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Online health information seeking and digital health literacy among information and learning resources undergraduate students

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ABSTRACT

Background: During the COVID-19 pandemic, students have trouble coping with the available health information regarding the coronavirus in their daily lives because of misinformation.

Objectives: The aim of this study was to evaluate online health information seeking and digital health literacy among information and learning resources undergraduate students at Taibah University during the COVID-19 pandemic.

Methods: To investigate the primary goal, this study used a simultaneous exploratory mixed methods design. Seventeen students participated in phone interviews, and 306 were invited to complete an online survey.

Analysis: The collected data was analyzed using both quantitative (SPSS) and qualitative (NVivo 10) methods.

Results: Search engines, social media, and YouTube were most often used by the respondents as sources to search for COVID-19-related information. COVID-19 symptoms, restrictions, and the current spread of COVID-19 were the most searched topics by the respondents. Significant and relevant differences emerged for the digital health literacy subscales "information search" and "adding self-generated content". However, there were no significant differences in the digital health literacy subscale "determining relevance".

Conclusion: Using the internet to provide health information tailored to the needs and interests of students to seek health information online and thereby improve their health literacy.

Introduction

The COVID-19 period is a time rich with meaningful insights on the students' health-related information-seeking. The rapid spread of the novel coronavirus disease (COVID-19) has wreaked havoc on people worldwide. It has put a halt to international trade, movement, and socialization. The world is currently experiencing unparalleled and severe effects as a result of the coronavirus disease epidemic of 2019 (COVID-19) (Al Jasser et al., 2020). The World Health Organization (WHO), global public health networks, and governmental public health agencies have used multiple media platforms in attempts to keep the public constantly informed of emerging health information (Leigh et al., 2020). Indeed, when a disaster such as COVID-19 occurs, information sources assist people in making sense of the situation, learning preventative actions, and reducing anxiety induced by the unclear scenario.

Information sources, particularly mass media, print media, and internet-based sources, can be beneficial but can also cause new difficulties (Soroya et al., 2021). Understanding public perceptions and practices, such as fears, widely used and trusted sources of information, and reasons to observe or disobey public health mandates, is critical to effective pandemic management (Parsons et al., 2020a, 2020b). COVID-19 produces a complicated situation that necessitates a person's ability to access, navigate, interpret, use, and critically evaluate information and services in ways that promote healthy and safe conduct.

During the COVID-19 pandemic, many countries used online cross-sectional surveys to measure public knowledge and determine sources of information from disinformation outlets (Shehata, 2020; Roselina et al., 2021). In Saudi Arabia, the Saudi Ministry of Health has introduced various informational resources to provide public health information to the population in the wake of the COVID-19 pandemic. Saudi

Arabia's government and private sector collaborated to create and launch approximately 19 applications dedicated to health information and medical services (Hassounah et al., 2020). However, increased public anxiety, underuse of health services, and mistrust of government communications have been related to the influx of COVID-19 misinformation. Zakar et al. (2021) stated that with the rapid spread of the COVID-19 pandemic, an 'infodemic,' or global epidemic of misinformation and disinformation, has emerged. COVID-19 resources, including both information and disinformation, are constantly flooding the internet and social media. Furthermore, this deluge of nuanced and contradictory information spreads fear, anxiety, uncertainty, disorder, and panic in the general population, even more than the virus itself.

Students are particularly prone to experiencing the infodemic because of how much they use technology. Students spend considerable time on digital devices, not just in their everyday lives but also for seeking health-related information (Lenhart, 2015; Park & Kwon, 2020). Given the current situation, it is critical to recognize the COVID-19-related information sources students use to learn about the COVID-19 pandemic and which sources were more accurate than others in disseminating information about the pandemic. Despite their broad awareness, students still require instruction in the proper use of information sources, particularly in terms of comprehending and deciphering the vast amount of information available on the internet. As a result, it is important to investigate students' digital health literacy and provide relevant education and sources to enhance their abilities to make related health decisions.

According to research conducted among university students, this age group needs to improve their capacity to appraise the usefulness of web-based information. Little research about the factors of digital health literacy in relation to COVID-19. This study fills in those gaps.

Unfortunately, there is little research on online information seeking behavior and digital health literacy during COVID-19, especially among university students. To fill this gap, this study investigated students' self-perceptions of their digital health literacy skills, identified the web-based information sources used by students to learn about the COVID-19 pandemic.

In order to accomplish this, the following research questions will guide this study:

RQ1. Which web-based information sources are used by the students?

RQ2. Which topics are searched for in the context of COVID-19 by the students?

RQ3. What are the students' levels of digital health literacy in related to COVID-19?

RQ4. What are the relationships between the sources used for information searching and digital health literacy?

Literature review

Health information seeking behavior

Health information seeking behavior is obtaining the amount and type of information required in making a medical decision (Lambert and Loiselle, 2007). Furthermore, according to Li et al. (2016), health information seeking behavior is a concept that explains how people seek out health-related information. Seeking health information is important because it helps individuals adjust psychosocially to illness and develop health activities.

