Health literacy predicts Covid-19 awareness and protective behaviours of university students

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Abstract

Background: Health literacy is expected to help individuals deal with the required infection control and knowledge to cope with the COVID-19 pandemic.
Objectives: This study examined the impact of health literacy on Covid-19 awareness and protective behaviours of university students in Pakistan.
Methods: An online questionnaire was used to collect data from students at three universities in Punjab. The approved questionnaire contained 12 statements related to HL, 21 items towards Covid-19 awareness, and 11 statements related to protective behaviours, along with some demographic data. Data analysis used Pearson correlation and simple linear regression.
Results: Health literacy of university students positively predicted their Covid-19 awareness and protective behaviours indicating that students with high health literacy were likely to be more aware of Covid-19 and adopt health protective behaviours. There were gender and rural/urban differences.
Conclusions: The results demonstrated an urgent need for planning a needs-based health literacy programme focusing specifically on Covid-19 literacy in Pakistan. This research might help policy-makers, NGOs, and health librarians devise suitable programme.

KEYWORDS
Asia, south; health literacy; public health; statistics; students

BACKGROUND

The development of coronavirus disease 2019 (Covid-19) into pandemic has wreaked havoc and dismantled daily activities at the workplace, academia and in everyday life. It not only caused panic and mental health problems for the public but also put pressure on health care systems (Bao et al., 2020; Xu et al., 2020). Public awareness is essential for the management of both emotions and behaviours in epidemic and pandemic situations such as Covid-19 (Moro et al., 2010). Knowledge of infection transmission mechanisms, common symptoms, prevention and self-care strategies are crucial to respond to pandemic situations at frontlines (Geldsetzer, 2020). In response to communicable diseases, health communication becomes more important to educate people about the mechanism of infection transmission, common symptoms, prevention mechanism and basic treatment (Paakkari & Okan, 2020). Infodemic has been recognized as an inevitable challenge not only for transmission of credible knowledge but also for restricting laymen to respond appropriately due to confusing and contradictory information such as misinformation, disinformation, mal-information (Hua & Shaw, 2020). Infodemic refers to a rapid and widespread of information and misinformation concerning an epidemic or pandemic like Covid-19 (Solomon et al., 2020).
In such a situation, people's ability to find credible health information becomes crucial not only to respond to pandemics and combat infodemic at frontlines.

The rapid and exponential spread of Covid-19 called for people's ability for the acquisition and application of health information and adaption of their behaviours worldwide (Paakkari & Okan, 2020; Zarocostas, 2020). People's ability to acquire and apply credible health information is essential to deal with the prevailing Covid-19 scenario (Paakkari, & Okan, 2020). The concept of health literacy is typically used in health communication for the education of people about health-related issues. It is defined as 'the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions' (Nutbeam, 2008). It not only requires a set of reading, listening, analytical and decision-making skills but also the self-efficacy to apply these skills in varied health situations (Sørensen et al., 2012). The WHO Health Promotion Glossary defined it as 'health literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health' (Nutbeam, 2000; World Health Organization, 1998). It refers here to peoples’ ability to acquire and understand critical medical information in the COVID-19 pandemic and infodemic (Seng et al., 2020).

The need for health literacy has never been more realized than in the days of the Covid-19 pandemic and infodemic when an infectious disease crisis simultaneously emerged around the globe (Abel & Mcqueen, 2020; Sentell et al., 2020). The spread of Covid-19 has not only exposed the ill-preparedness of governments, health care systems and social safety networks to respond to the longstanding and emerging health-related needs of people but also caused huge burdens to government, organizations and individuals (Duan et al., 2020; Nguyen, Do, et al., 2020; Rosenbaum, 2020). Health communication of WHO and governments of different countries set up advisory platforms for the education of the general public about Covid-19 symptoms, the way to avoid getting and spreading the infection, and where to find credible and latest advice. Unfortunately, the availability of misinformation, disinformation and mal-information through social media and mass-media exacerbated the effect of the Covid-19 pandemic among the general public (Naem et al., 2020). It not only caused fear among people but also produced unprecedented challenges for health education and health care systems (Nguyen, Do, et al., 2020).

