports the argument that the relationships between social media usefulness with health awareness and health awareness relationship with health education in Pakistan are positive and significant. Moreover, as the study featured the conceptual framework based on Innovation Diffusion Theory (IDT), developing countries are termed the late majority and laggards in adopting social media for healthcare interventions. The IDT also stresses the use of platforms popular in the region. In some areas, Facebook, WhatsApp, and locally developed platforms may be more effective than global ones. Applying (IDT) to social media usefulness for health awareness involves understanding how new ideas, information, or behaviors spread among a population, and simplifying innovation makes it easy for a wider audience to understand.

The health professionals in private hospitals indicated a strong influence of social media tools for health awareness and education in Pakistan. They recommended the usage of social media by various health departments to disseminate information about public health issues, vaccination drives, and disease prevention tips. The government of Pakistan can also play a significant role in spreading health awareness. They can use social media to run campaigns on maternal health, child nutrition, and disease prevention. The health professionals in private hospitals also indicated that live sessions and webinars on platforms like Facebook Live and Instagram Live to educate the patients and hospital staff on various health issues and answer their real-time questions have been very useful.

Using social media for health education in Pakistan could be a game-changer, surpassing the expectations of spreading awareness regarding health needs in a particular community. This potential is not just theoretical; it has been proven in developed countries, such as the US, Jordan, the UK, and Europe, where social media was used during COVID-19 to combat the pandemic and other notable diseases [15]. Moreover, Social media platforms have been utilized to promote telemedicine services, enabling healthcare professionals to connect with patients remotely for consultations, follow-ups, and monitoring of chronic conditions [16,30].

Overall, the present study validated the use of social media to improve public health education through public awareness. Therefore, the study concludes that health professionals should use social media tools to inform the wider public and address healthcare issues in Pakistan.

Conclusion:

The findings of this study underscore the significant role that social media plays in enhancing

healthcare awareness and education among various populations in developing countries like Pakistan. With their wide reach and interactive features, social media platforms have proven effective tools for disseminating health-related information and engaging individuals in meaningful health conversations. Social media breaks down geographical barriers, allowing health information to reach a global audience instantly. This broadens the scope of healthcare awareness campaigns and makes information accessible to a diverse demographic, including those in remote or underserved areas. The interactive nature of social media facilitates active engagement between healthcare providers and the public. This interaction fosters a sense of community, encourages sharing personal health experiences, and allows for immediate feedback and clarification of health information. Also, Social media platforms enable the dissemination of personalized health information tailored to specific audiences' needs. Moreover, the real-time nature of these platforms ensures that information is up to date, which is crucial during health emergencies or outbreaks.

Health education through social media can help understand how to prevent common diseases such as malaria, tuberculosis, hepatitis, and polio through vaccination, sanitation, and hygiene in Pakistan. Awareness campaigns can encourage healthier lifestyles, reducing the incidence of chronic diseases such as diabetes, hypertension, and heart disease. Educating women about prenatal and postnatal care, safe delivery practices, and child nutrition can significantly lower maternal and infant mortality rates. Awareness through social media about proper nutrition, immunization, and hygiene practices helps improve children's health and development in the rural outskirts of Pakistan. Also, awareness about communicable diseases and their transmission can help in preventing outbreaks of diseases like HIV/AIDS, tuberculosis, and waterborne illnesses.

Governmental policies provide a framework for regulating the content shared on social media, ensuring that the information disseminated is accurate, reliable, and in line with public health guidelines. Information shared by government-endorsed social media accounts is more likely to be trusted by the public. Official policies lend credibility and legitimacy to health messages, increasing the likelihood of public acceptance and compliance. All active organizations (govt and private) working in the health industry of Pakistan seek prior permission/ethical clearance to initiate any new work. Without government support, the organizations lack the confidence to spread and advertise any health-related content due to fear that they may be subject to local resistance.
Despite its benefits, the use of social media in healthcare awareness also presents challenges, such as the spread of misinformation and the need for privacy and data protection. Healthcare organizations must implement strategies to verify information and ensure the credibility of the content shared. Hence, the study suggests that Pakistan's healthcare organizations should continue leveraging social media to enhance health communication strategies and education. Ongoing research is also needed to explore new ways to maximize social media's benefits while mitigating its risks.

In conclusion, social media is a powerful tool for healthcare awareness, offering unprecedented opportunities to reach and engage with a wide audience. By harnessing its potential in developing economies, healthcare organizations can improve public health literacy, promote healthy behaviors, and ultimately contribute to better health outcomes. Collaborative efforts between healthcare professionals, social media platforms, and policymakers will be crucial in leveraging social media's full potential for public health advancement.