Additionally, the Medical Library Association describes health information-seeking behavior as the capacity to know the significance of well-being data, methods of obtaining wellbeing data, and how to apply that information in daily life (Eriksson-Backa et al., 2012; Soleymani et al., 2021). Li et al. (2016) also address how individuals seek well-being data. According to Hassan and Masoud (2020), seeking health information behavior has drastically changed over time. In this era, people are using digital means to obtain health information even before

seeing a health care provider. For instance, the internet has made life easy as people can now obtain the information needed in the comfort of their homes without visiting libraries or hospitals (Lupton & Lewis, 2021). While information may be easy to obtain on the internet, there is plenty of literature about how the abundance of information has made life complicated and hard for people. The internet affects people's ability to make timely decisions. Feel confused, stressed, frustrated and of course start making mistakes (Zhang et al., 2022).

Soroya et al. (2021) noted that the media played a significant role in transforming the medical environment and the emergence of medical consumers. The study shows that people have used media, especially social media, to obtain health information. Many social media platforms offer health coaching to individuals with no medical knowledge (Shehata, 2020). This helps people know the importance of good health and how to achieve it.

The literature reports that exposure to various information sources is important as it helps people to be able to preserve and care for their health because of the ability to identify and retrieve information related to health (Hassan & Masoud, 2020; Shehata, 2020; Soroya et al., 2021; Tabacchi et al., 2016). Shehata (2020) believes that well-being data accessible on the internet are fundamental in the personal satisfaction of individuals. Currently, when people experience certain signs and symptoms, they rush to the internet to search for the type of illness they may be experiencing (Soroya et al., 2021). Hassan and Masoud (2020) sought to investigate sex differences in information seeking among people who possessed no medical knowledge. The findings showed that females have higher digital health literacy than males. In addition, females have a well-informed behavior of seeking health information more frequently than males who do not care much about their health unless the signs and symptoms are clear (Hassan & Masoud, 2020). Therefore, seeking health information more frequently is a sign of anxiety about one's health rather than a coping strategy.

Hassan and Masoud (2020) discovered that the most searched topic on the internet is health information. This means that technology and the digital era have exerted an influence on people's health information seeking. Many people have been taught about the impacts of the internet and how it can be used to obtain health information (Ma et al., 2020).

Need and information seeking regarding COVID-19

Globally, life has been disrupted by COVID-19, which spread quickly and changed the ways people live. In such difficult times, seeking health information digitally has increased because many people do not know more about the coronavirus and its symptoms (Zakar et al., 2021). Therefore, there has been a need to seek information regarding the disease on the internet, and it is one of the researched subjects. According to Soroya et al. (2021), when the pandemic hit various countries, governments decided to use the media and the internet to pass information regarding the disease to citizens. However, citizens had to be offered digital literacy to search the precautionary measures set by the government and any other information released by the WHO regarding the coronavirus (Zakar et al., 2021).

When the disease was declared a pandemic by the WHO, information dissemination began in China through WeChat to empower people with information and provide precautions about the disease (Ma et al., 2020). This information was provided to enlighten people and show them the danger ahead if they did not protect themselves well (Ma et al., 2020). Dadaczynski et al. (2021) note that digital communication technology has played an essential role in communicating health strategies set by the government to fight COVID-19. Thus, people who have health information regarding COVID-19 are aware of the measures being reinforced by the government to prevent its spread. Information is a powerful tool in the health sector, and it can be valid or biased (Ma et al., 2020). The influence of this new information environment can be illustrated in the instance of the COVID-19 outbreak. The transmission of information has the potential to significantly influence people's behavior

and impact the efficacy of government countermeasures (Cinelli et al., 2020).

People begin to recognize the importance of obtaining full, reliable, and correct information about the COVID-19 pandemic from a variety of sources (Roselina et al., 2021). This information activity is intriguing to investigate, particularly because much of the information circulating in the community is fake information. Roselina et al. stated that respondents who were seeking information on COVID-19 used two main sources. The majority of respondents (78.3 %) obtained their information from social media while others obtained it from online news websites (55.3 %).

Ma et al. (2020) opine that in times of global health crises such as the coronavirus, information found online may be distorted and fail to give the necessary valid data. To make informed decisions, people consult various sources of information, leading to information overload that the brain cannot process (Soroya et al., 2021). This, in turn, creates negative behavioral and psychological responses. Researchers such as Soroya find that personal networks and social media are not fit to seek health information about COVID-19 because such platforms spread rumors and do not verify the information. Information that is not verified can lead to unnecessary tension among the people. In research conducted by Parsons Leigh et al. (2020) in Canada on the beliefs, knowledge, and perception of COVID-19, it was evident that Canadians were worried about how the health care system, their family members, and themselves had been threatened by the disease. The research shows that Canadians had valid and verified information regarding the disease. Seeking health information regarding COVID-19 is important. It helps people who suffer from chronic diseases know how to protect themselves and the type of treatment they need when they contract the disease (Ma et al., 2020). Alternatively, Kor et al. (2020) report that online health information does not benefit people suffering from chronic diseases because most information is not verifiable. Therefore, digital health literacy can be used to measure whether all people are satisfied with the information they obtain online.