Health literacy has been recognized as the fundamental and crucial factor for improvement of health care quality, maintenance of healthy lifestyles, amelioration of people's well-being, adoption of health protective behaviours and alleviation of health inequities (Greenhalgh, 2015; Nguyen, Nguyen, et al., 2020; Watson, 2011). It not only enables a healthy environment but also helps in implementing health-related policies, better health care outcomes, reduce costs and burden on the health care system (Ishikawa & Yano, 2008). Several studies have reported that people with limited health literacy usually had poorer health status and less likely to use preventive measures (Nielsen-Bohlman et al., 2004), likely to utilize more health services (Cho et al. (2008), greater likelihood to take incorrect medicines (Qin et al., 2015), more likely to be hospitalized along with bad health outcomes (Baker et al., 2002; Schillinger et al., 2002), increase inpatients expenditures (Howard et al., 2005), high mortality rates (Baker et al., 2007) and poor quality of life. A systematic review of literature on pandemic related health literacy such as MERS, COVID-19, and SARS by Seng et al. (2020) also indicated the sub-optimal level of health literacy ranging from 4.3% to 57.9% among populations related to health care and 4.0% to 82.5% among general populations. The studies included in the systematic review evaluated most frequently knowledge of symptoms, the infection spread, and transmission, fear of getting an infection and preventive measures such as mask-wearing and hand hygiene.

In relation to health literacy specifically with the Covid-19 pandemic, Parikh et al. (2020) assessed the knowledge of Covid-19, perceptions, and sources of information among both health care professionals and the general public. The results revealed that the participants were worried about getting an infection. Health care professionals approached advisory websites whereas the general public relied on television for health information. These participants had reasonably good knowledge about major Covid-19 symptoms, practiced precautionary measures to respond to infection spread and transmission, and showed agreement towards seeking medical advice and self-quarantine if they would involve in berating difficulty. The recent study by Nguyen, Nguyen, et al. (2020)
reported that people with low health literacy appeared to have higher depression caused by the Covid-19 pandemic. In another research, Nguyen, Do, et al. (2020) validated the Fear of Covid-19 Scale developed by Ahorsu et al. (2020) and found the association of higher health literacy with the lower fear of Covid-19. The study of Sajadi et al. (2020) examined the levels of health literacy among students and factors influencing these levels at Isfahan University in Iran. The results revealed 46% of students had adequate health literacy, followed by those students (36.7%) who had health literacy at a sub-optimal level. A good number of students (18.9%) had health literacy at an excellent level. The students’ level of education and faculty of the study were significantly associated with health literacy. Fauzi et al. (2020) explored Covid-19 literacy among biological students in Indonesia and found that most of the students had poor health literacy related to Covid-19 as they had a wrong understanding of symptoms, vaccination role and transmission ways. The study of Clements (2020) reported that low knowledge of Americans had an association with their engagement in buying goods than necessary, participation in large gatherings, and wearing medical masks. McCaffery et al. (2020) explored that the Australian adult people with limited health literacy had poorer knowledge about symptoms of Covid-19 infection, less likely to have preventive behaviours, and faced difficulty in finding health information and understanding public advisory messages by the government. Considering the results of these studies, one can easily conclude that adequate health literacy is essential to cope with the Covid-19 pandemic as it helps people to acquire and use credible health-related knowledge and adopt protective behaviours. The general public and the governments usually pay a high cost for low health literacy which is often overlooked. Košir and Sørensen (2020) considered health literacy as a key to creating public awareness and flattening the curve of Covid-19 infection.

A perusal of published research indicated the need for more research addressing health literacy assessment especially in the prevailing scenario of Covid-19 pandemic and infodemic. Only a limited number of studies appeared to have been conducted in Pakistan (e.g. Naveed & Shaukat, 2020; Naveed et al., 2020; Shaukat & Naveed, 2021). As of 15 January 2021, Pakistan has reached about 5,06,701 confirmed cases infected with Covid-19 along with 10,717 deaths (World Health Organization, 2021). The health care system of Pakistan cannot bear the burden of overwhelming Covid-19 patients but can prevent people from Covid-19 infection through health literacy programmes focusing specifically on Covid-19 awareness which will ultimately help people to adapt in compliance with Covid-19 protocols. This research, therefore, intended to investigate the impact of health literacy on Covid-19 awareness and protective behaviours of university students in Pakistan. The results of this study will not only be helpful to policymakers in Pakistan but also for information professionals, especially those engaged in health literacy programmes in Pakistan. These results can be used as a guide in developing the Covid-19 literacy curriculum for health literacy programmes not only in Pakistan but also in other developing countries, especially South Asian countries (e.g. Sri Lanka, Bangladesh, India, Nepal) as no such study appeared to have been conducted so far. This research is geared towards answering specifically the following research objectives:

1. To identify the nature of the relationship of health literacy, Covid-19 awareness, and protective behaviours with personal and academic variables of university students.
2. To investigate the relationship of health literacy with Covid-19 awareness and protective behaviours of university students
3. To determine the impact of health literacy on Covid-19 awareness and protective behaviours of university students

**Research hypotheses**

H₁: The health literacy of university students positively predicts their Covid-19 awareness.