Acknowledgments:

I would like to thank Mr. Nabil Ahmed, Director at Integral Global Consulting LLC, Tucker, GA, US for providing the necessary resources and facilities that enabled the successful execution of this research. I also wanted to extend my special thanks to all the respondents and hospital management in Lahore, Pakistan, for their feedback and the collaborative environment that fostered productive

discussions and the exchange of ideas.

Conflict of Interest:
The authors have no interests to declare.

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Questionnaire

Socio-demographic factors:

1. Name: _____ (You can leave this blank if you don't want to provide your name)

2. Gender:

☐ Male
☐ Female

3. Age:

☐ Less than 25 years
☐ 25 – 35 years
☐ More than 35 years

4. Social Media Experiences:

☐ Less than 01 year
☐ 02 to 05 years
☐ More than 35 years

5. Health Services Experience:

☐ Less than 03 years
☐ 03 to 06 years
☐ More than 06 years

6. Education:

☐ Less than Secondary School
☐ Secondary School to Graduation
☐ Medical Degree (MBBS/BDS) or Masters

7. Monthly Income:

☐ Less than Rs. 40,000
☐ Rs. 40,000 to Rs. 80,000
☐ More than Rs. 80,000

In the below Likert scale, SD (Strongly Disagree = 1), D (Disagree = 2), SD (Somewhat Disagree = 3), N (Neutral = 4), SA (Somewhat Agree = 5), A (Agree = 6), (Strongly Agree =7)

(Please check the box to record your answer against each question statement)

"S. #	**Question Statements**	**LIKERT SCALE**

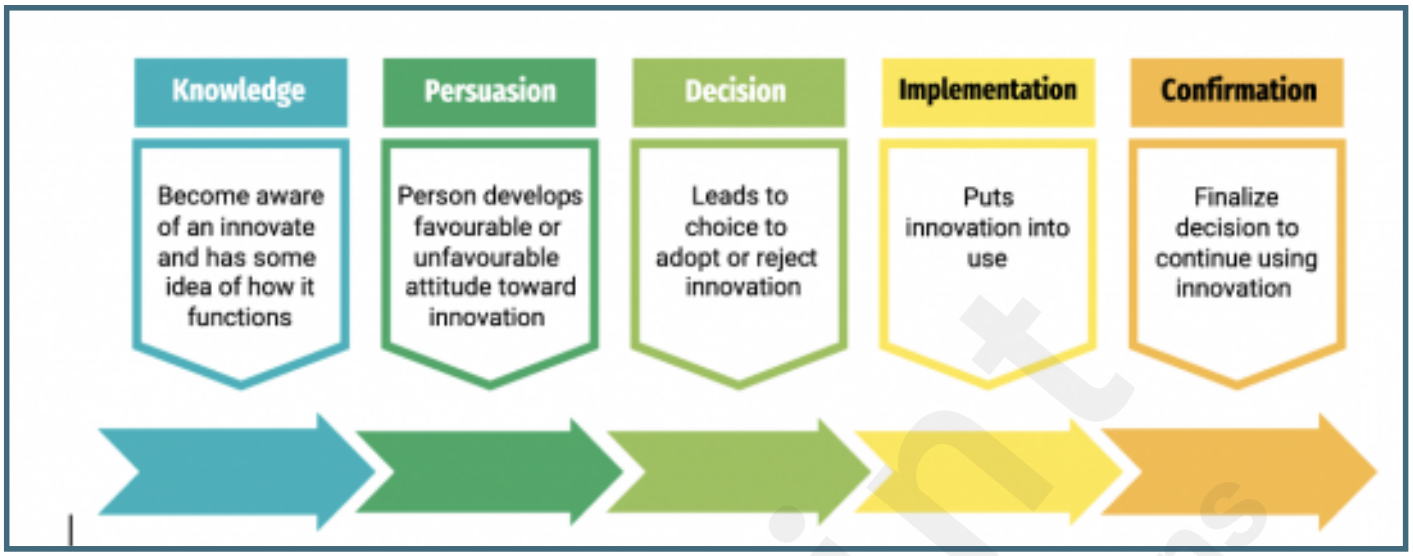
		SD (1)	D (2)	SD (3)	N (4)	SA (5)	A (6)	SA (7)
8.	Social Media tools (Facebook, Tiktok, Twitter, Instagram, YouTube etc) are easy to learn and navigate.							
9.	Social Media tools (Facebook, Tiktok, Twitter, Instagram, YouTube etc) generally helps me to find the relevant contents in a convenient way.							
10.	Social Media tools (Facebook, Tiktok, Twitter, Instagram, YouTube etc) are productive for easy access of larger information.							
11.	Social Media tools (Facebook, Tiktok, Twitter, Instagram, YouTube etc) are flexible and offers support in socializing with other people.							
12.	I understand the social media language and I use it to enjoy interesting contents.							
13.	The social media features are easy to navigate and most of their tools are user-friendly.							
14.	I have complete awareness of social media and what are the pros and cons associated with its usage.							
15.	I am aware about the procedure how to create my personal account and how to obtain the login details on social media.							
16.	Social medial tools can be used to spread the awareness and education in country.							
17.	I get the chance to learn many new developments in my health filed through social media.							
18.	I can see contents and my profession related videos whenever I want through social media.							
19.	Health professionals can use this social media to spread education among people							
20.	I have seen a few videos and contents from health professionals spreading the awarness through social media.							
21.	People of my field enjoy using social media for entertainment as well as for education purposes.							
22.	Social Media tools (Facebook, Tiktok, Twitter, Instagram, YouTube etc) can be							