Health literacy related to COVID-19

Health literacy is obtaining and processing essential health knowledge required in choosing proper wellbeing choices (Berkman et al., 2010). According to Patil et al. (2021), understanding college students' digital health literacy and their behaviors and attitudes related to the pandemic, health profiles, and patterns of seeking and using health information are essential. In addition, Norman and Skinner (2006) describe digital health literacy as using electronic sources to find, appraise, understand, and seek information related to health. Focusing on web interactivity, self-generated content, and privacy protection are measures undertaken under digital health literacy (Ivanitskaya et al., 2006). Knowing healthy digital literacy leads to better health and positive health behaviors, such as preventing and managing chronic diseases (Patil et al., 2021). Shehata (2020) adds that the capacity to retrieve health information is essential in maintaining good health.

Health literacy is significant in making appropriate health decisions because it gives people the ability to process and obtain essential wellbeing data (Berkman et al., 2010). Health illiteracy affects how people understand their health and renders them ignorant (Zakar et al., 2021).

Everyone needs at least a little, i.e., some education because it helps in disease prevention and health protection. According to Ivanitskaya et al. (2006), in his recent study, a high level of health literacy makes people adopt healthier behaviors and helps them control their health. Low levels of health literacy make people make chronically weak choices and be helpless when comprehending discretionary therapies, side effects, and health status (Ivanitskaya et al., 2006). There has been misinformation regarding COVID-19, and it is a challenge for those seeking health information. Based on a recent report on the coronavirus in Germany, Germans have trouble coping with the available health information regarding the coronavirus in their daily lives because of misinformation (Dadaczynski et al., 2021).

According to Shehata (2020), the capacity to retrieve health information is essential in maintaining good health. When COVID-19 was diagnosed, people had little knowledge of handling the disease, and only a few elites knew its signs and symptoms. The internet plays an important role by providing the necessary information for people to recognize the virus (Rosário et al., 2020). As a result, the government developed strategies to prevent the virus from spreading and affecting more people. According to Zakar et al. (2021), people who lack knowledge of COVID-19 should be taught. The government can strategize on reaching every person countrywide and educate them on the effects of COVID-19. Kor et al. (2020) believes that people suffering from diseases and that are highly susceptible to COVID-19 should be provided with valid health information. Similarly, Soroya et al. (2021) concluded that even though information is important, some instances should be avoided because of being biased. Most of the social media information regarding COVID-19 is unverifiable and can negatively affect people with chronic diseases. Thus, relevant information related to COVID-19 is significant in health literacy.

Research methods and data collection

Study design and participants

The goal of this study is to examine students' information-seeking behaviors and ability to locate COVID-19–related health information among undergraduate students enrolled in the Information and Learning Resources Department at Taibah University, Saudi Arabia. This study adopted a mixed method approach using both a qualitative exploratory method and a quantitative approach to answer the research questions. The study utilized a cross-sectional questionnaire survey and semistructured interviews to inspect how they handle COVID-19–related digital health literacy and to investigate the reasons behind these views.

Cross-sectional survey

Everyone enrolling in the information science program was given the opportunity to take the survey. All participation was voluntary. Data was gathered via an online survey questionnaire to address the study's questions. The online survey conducted among 306 student participants at Taibah University in Saudi Arabia. Using Google Forms, a survey questionnaire was created and distributed to all students in the department during the first week of May 2021. The sample size was calculated using a 70 % frequency, a 5 % significance level, and a 95 % confidence level, resulting in a minimum of 306 people. A random selection procedure was used to select participants from the university campus. The study's target demographic was undergraduate students of both sexes who were able to participate. The researcher gave an overview of the study and sent an email to the students in the department with a link to participate. The data were collected until the necessary sample size was reached.

The study protocols were reviewed and approved by the Institutional Ethical Review Board (COPTU-REC) at Taibah University (IORG #0010594 AND IRB#0012561). A student who was willing to complete the survey provided their informed consent before accessing the online survey. Participants had the freedom to skip questions or stop answering at any time. A total of 319 surveys were conducted. However, the final analysis did not include 13 incomplete responses.

Semistructured interviews

Participants were asked to include their contact information after completing the survey if they wanted to participate in a follow-up semistructured interview. Participants who showed an interest were purposefully chosen. Interviews were performed over the phone and lasted approximately 15 min. The interviews took place on May 10 and

May 30, 2021.

Measures

The questionnaire had three primary sections of the study. The first section focused on the participants' demographic information, such as age (in years), sex (male or female), and academic year (first year, second year, third year, or fourth year). The second section examined participants' online health information seeking behavior related to COVID-19, such as their experience with online health information seeking on COVID-19. Knowledge of Web-based information sources were measured using multiple items on a five-point Likert-type scale ranging from 1 ("don't know") to 5 ("often"). Students were also asked to list the precise COVID-19 topics that they were seeking. The evaluation was based on a self-developed list of nine topics (multiple response). The contents are provided in Appendix.

The final section used the newest instrument to assess the participants' digital health literacy (Van der Vaart & Drossaert, 2017). The Digital Health Literacy Scale consists of four subscales: (1) information searching, (2) adding self-generated content (3) evaluating reliability, (4) determining relevance of online information. A total of 12 items (3 per subscale), which was measured using multiple items on a five-point Likert-type scale ranging from 1 ("very difficult") to 5 ("very easy").