H₂: The health literacy of university students positively predicts their protective behaviours.

**METHODS AND PROCEDURES**

Quantitative research design using a survey method was adopted to conduct proposed research as it was most adequate to study larger and geographically dispersed population by choosing a small sample. A cross-sectional survey using a questionnaire was conducted to collect data from university students. The questionnaire contained a new short-form health literacy scale (HLS-SF12), developed by Duong and et al. (2019) for the general public, along with 21 statements related to Covid-19 awareness and 11 statements related to protective behaviours (Appendix). HLS-SF12 is a standardized 12-item unidimensional instrument used to measure health literacy. This short-form version was developed by collecting data from 10,024 participants from six counties in Asia such as Indonesia, Malaysia, Kazakhstan, Myanmar, Taiwan and Vietnam using the 47-item European Health Literacy Questionnaire (HLS-EU-Q47) developed by Sørensen.
et al. (2013). It is a comprehensive measure that also expands its ability by adding virtual media and social support that lacked in other instruments (Liu et al., 2018). HLS-SF12 is a reliable and valid measure due to its adequate psychometric properties and useful tool to measure the health literacy of the general public. The shortness of HLS-SF12 allows the researcher to combine it with other instruments to investigate its relationship with another construct. Each statement of HLS-SF12 was measured on a 4-point scale that ranged between very difficult to very easy (e.g., Very Difficult = 1, Difficult = 2, Easy = 3, and Very Easy = 4).

As there was no standardized instrument available to measure Covid-19 awareness and protective behaviours. The statements related to Covid-19 awareness and protective behaviours were carefully generated based on existing literature and advisory platforms by the Government of Pakistan and the World Health Organization. Then initial draft of the questionnaire was submitted to a panel of experts (e.g. two doctors dealing with Covid-19, one educationist, and one researcher having extensive experience of health information-seeking) for construct validity and revised following their comments for its content and language. Afterward, it was pilot tested with 31 students who were not included in the study sample and revised for its language. The reliability of HLS-SF12, Covid-19 awareness, and protective behaviours was checked using Cronbach alpha based on the present data set of this study. The high values of Cronbach alpha indicated internal consistency of these instruments such as health literacy (12 statement, CA = 0.851), Covid-19 awareness (21 statements, CA = 0.973), protective behaviours (11 statements, CA = 0.800). The items related to Covid-19 awareness were measured on a five-point Likert scale such as (Strongly Disagree = 1, Disagree = 2, Undecided = 3, Agree = 4, and Strongly Agree = 5). Whereas, the statements related to protective behaviours were measured on a five-point scale such as Never = 1, Rarely = 2, Sometimes = 3, Often = 4, and Always = 5.

All the students enrolled at the University of the Punjab, Lahore (PU), University of Sargodha, Sargodha (SU), and University of Management and Technology, Lahore (UMT) in social and business science disciplines were considered as the population of this study. The PU and SU were public sector universities whereas UMT was a private sector university. These universities were purposively selected as PU was the oldest and the largest university in Pakistan and SU was a newly emerging and fast-growing public university from Sargodha. While UMT belonged to the private sector. The students enrolled in these universities were somehow representative of rural, urban, and middle-income populations of Pakistan. The questionnaire was administered online created in Google forms with the permission of concerned authorities (Deans/ heads) in June to mid-July as it was possible due to online classes being carried out in these universities due to Covid-19 Pandemic. The departmental heads facilitated the distribution of online questionnaires among students of different programmes with the help of their programme coordinators. The coordinators shared the questionnaire link along with a covering letter through the WhatsApp group of each class. The students were requested to participate in the survey voluntarily. The students were assured about the confidentiality and anonymity of their responses and usage of data only for research purposes. The follow-up reminders were also sent through programme coordinators to increase the survey responses. A total of 249 responses were received which were imported in SPPS for data analysis.