	used to spread the awareness and education for various health diseases in the country.							
23.	Social Media tools (Facebook, Tiktok, Twitter, Instagram, YouTube etc) can be effective to spread awarness and education to reduce disease burden in the country.							

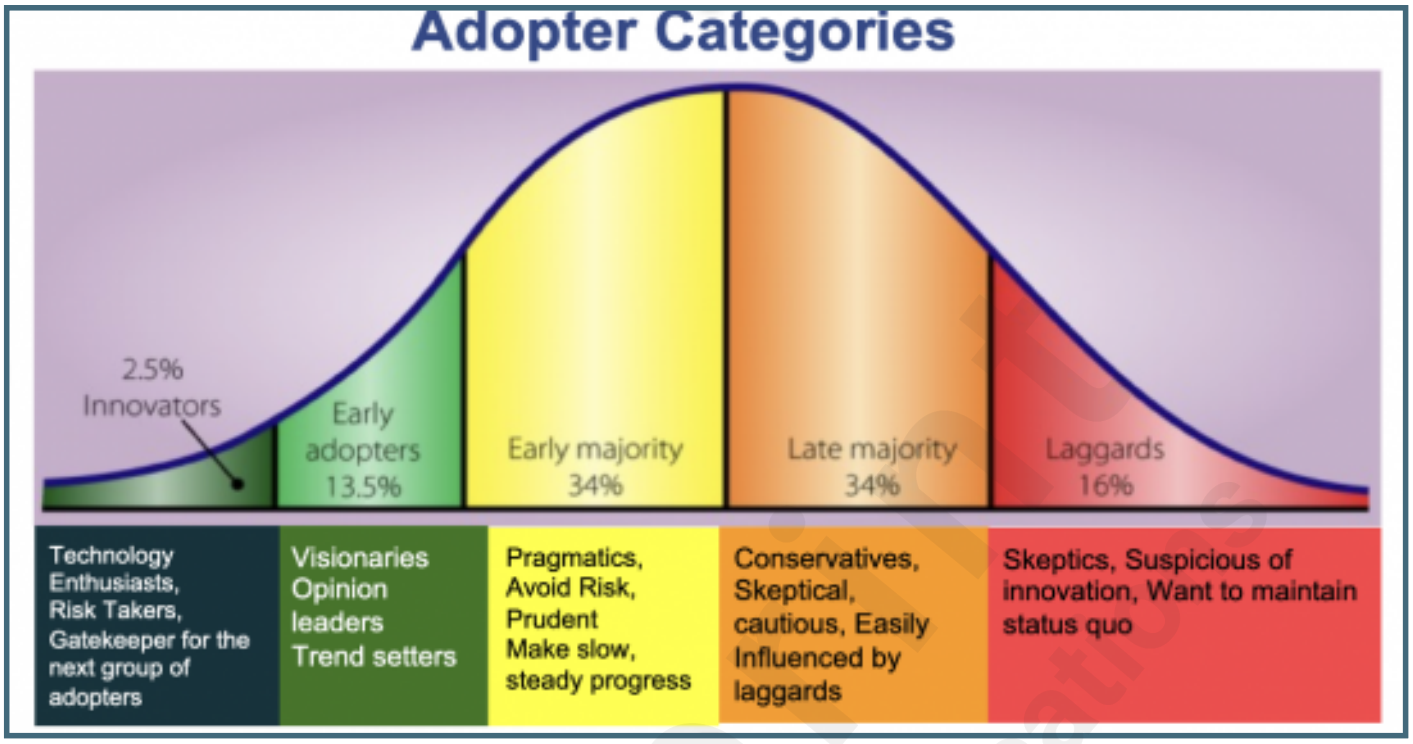
Supplementary Files

Figures

Innovation Decision Process proposed by Everett Rogers (1962).



Adopter Categories proposed by Everett Rogers (1962).



Conceptual Framework of the Study.