The reliability statistics (Cronbach alpha) of the overall Digital Health Literacy scale (12 items) is $\alpha = 0.88$ in this study. The questionnaire was tested on 30 students to ensure that it was clear and understandable. The overall scores were divided into three categories: limited health literacy (1–2), possible limited literacy (2–3), and acceptable health literacy (4–5).

Data analysis

Statistical Package for Social Science (SPSS) version 28 was used to analyze the data. ANOVA tests were used to examine differences between the sources used for information searching and digital health literacy. P values of 0.05 were considered statistically significant in all analyses.

The goal of the qualitative data analysis was to develop descriptive data that provided better insight into student online health information seeking and digital health literacy during the COVID-19 pandemic. The NVivo 10 qualitative data analysis software package was used to analyze the semistructured interview. These data coded based on common themes and categories.

Results

Table 1 shows that a total of n = 306 respondents participated in the survey and 13 students (7 females,6 male) completed the semistructured interview. 63.7 % of participants aged between (21–23) years). Overall, 52.0 %% were male and 48.0 % were females. Students in the second year represented around 33.0 % of the sample. According to Experience of online health information seeking on COVID-19, 44.4 % of participated search information for themselves and other people.

Web-based information-seeking behaviors

RQ1: Which web-based information sources are used by the students?

Table 2 below demonstrates the Web-based information sources preferred by the students. Findings revealed that a significant number of students often sought information through Search engines (mean = 4.48), Social media (mean = 3.75), YouTube (mean = 3.72). The quantitative research data in Table 2 are supported by the data acquired from the NVivo qualitative research analysis (analysis of interviews). The analysis revealed three sources: Search engines, Social media, and YouTube.

Table 1

The sample distribution and experience of online health information seeking.

Demographic data of participants on the interviewees.		
Characteristics	Number	%
Male	6	46 %
Female	7	54 %
Demographic data of participants using survey		
Characteristics	Number	%
Sex		
Male	159	52.0 %
Female	147	48.0 %
Age of respondents		
18–20 years	75	24.5 %
21–23 years	195	63.7 %
>23 years	36	11.8 %
Academic year		
First-year	67	21.9 %
Second-year	101	33.0 %
Third-year	89	29.1 %
Fourth-year	49	16.0 %
Experience of online health information seeking on COVID-19		
Yes, only information for me	95	31.0 %
Yes, only information for other people	73	23.9 %
Yes, information for me and other people	136	44.4 %
No, I have not searched for information in the past 4 weeks	2	0.7 %

Table 2

Web-based information sources consulted to obtain COVID-19 information

Characteristics	Mean	S.Dev.
Search engines (Google, Bing, Yahoo)	4.48	0.906
Wikipedia and other online-encyclopedias	3.03	1.177
Social media (Facebook, Instagram, Twitter)	3.75	1.346
YouTube	3.72	1.298
Blogs on health topics	3.65	1.197
Guidebook communities	3.38	1.215
Websites of public bodies (MOH, provincial health departments)	3.46	1.168
Websites of doctors/pharmaceutical companies	3.61	1.202
News portal (e.g. newspapers, TV stations)	3.24	1.209

Search engines

Students utilized such search engines as Google, Bing, and Yahoo to obtain more information about the pandemic. They often keyed in particular keywords about Covid-19 to obtain search results that would help them obtain the required insights. Search engines was the most common web-based source of information because of its accessibility, ease of use, and convenience. One of the participants stated: "When crises occur, I usually search for information in Google because they show me the most important results. I prefer the Internet more than reading books because the medical and scientific terms in books that I have no idea what they mean. I prefer the Internet since it is a simple word" (f6). Another participant also stressed the ease of use and accessibility of search engines in obtaining information on Covid: "Among other resources, the Internet is the most accessible. I use Google to look for a variety of things related to COVID 19" (m2). Notably the participants were also keen to verify whether the Covid-related information from social media was from authentic and verifiable sources. One of them stated: "I conducted my initial online search there, as I feel I do for practically everything. When I come across Corona information, I look at the writer to see if it was published by a doctor or an expert" (f7). Overall, students could easily access search engines using their phones or any other mobile devices and could understand the results easily.

Social media

Next, the other source was social media. Social media was also a major source of information among students. Naturally, a considerable number of students are in social media platforms, including Facebook,

Instagram, and Twitter. Some of the participants prefer social media because of their unique features. One of them stated: "I usually use Twitter because I can filter the fields like a specific hashtag, time period. I keep looking on the COVID 19 hashtag that I want to browse, and all tweets that contain that hashtag appear" (f2). Clearly, some social media sites offered custom access to Covid-19 information.

These social media sites have various entities that offered information on the pandemic, including news, governmental, health, and non-profit organizations. Celebrities, communal groups, and family and friends were also significant sources of information on social media. Students could access their posts by following them or through sponsored posts. One of the participants stated: "I don't have enough time to visit a doctor. As a result, I'd rather use information from social media. Some Telegram channels give information about Corona viruses, which are quite beneficial and which I have extensively used" (m4). Another one stated: "I received all the messages of the Ministry of Health about COVID 19 from Twitter. It is my main source of information science there are no scientific references or scientific research centers concern about COVID 19. Also, I think that the doctors are not sufficiently familiar with this virus yet" (m1). Another one remarked: "In quarantine, I used to follow social media, snapchat app, because there are some of my favorite celebrities who give advice about Corona to their followers" (f1). Hence, most participants had specific reasons for using social media.