Prior to data analysis, the received questionnaires were screened. The negatively worded statements were reversed so that all the statements might be measured in the same direction. The composite variables for health literacy, Covid-19 awareness and protective behaviours

| Statistics                  | Health literacy | Covid-19 awareness | Protective behaviour |
|-----------------------------|-----------------|--------------------|----------------------|
| n                           | 249             | 249                | 249                  |
| Missing                     | 0               | 0                  | 0                    |
| Mean                        | 2.98            | 3.62               | 3.58                 |
| Standard Deviation          | 0.622           | 0.911              | 0.762                |
| Skewness                    | -0.211          | -0.144             | -0.262               |
| SE of Skewness              | 0.154           | 0.154              | 0.154                |
| Kurtosis                    | 0.631           | 0.275              | 0.363                |
| SE of Kurtosis              | 0.307           | 0.307              | 0.307                |
| Shapiro–Wilk test’s Sig Value | 0.769       | 0.649              | 0.798                |
were created by computing the means of their respective statements to obtain an overall assessment of health literacy, or COVID-19 awareness and protective behaviour. Moreover, the data have been screened for outliers and normal distribution. The different statistics in Table 1 indicated the normal distribution of data. There was a bell-shaped curve for histograms of three constructs. The standard deviations of these constructs also remained between +1 and −1. The values of skewness, kurtosis and Shapiro–Wilk test were also acceptable for the construct of health literacy, Covid-19 awareness and protective behaviour. Later on, the Pearson correlation was applied using SPSS to investigate the relationship of health literacy with Covid-19 knowledge and protective behaviours. A simple linear regression was calculated to determine the impact of health literacy on Covid-19 awareness and protective behaviours of university students.

RESULTS

Survey participants’ profile

Out of 249 survey participants, there were 103 (41.4%) males and 146 (58.6%) females. A large majority of these participants (n = 201, 80.7%) belonged to BS/MA programmes (16 years of education), followed by those (n = 42, 16.9%) who belonged to MS/MPhil programmes (18 years of education), and Ph.D. programme (N = 6, 2.5%). The age of these participants ranged from 18 to 49 years. A large majority of these participants (n = 205, 82.3%) had their age up to 25 years, followed by those having an age bracket 26–30 years (n = 26, 10.5%). There only 18 (7.2%) participants had an age of more than 30 years. Most of these students (n = 137, 55.0%) belonged to the University of Sargodha, Sargodha. It was followed by those students (n = 73, 29.3%) enrolled at the University of the Punjab, Lahore. There only 37 students (14.9%) who belonged to the University of Management and Technology, Lahore. As far as their background is concerned, 133 (53.4%) students belonged to urban areas and 116 (46.6%) were from rural areas.

RQ1: Relationship of health literacy, Covid-19 awareness and protective behaviours with personal and academic variables

The relationship of health literacy, Covid-19 awareness, and protective behaviour with students’ personal and academic variables was checked by calculating Pearson Correlation Coefficient (r), an independent sample t-test, and one-way ANOVA. Pearson Correlation coefficient (r) was calculated to check the correlation of participants’ age with their health literacy, Covid-19 awareness, and protective behaviour and t-test was applied to examine the mean differences in the index of health literacy, Covid-19 awareness, and protective behaviour based on participants’ gender and geographical background. While one-way ANOVA was performed to test differences in average scores of health literacy, Covid-19 awareness, and protective behaviour in accordance with the university and study programme. Table 2 outlined the details of the results. These figures showed that there were no statistically significant mean differences in the index of health literacy and Covid-19 awareness based on students’ age, gender, university and programme of study (p-value > 0.05). However, the statistically significant mean differences were found in the index of health literacy and Covid-19 awareness based on students’ geographical background (p-value < 0.05). It meant that the students with rural background have lower levels of health literacy than students with urban background as the mean score of rural students (Mean = 2.41, SD = 0.809) were lower than those having urban background (Mean = 3.22, SD = 0.514). Similarly, the rural students had lower Covid-19 awareness (Mean = 3.71, SD = 0.811) as compared to urban students (Mean = 4.21, SD = 0.615).

As far as protective behaviour is concerned, it was also not correlated with students’ age and programme of study (p-value > 0.05). However, there were statistically significant mean differences in the index of students’ protective behaviour based on their gender, geographical background, and the name of the university (p-value < 0.05). In other words, the female students (Mean = 3.70,
SD = 0.727) were more likely to adopt health protective behaviours as compared to male students (Mean = 3.41, SD = 0.781) as the mean scores of girls were greater than the mean scores of boys. Furthermore, the student having urban background likely to adopt protective behaviours than those having rural background as the mean scores of urban students (Mean = 4.11, SD = 0.827) were greater than the students with rural background (Mean = 3.51, SD = 0.711). As the results of one-way ANOVA was significant in accordance with university, Tukey’s post hoc analysis for pairwise comparison was computed for the name of the university and protective behaviour of university students. The results indicated that the students from the University of Management and Technology, Lahore (Mean = 3.95, SD = 0.769, p = 0.049) and the University of the Punjab, Lahore (Mean = 3.72, SD = 0.627, p = 0.041) were more likely to adopt protective behaviour as compared to the students who belonged to the University of Sargodha, Sargodha (Mean = 3.40, SD = 0.531, p = 0.000).