However, social media could also help group like-minded people and promote misinformation. One of the participants stated: "We have a WhatsApp group to share information about the Corona virus, especially because all members of the group believe in alternative medicine and herbal treatments that support the immune system instead of relying on medicines" (f3). Also, some found it challenging to verify Covid-related information from social media. One of them stated: "Recently, I have started receiving health information via the Instagram, however the quality of this information is unknown" (f5). Nonetheless, a considerable number of participants preferred to access information using social media.

YouTube

Lastly, another significant source of web-based information was YouTube. Similarly, entities that offered information on the pandemic, including news, governmental, health, and non-profit organizations are on YouTube as well and students could access their posts by subscribing to their channels or through sponsored posts. One of the participants stated: "It was helpful to watch someone on YouTube. I don't like to watch TV these days, I didn't pay too much attention to it because I think it is a source of panic. All numbers and statistics about the number of people infected with the virus around the world are inaccurate and not subject to study and scientific comparison" (m5). Another one noted: "Pharmaceutical companies have taken advantage of the Corona crisis to promote their products because their goal is to make a greater profit. Therefore, I watch YouTube because I can find information from trusted people" (m3). Another remarked: "The YouTube has been quite helpful to me recently. They mostly provide COVID19 information, which has proven to be really beneficial. Some doctors even appear to speak about ailments and how to handle them" (f4). Hence, YouTube was a crucial web-based source as well.

RQ2. Which topics are searched for in the context of COVID-19 by the students?

As illustrated in Table 3, the respondents were asked to identify their specific search topics for COVID-19. According to the questionnaire results, the symptoms of COVID-19 were the most-searched topics for students (95.8 %). Next, restrictions (84.3 %) and the current spread of COVID-19 were also searched even less (79.4 %); however, nearly half of respondents (47.7 %) explored the economic and social consequences of COVID-19.

These searches correspond to the fact that Covid-19 restrictions and

Table 3
Specific topics searched for in the context of COVID-19 (multiple response)

Characteristics	N	%
Symptoms of COVID-19	293	95.8
Restrictions (e.g., exit restrictions and stay-at-home orders)	258	84.3
Current spread of COVID-19 (e.g., number of infected cases)	243	79.4
Individual measures to protect against infection (e.g., hand-washing tips)	229	74.8
Transmission routes of COVID-19	185	60.5
Dealing with psychological stress caused by COVID-19	167	54.6
Current situation assessments and recommendations	166	54.2
Hygiene regulations (e.g., disinfection and cleaning)	154	50.3
Economic and social consequences of the COVID-19	146	47.7

resultant social-economic consequences had a direct impact on their lives. Other topics searched included the current spread of Covid-19, individual measures to protect against infection, transmission routes of COVID-19, handling psychological stress caused by COVID-19, current situation assessments and recommendations, and hygiene regulations. Table 3 below outlines the topics searched and their relative distribution.

The themes that emerged from the interview data regarding the topics searched for in the context of COVID-19 are as follows: Information to self-educate about COVID-19, prevention information, and information on Vaccines.

Information to self-educate about COVID-19

Under this context, participants search for topics on three main categories: medical conditions, handling of Covid-19 related stress, and symptoms of Covid-19. Regarding medical conditions, many students were worried about symptoms. Possibly, students were interested in the symptoms of the disease for self-diagnosis or awareness. By knowing the symptoms, they could determine or when they became sick or those around them became infected in order to undertake necessary measures. One of the participants stated: "I have been experiencing catarrh, I do not know whether the coronavirus has infected me or not. Last night, for instance, I could not breathe, so I searched online and learn more about catarrh" (m4). Hence, participants used the web to learn more about the medical aspect of Covid.

Concerning Covid-related psychological stress, some students were interested in knowing how to deal with anxiety and stress caused by the disease. One of them stated: "I read other people's stories regarding how to deal with the coronavirus infection of a family member in order to obtain information on the most appropriate way to deal with the situation" (f4). Another one noted: "I was scared it could be COVID-19 at the first sign, such as a cough and headache. Because I interact with a variety of people, I am worried about my parents because if I get sick, my entire family is contaminated" (f5). Generally, the participants used the web to confirm their suspicions.

Other students were looking for information on symptoms of the disease. They used anecdotal evidence and other societal clues to get information on how they could handle COVID-19-like symptoms, understand what was ailing them, and protect themselves and others. One of them stated: "When changing seasons from winter to spring, I know that it is the season of colds. It is common knowledge that a cold, fever, cough and headache are all symptoms of a cold, which often do not require a visit to a doctor, but these days I feel panicked and in a state of confusion. I have been looking more closely at the symptoms of the coronavirus, such as the type of cough, and so on (f6)". Students also sought for how to distinguish COVID-19 symptoms from the symptoms of other similar illnesses such as colds and flu.

Prevention information

Under this context, participants search for topics on two main

categories: restrictions and alternative medicines. Some searched for data on restrictions because they wanted to know how to comply with regulatory requirements and control the disease. For instance, one of them stated: "I was looking for what to do to protect against covid-19, such as how much distance I should keep from others to reduce the risk of infection when they cough, sneeze, or talk in enclosed spaces such as the classroom. (f1)" Another one remarked: "The coronavirus is a very mysterious disease, especially after it developed itself. Therefore, people are seeking prevention ways. For example, I was looking for basic information on how to wear a mask. Also, I searched on the effectiveness and people's opinions about the use of valved masks (m2)." Others went a step further to seek alternative medicine. One of the participants remarked: "We have a WhatsApp group that shares information about the coronavirus. All members of the group believe in alternative medicine and herbal treatments that support the immune system instead of relying on medicines (f3)." Clearly, most students sought information on any approaches that could help manage the disease.

Information on vaccines

Lastly, a considerable number of them searched for information on vaccines. Vaccines were crucial to managing the epidemic and were the only measure that could help return to normalcy. Therefore, a significant number of students were interested in obtaining news or information about vaccines. For example, one of the participants stated: "Personally, I search every day for COVID-19-related information, especially on vaccines. It is quite beneficial to have as much information as possible. That seems to help me unwind slightly more (m3)". Another one stated: "I searched about the government and private hospitals that were performing coronavirus tests and the vaccines. Also, I was looking on the types of COVID-19 vaccines and how does it work? (f7)" Overall, information on vaccines was vital.

Digital health literacy

RQ4: What are the students' levels of digital health literacy in related to COVID-19?

Table 4 shows the different dimensions of digital health literacy and the percentages of students providing the answers. To report the frequencies for each digital health literacy subscale, scores were assessed as the mean ratings and standard deviations. Higher means for various subscales of digital health literacy were recorded for "information search" (M = 3.8, SD + 1.1), "adding self-generated content" (M = 3.7, SD + 1.1), "evaluating reliability" (M = 3.1, SD + 1.0), and "determining relevance" (M = 3.2, SD + 0.9). The findings show that many respondents found the online search for information easy and even very

easy, including using the proper words/search query (62.4 %), choosing information to find (57.9 %), and finding the exact information they sought (72.2 %); conversely, the lowest reported scale was for determining relevance. The findings show that using this information in daily life caused difficulties for approximately 32.6 %.

RQ5: What are the relationships between the sources used for information searching and digital health literacy?

ANOVA (Tables 5–6) was used to examine the significant differences in digital health literacy and the web-based information sources utilized to obtain COVID-19 health information. Significant and relevant differences emerged for the following digital health literacy subscales: "information search" and "adding self-generated content". Respondents with acceptable digital health literacy in that dimensions reported using Search engines (Google, Bing, and Yahoo) more frequently. The opposite could be observed for News portals (e.g., newspapers and TV stations).

Discussion

This study's findings show that the participants use different formal and informal resources to obtain information related to COVID-19. It was found that the study sample preferred search engines, social media, and YouTube as sources to obtain information related to COVID-19. This is consistent with other studies (Shehata, 2020; Olaimat et al., 2020; Saleem et al., 2020; Dadaczynski et al., 2021). One commonly reported reason for seeking information from social media is that social media have evolved into a valuable source of health information and a forum for sharing personal stories, thoughts, and concerns about health. For example, YouTube and Twitter give users instant access to an unparalleled volume of information related to COVID-19, and algorithms mediate and facilitate content promotion by considering users' interests and attitudes (Cinelli et al.,2020). However, COVID-19 reporters' social media content has been repeatedly chastised for propagating inaccurate or misleading information (Shehata, 2020). Favorite search topics were the symptoms of COVID-19 and restrictions. This is similar to the results of other population health literacy studies (Dadaczynski et al., 2021). Many students were worried about symptoms they possibly had that could correspond to the ongoing pandemic's virus's symptoms, so they were frantically searching for information using online forums, generally looking for information in the fastest and most convenient ways.

Finally, the findings revealed that based on the students' self-perceptions of their digital health literacy skills a high proportion of the respondents had acceptable levels of digital health literacy. This is consistent with Zakar et al.'s study (Zakar et al., 2021), which reported that >50 % of university students in Pakistan had high digital health literacy level in relation to COVID-19. Nevertheless, the finding contrasts Juvinyà-Canal et al.'s study (Juvinyà-Canal et al., 2020), which