RQ2: Relationship of health literacy with Covid-19 awareness and protective behaviours

Pearson correlation coefficient was calculated to determine the relationship of health literacy with Covid-19 awareness, fear of Covid-19, protective behaviours, and conspiracy beliefs of university students. The details of the results are outlined in Table 3. These figures revealed no relationship of health literacy with fear of Covid-19 and conspiracy beliefs of university students because p-values were greater than the alpha value. Conversely, there was a statistically significant but positive relationship of health literacy with Covid-19 awareness and protective behaviours as p-values are less than the alpha value at 0.01. In other words, the health literacy, Covid-19 awareness, and protective behaviours of university students modestly correlated with each other according to the suggested criterion for the social sciences (Cohen, 1988, 1992). Thus, the simple linear regression can be calculated to determine the impact of health literacy on Covid-19 awareness and protective behaviours.

RQ3: Impact of health literacy on Covid-19 awareness and protective behaviours

A simple linear regression was performed to determine the impact of health literacy of university students on their Covid-19 awareness and protective behaviour in the pandemic situation. The following paragraphs presented the detail of the results of the regression analysis related to each variable.

### H1: Impact of health literacy on Covid-19 awareness

The results of a simple linear regression analysis that was performed to predict Covid-19 awareness based on health literacy indicated a significant regression equation has appeared (F (1, 247) = 41.640, p < .000), with an R² of 0.144. Table 4 showed that health literacy (Beta = 0.380, p = 0.000 < 0.05) was a statistically significant and positive predictor of Covid-19 awareness among university

| Variables      | Covid-19 pandemic |       |       |       |       |       |       |       |       |       |       |
|----------------|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                | Covid-19 awareness |       |       |       |       |       |       |       |       |       |       |
|                | Pearson correlation | Sig.  |       |       |       |       |       |       |       |       |       |
| Health Literacy|                   | 0.375**| 0.000 |       |       |       |       |       |       |       |       |

**Correlation is significant at the 0.01 level.

| Variables       | Protective behaviours |       |       |       |       |       |       |       |
|-----------------|-----------------------|-------|-------|-------|-------|-------|-------|
| Health Literacy |                      | 0.177**| 0.004 |       |       |       |       |

| Model            | Unstandardized coefficients | Standardized coefficients |       |       |       |       | R²    |
|------------------|------------------------------|----------------------------|-------|-------|-------|-------|-------|
|                  | B                | SE     | Beta (β) | T    | Sig. | F    | Sig | R²   |
| (Constant)       | 2.178           | 0.263  |          | 8.283| 0.000| 41.640| 0.000| 0.144|
| Health Literacy  | 0.557           | 0.086  | 0.380    | 6.453| 0.000|        |      |      |

*Dependent Variable: Covid-19 awareness.

*Predictors: (Constant), Health Literacy.
students. Thus, this finding supports the research hypothesis $H_1$ as health literacy of university students positively predicts their Covid-19 awareness.

$H_2$: Impact of health literacy on protective behaviours

The results in Table 5 indicated a significant regression equation ($F (1, 247) = 7.980, p < 0.05$), with an $R^2$ of 0.031 when a simple linear regression was calculated to predict protective behaviour of university students based on their health literacy. These figures also revealed that health literacy ($\beta = 0.177, p = 0.005 < 0.05$) was a statistically significant and positive predictor of protective behaviours of university students. Thus, this study supports the research hypothesis $H_2$ as health literacy of university students positively predicts their protective behaviour.

DISCUSSION

The primary objective of this research was to investigate the impact of health literacy on Covid-19 awareness and protective behaviours of university students in Pakistan. The results revealed that the university students’ age, gender, university name, and programme of study did not predict their health literacy and Covid-19 awareness. However, the geographical background of the university students predicted their health literacy and Covid-19 awareness as the rural students had lower levels of health literacy and Covid-19 awareness than students with urban background. These results were not consistent with that of Seng et al. (2020) who systematically reviewed the literature on pandemic-related health literacy (e.g. MERS, COVID-19, and SARS) and reported that sociodemographic variables such as higher educational level, older age and females had an association with better health literacy. These results partially contradicted that of Clements (2020) who reported differences in Covid-19 knowledge based on age as people with greater age were more knowledgeable than younger age groups. Besides, the people of younger ages reported attending large gatherings, purchasing goods, and wearing masks. These results were partially supported by the findings of Fauzi et al. (2020) who discovered that the biological students’ year of study did not have a significant effect on their health literacy related to Covid-19 pandemic.

However, the students’ gender appeared to be associated with their health protective behaviours in the Covid-19 pandemic which meant that female students were more likely to adopt health protective behaviours as compared to male students. There might be cultural reasons for low adoption of health protective behaviour by male students in Pakistan as the bringing up of male children is totally different than females. The males are prepared for a challenging life. Therefore, they feel secure in managing every day activities and are careless as compared to females in adoption of health protective behaviours. Whereas the females feel insecure especially outside their homes and are more careful towards getting Covid-19 infection. Thus, there should be specific public health messaging for men focussing more on behaviour and less on information as gender did not appear to correlate health literacy and Covid-19 knowledge. This finding appeared to agree with that of Galasso et al. (2020) who also reported gender differences in Covid-19-related attitude and behaviour in eight OECD countries as women are more likely to perceive Covid-19 as a serious health issue and comply with public policy measure than men. In addition, the students from universities situated in Lahore and having urban backgrounds were more likely to adopt protective behaviours as compared to the students who belonged to the university situated at Sargodha and having rural background. These results were not surprising and appeared as logical as Lahore is a developed city, had higher literacy levels, and had more cases of Covid-19 infection as compared to Sargodha. This finding was consistent with that of Abdullah and Zakar (2019) who reported that the students having rural backgrounds had lower levels of health literacy as compared to urban students.

The results indicated that health literacy positively predicted Covid-19 awareness of university students in Pakistan which meant that the students with high health literacy likely to be more aware of Covid-19. These results were anticipated and quite logical as health literacy
generally improve people’s awareness about a particular disease and instigate them to respond it properly while adopting health protective behaviours not only in normal but also in pandemic situations. People’s ability to reflect on critical and complex health issues and evaluate critically available information enables them to make the right decisions and strengthen attitudes and behaviours to reduce carelessness and prevent over-reactions (Abel & Mcqueen, 2020). Health literacy not only enhances individuals’ knowledge about a particular disease but also prepares them for collective societal response and encourages the adoption of more appropriate behaviours during pandemic situations such as Covid-19 (Paakkari & Okan, 2020). Community engagement is essential to respond to pandemic and infodemic situations as it enables a collective societal response through informed and need-based decision making, the adaption of existing lifestyles, and adoption of preventive behaviours (Chong et al., 2020; Paakkari & Okan, 2020). The systematic literature review on pandemic-related health literacy (e.g., MERS, COVID-19, and SARS) by Seng et al. (2020) also highlighted that health literacy had a crucial role not only in stemming the infection spread, mitigating the pandemic affects, responding proactively the prevailing situations but also fight with infodemic.

In addition, this finding was also supported by the study of Okan et al. (2020) who reported that the confusion about Covid-19 information was greater among those adults in Germany who had lower levels of health literacy. Chesser et al. (2020) reported the results of a survey assessing Covid-19 knowledge that the university students had a low level of Covid-19 knowledge indicating a need for sharing of health information through more accessible channels to enhance student health literacy. Song and Karako (2020) stated that health literacy is most important to respond to widespread misinformation related to Covid-19 on social media. This finding also confirmed the results of McCaffery et al. (2020) who reported that people with limited health literacy had low knowledge of Covid-19 symptoms, less likely to have preventive behaviours, faced difficulty in finding health information, and a poorer understanding of public advice by the government in Australia. Similar results were reported by Fauzi et al. (2020) that most of the biological students in Indonesia had poor Covid-19 literacy as they had a poorer understanding of Covid-19 symptoms, the role of vaccination, and the ways of transmission from one to another. However, the results of Parikh et al. (2020) indicated that both health care professional and the general public in India were worried about getting an infection, approached advisory websites and television respectively for Covid-19 information, had good knowledge of symptoms, practiced precautionary measures, and showed tendency in seeking medical advice and self-quarantine if needed.