Table 4
Digital health literacy levels of university students

Characteristics	Very easy N(%)	Easy N(%)	Average N(%)	Difficult N(%)	Very difficult N(%)	Cronbach's Alpha
Information searching						0.88
Make a choice using all the found information	104 (34.0)	73 (23.9)	55 (18.0)	61 (19.9)	13 (4.2)	
Use the proper words/search query to find information	120 (39.2)	71 (23.2)	53 (17.3)	47 (15.4)	15 (4.9)	
Find the exact information sought	152 (49.7)	69 (22.5)	38 (12.4)	27 (8.8)	20 (6.5)	
Adding self-generated contents						0.902
Clearly formulate question	137 (44.8)	67 (21.9)	38 (12.4)	42 (13.7)	22 (7.2)	
Express opinions, thoughts or feelings in writing	137 (44.8)	70 (22.9)	39 (12.7)	36 (11.8)	24 (7.8)	
Write message as such for people to understand exactly what he or she means	101 (33.0)	69 (22.5)	54 (17.6)	66 (21.6)	16 (5.2)	
Evaluating reliability						0.755
Decide whether the information is reliable	97 (32.7)	74 (24.2)	54 (17.6)	63 (20.6)	18 (5.9)	
Decide whether the information is written with commercial interests	54 (17.6)	75 (24.5)	81 (26.5)	45 (14.7)	51 (16.7)	
Check different websites to see whether they provide the same info	53 (17.3)	88 (28.8)	80 (26.1)	58 (19.0)	27 (8.8)	
Determining relevance						0.585
Decide whether the found information is applicable	80 (26.1)	85 (27.8)	65 (21.2)	49 (16.0)	27 (8.8)	
Apply the found information in daily life	66 (21.6)	60 (19.6)	80 (26.1)	46 (15.0)	54 (17.6)	
Use found information to make health-related decisions	67 (21.9)	77 (25.2)	82 (26.8)	41 (13.4)	39 (12.7)	

Table 5

Relationship between web-based information sources and digital health literacy level for the "information search" and "adding self-generated content" subscales

Characteristics	Information search					Adding self-generated content				
	Limited	Possible	Acceptable	f	sig	Limited	Possible	Acceptable	f	Sig
										0.0
	Mean (SD)	Mean (SD)	Mean (SD)			Mean (SD)	Mean (SD)	Mean (SD)		
Search engines (Google, Bing, and Yahoo)	4.0 (1.6)	4.3 (0.8)	4.6 (0.6)	10.1	0.0	4.1 (1.4)	4.0 (0.9)	4.76	24.7	0.0
Wikipedia and other online encyclopedias	2.2 (1.2)	3.0 (1.0)	3.2 (1.1)	12.5	0.0	2.5 (1.2)	2.8(0.9)	3.2 (0.9)	10.3	0.0
Social media (Facebook, Instagram, and Twitter)	3.3 (1.4)	3.5 (1.3)	3.9 (1.3)	5.3	0.0	3.4 (1.3)	3.2 (1.2)	4.0 (1.1)	11.5	0.0
YouTube	2.9 (1.5)	3.6 (1.2)	3.9 (1.1)	11.6	0.0	3.0 (1.4)	3.2 (1.1)	4.09 (1.2)	21.0	0.0
Blogs on health topics	2.4 (1.3)	3.5 (1.1)	3.9 (1.0)	30.1	0.0	2.8 (1.3)	3.1 (1.0)	4.0 (1.1)	33.9	0.0
Guidebook communities	2.3 (1.2)	3.3 (1.1)	3.6 (1.1)	22.0	0.0	2.6 (1.3)	3.1 (1.0)	3.7 (0.9)	21.4	0.0
Websites of public bodies (MOH and provincial health departments)	2.3 (1.2)	3.4 (1.1)	3.7 (1.0)	29.6	0.0	2.6 (1.3)	3.1 (1.0)	3.8 (1.0)	32.9	0.0
Websites of doctors/pharmaceutical companies	2.4 (1.3)	3.5 (1.1)	3.9 (1.0)	29.2	0.0	2.8 (1.3)	3.1 (1.0)	4.0 (0.9)	30.8	0.0
News portals (e.g., newspapers and TV stations)	2.2 (1.2)	3.2 (1.1)	3.4 (1.1)	16.7	0.0	2.6 (1.3)	3.0 (1.0)	3.5 (1.1)	13.5	0.0

Table 6

Relationship between web-based information sources and digital health literacy level for the "evaluating reliability" and "determining relevance" subscales

Characteristics	Evaluating reliability					Determining relevance				
	Limited	Possible	Acceptable			Limited	Possible	Acceptable		
	Mean (SD)	Mean (SD)	Mean (SD)	F	Sig	Mean (SD)	Mean (SD)	Mean (SD)	F	sig
Search engines (Google, Bing, and Yahoo)	4.2 (1.1)	4.4 (0.9)	4.6 (0.6)	3.6	0.02	4.5 (1.0)	4.4 (0.8)	4.5 (0.9)	0.14	0.86
Wikipedia and other online encyclopedias	2.6 (1.0)	3.1 (1.2)	3.1 (1.1)	3.4	0.35	3.1 (1.3)	3.0 (1.1)	3.0 (1.0)	0.13	0.87
Social media (Facebook, Instagram, and Twitter)	3.2 (1.3)	3.9 (1.2)	3.8 (1.3)	5.1	0.00	3.7 (1.3)	3.8 (1.3)	3.6 (1.3)	1.01	0.36
YouTube	3.4 (1.3)	3.6 (1.3)	3.9 (1.1)	3.3	0.03	3.7 (1.4)	3.7 (1.3)	3.6 (1.2)	0.67	0.51
Blogs on health topics	3.2 (1.3)	3.6 (1.2)	3.9 (1.0)	7.2	0.00	3.7 (1.3)	3.6 (1.2)	3.6 (1.1)	0.07	0.92
Guidebook communities	3.0 (1.2)	3.3 (1.2)	3.5 (1.4)	3.8	0.02	3.5 (1.4)	3.3 (1.2)	3.4 (1.1)	0.59	0.55
Websites of public bodies (MOH and provincial health departments)	3.0 (1.2)	3.4 (1.2)	3.7 (1.0)	6.9	0.00	3.6 (1.3)	3.4 (1.1)	3.4 (1.1)	0.30	0.73
Websites of doctors/pharmaceutical companies	3.1 (1.3)	3.6 (1.2)	3.8 (1.0)	6.5	0.00	3.6 (1.3)	3.6 (1.2)	3.6 (1.1)	0.09	0.90
News portals (e.g., newspapers and TV stations)	2.9 (1.2)	3.2 (1.2)	3.3 (1.1)	1.9	0.14	3.3 (1.3)	3.1 (1.2)	3.3 (1.1)	0.84	0.43