Health literacy also positively predicted health protective behaviour of university students in Pakistan which meant that the students with high health literacy likely to adopt health protective behaviours. These results were expected and logical as health literacy generally improves people’s awareness about a particular disease and instigates them to respond it properly while adopting health protective behaviours not only in normal but also in pandemic situations. This finding is consistent with the results of Shaukat et al. (2021) who also reported the positive relation of health literacy with health preventive behaviours. Similar results were reported by Riiser et al. (2020) who found that Norwegian adolescents with good health literacy were more likely to adopt health preventive behaviour in the Covid-19 pandemic. This finding was also supported by the results of Clements (2020) who found that the lower knowledge of Americans related to Covid-19 pandemic predicted their engagement in buying more goods than necessary, participation in large gatherings, and wearing medical masks outside. These results were consistent with that of Riad et al. (2020) who reported the people with knowledge of Covid-19 are more likely to adopt protective behaviours. The study of Luo et al. (2020) also partially supported these results by reporting that prevention information, motivation, and behavioural skills positively predict health behaviour. These findings are also supported by the results of Dobe (2012) that people’s knowledge has the potential to impact health-related behaviours. Warner (2003) also reported that individuals’ knowledge about Alzheimer’s symptoms linked to their health-seeking behaviours. The study of DiClemente et al. (1990) also found that college students’ knowledge about AIDS predicted their HIV preventive behaviours. The intention and behaviours of school children to exercise was also predicted by their awareness about the importance of physical exercise (Ferguson et al., 1989).

**CONCLUSIONS**

The results indicated the potential benefits of health literacy to respond to the threat posed by the Covid-19 pandemic and infodemic as health literacy positively predicted people’s awareness about coronavirus infection and health protective behaviours among students. This research demonstrated the need for improved health information communication through trusted information channels that are compatible with people’s information behaviour as it increases students’ awareness about the Covid-19 pandemic and enhances the adoption of preventive behaviour. The strategic and campus-wide health...
literacy programme would be more useful for students as these students can act as information agents for people around them. Besides system preparedness, individual preparedness is of equal importance to cope with complex health problems like the Covid-19 pandemic especially infection prevention and care. Poor health literacy is an underestimated problem so far in Covid-19 that requires special attention by the governments and individuals as people with adequate health literacy can easily understand the reason behind recommendations and outcome of adopting protective behaviours. Furthermore, it has the potential to play a crucial role in stemming the spread of Covid-19 infection, mitigating the pandemic effects, responding proactively to the prevailing situations, and fight an infodemic associated with Covid-19.

There is a need for consideration of health literacy as a frontline tool for the prevention of both communicable and non-communicable diseases including Covid-19 infection. The development of people’s ability to cope with complex health situations such as Covid-19 is more needed than ever. Therefore, the governments should invest in health education and communication to take sustainable and strategic measures for the preparation of individuals to cope with the prevailing pandemic and infodemic requiring rapid reaction. The results of this study would not only help policymakers in making evidence-based and informed decisions but also for information professionals, especially those engaged in health literacy programmes in planning need-based health literacy programme. These results can be used as a guide in developing the Covid-19 literacy curriculum for health literacy programmes not in Pakistan but also in other developing countries especially South Asian countries (e.g. Sri Lanka, Bangladesh, India, Nepal) as no such study appeared to have been conducted so far. The rural students should be focused specifically on health literacy programmes as they appeared to have lower levels of health literacy, Covid-19 awareness and less likely to adopt health protective behaviours as compared to students with an urban background (Table 2).

There were certain limitations of this study. Firstly, the results of this study should carefully be generalized as the data were collected from 249 students of only three universities in Pakistan. Therefore, this study does not claim in any way to be the voice of the whole Pakistani community. Secondly, this research used non-standardized questionnaires for assessing Covid-19 awareness and protective behaviours. Although the questionnaires were validated through a panel of experts and pilot testing, it might affect the compressive and holistic view of respondents about Covid-19 awareness and protective behaviours. Therefore, there is an urgent need for the development of up-to-date, validated, and standardized instruments for rapid assessment of Covid-19 related health literacy and protective behaviours among medical and general populations. It might be worth exploring motivations of men and rural people for their lower engagement in protective behaviours in the future investigations. The future inquiries should develop and validate tools for men focussing on their behaviour change and developing or evaluating health literacy interventions for rural students.

CONFLICT OF INTEREST
This project did have any conflict of interest with anyone.

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APPENDIX

SURVEY QUESTIONNAIRE

Impact of health literacy on Covid-19 awareness and protective behaviour of university students

Dear students:
The Covid-19 pandemic has wreaked havoc and dismantled daily activities at workplace, academia and in everyday life. As we all know, the virus is sp55 reading at an alarming rate, and the fallout has spanned the globe, exposing the ill-preparedness of governments, health systems, and social safety networks to respond to the longstanding and emerging needs of people – especially relating to the health. This research intends to investigate the impact of health literacy on Covid-19 awareness and protective behaviour of university students in the prevailing scenario of Covid-19 pandemic. Your cooperation by participating in this survey will help us in achieving our
objective. It will take up to 15 min to complete. Your responses will be kept anonymous, confidential and only be used for research purposes.