reported that students had limited levels of digital health literacy. Greater digital health literacy is a sign of personal well-being and self-efficacy in the face of pandemics.

Conclusion

The current research was conducted to clarify information-seeking behavior and examine self-perceptions of digital health literacy among information and learning resources undergraduate students at Taibah University during the COVID-19 outbreak. Since the crisis began with the spread of the virus in China late last year, it has been transmitted to other countries. The crisis has created panic among students, so there is an important need to study how students have been searching for information related to COVID-19 in order to avoid problems that may develop as a result of relying on false information) Shehata, 2020(. Relying on inaccurate information can lead to further harm and prevent students from engaging in healthy habits.

In order to execute interventions to lessen the disease's negative impacts, it is critical to understand students' informational needs and information-seeking behaviors regarding COVID-19. Knowing how people look for information can also be very helpful in creating strategies for publicizing information should other health emergencies take place in the future. Also, having this type of data would be helpful to university administrators needing to convey policy and procedural information to students during a health crisis, and could also be useful to public health providers.

Search engines and social media are more frequently used than other media to gain information regarding COVID-19. Thus, this study aids in the prevention of the propagation of false news in crisis situations. The harmful effects of pseudoinformation and misinformation are reduced when students' digital health literacy is improved. The findings can be used to establish rules for notifying university students about misleading information during crises. Moreover, these findings highlight the necessity for health education programs to help students improve their health literacy skills. Furthermore, more precise public health information platforms are required to deliver timely and evidence-based information to inform individual behavior and system-level actions. Finally, by evaluating digital health literacy and information seeking in students, the study has added to the evidentiary base on digital health literacy. Limited digital health literacy is a significant issue for health policies and practices. The findings may also support insights for health planners and policy-makers to establish appropriate digital health literacy programs in order to address this health literacy deficiency. The findings of the current study may be used to help various information science departments in Saudi Arabia universities to create a course plan that will help students become more literate in using health information.

In terms of the study's limitations, it is worth noting that the participants were information science students who were taught how to find credible information. For the "average" student, the results may differ. As a result, more research in other departments is needed as the outcomes may differ. To address the epidemic, targeted approaches should be developed to improve digital health literacy among Taibah University students.

Another limitation is that all information is self-reported. Digital health literacy levels rely on respondent self-evaluation rather than on any objective measures of their literacy. Also, because the survey was cross-sectional, the author was unable to access digital health literacy 's changes over time. On the basis of a practical sampling method, the sample self-selects. Consequently, the findings' ability to be generalized may be constrained.

Data availability

Data will be made available on request.

Appendix A

The web-based information sources

1. Search engines (Google, Bing, Yahoo)
2. Websites of public bodies (NCOC, provincial
3. health departments)
4. Wikipedia and other online-encyclopedias
5. Social media (Facebook, Instagram, Twitter)
6. YouTube
7. Blogs on health topics
8. Guidebook communities
9. Health portals
10. Websites of doctors/pharmaceutical companies
11. News portal (e.g. newspapers, TV stations)

Topics searched for in the context of COVID-19 (multiple response)

1. Current spread of COVID-19 (e.g. number of infected cases).
2. Transmission routes of COVID-19
3. Symptoms of COVID-19
4. Individual measures to protect against infection (e.g. hand-washing tips)
5. Hygiene regulations (e.g. disinfection and cleaning)
6. Current situation assessments and recommendations
7. Restrictions (e.g. exit restrictions, stay-at-home orders)
8. Economic and social consequences of the COVID-19
9. Dealing with psychological stress caused by COVID-19
10. Others.

Digital health literacy

Information searching

1. Make a choice from all the found information
2. Use the proper words/search query to find information
3. Find the exact information looking for

Adding self-generated contents

1. Clearly formulate question
2. Express opinion, thoughts or feeling in writing
3. Write message as such for people to understand exactly what he/she means

Evaluating reliability

1. Decide whether the information is reliable or not
2. Decide whether the information is written with commercial interests
3. Check different websites to see whether they provide the same info

Determining relevance

1. Decide whether the found information is applicable
2. Apply the found information in daily life
3. Use found information to make health-related decisions

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