Section A: Health literacy
You are being asked to respond to the following statements concerning your health literacy. On a scale from very difficult to very easy, how easy would you say it is to:

| SN | Statements                                                                 | VD | D | E | VE |
|----|----------------------------------------------------------------------------|----|---|---|----|
| 1  | Find information on treatments of illnesses that concern you?              | 1  | 2 | 3 | 4  |
| 2  | Understand the leaflets that come with your medicine?                      | 1  | 2 | 3 | 4  |
| 3  | Judge the advantages and disadvantages of different treatment options?    | 1  | 2 | 3 | 4  |
| 4  | Call an ambulance in an emergency?                                         | 1  | 2 | 3 | 4  |
| 5  | Find information on how to manage mental health problems like stress or depression? | 1  | 2 | 3 | 4  |
| 6  | Understand why you need health screenings (such as breast exam, blood sugar test, blood pressure)? | 1  | 2 | 3 | 4  |
| 7  | Judge which vaccinations you may need?                                     | 1  | 2 | 3 | 4  |
| 8  | Decide how you can protect yourself from illness based on advice from family and friends? | 1  | 2 | 3 | 4  |
| 9  | Find out about activities (such as meditation, exercise, walking, Pilates etc.) that are good for your mental well-being? | 1  | 2 | 3 | 4  |
| 10 | Understand information in the media (such as Internet, newspaper, magazines) on how to get healthier? | 1  | 2 | 3 | 4  |
| 11 | Judge which everyday behaviour (such as drinking and eating habits, exercise etc.) is related to your health? | 1  | 2 | 3 | 4  |
| 12 | Join a sports club or exercise class if you want to?                       | 1  | 2 | 3 | 4  |

Section B: COVID-19 awareness
Kindly respond to the following statements concerning your awareness of Covid-19 pandemic by selecting one of the options given against each statement:

1 = Strongly Disagree (SD); 2 = Disagree (D); 3 = Undecided (U); 4 = Agree (A); 5 = Strongly Agree (SA)

| SN | Statements                                                                 | SD | D | U | A | SA |
|----|----------------------------------------------------------------------------|----|---|---|---|----|
| 1  | I understand that Covid-19 is transmitted from one person to another.       | 1  | 2 | 3 | 4 | 5  |
| 2  | I know that the person who has contacted with the Covid-19 infected person must be isolated for two to three weeks. | 1  | 2 | 3 | 4 | 5  |
| 3  | I am aware that the Covid-19 infected person must be isolated for two to three weeks. | 1  | 2 | 3 | 4 | 5  |
| 4  | I understand that the Covid-19 infected people can be cured.                | 1  | 2 | 3 | 4 | 5  |
| 5  | I am able to identify the possible infected people and areas around me.     | 1  | 2 | 3 | 4 | 5  |
| 6  | I understand the transmission ways and levels of Covid-19.                  | 1  | 2 | 3 | 4 | 5  |
| 7  | I am aware of the risks of possible infection from cured patients.          | 1  | 2 | 3 | 4 | 5  |
| 8  | I understand Covid-19 symptoms (e.g. coughing, sore throat, fever, shortness of breath, etc.). | 1  | 2 | 3 | 4 | 5  |
| 9  | I am aware of precautionary measures (e.g. washing hands, using sanitizer, wearing mask, social distancing, avoiding public gatherings and traveling, covering mouth while sneezing, and self-quarantine). | 1  | 2 | 3 | 4 | 5  |
| 10 | I understand that the infected people can spread it up to 14 days.          | 1  | 2 | 3 | 4 | 5  |
| 11 | I Know that asymptomatic person can spread Covid-19 infection for 15 days when infected with it. | 1  | 2 | 3 | 4 | 5  |
Section C: Protective behaviour in Covid-19 pandemic

Kindly respond to the following statements concerning your protective behaviour in Covid-19 pandemic by selecting one of the options given against each statement:

1 = Never (N); 2 = Rarely (R); 3 = Sometimes (S); 4 = Often (O); 5 = Always (A)

| SN | Statements                                                                 | N | R | S | O | A |
|----|--------------------------------------------------------------------------|---|---|---|---|---|
| 1  | I wash hands more often now for 20 s.                                    | 1 | 2 | 3 | 4 | 5 |
| 2  | I frequently use hand sanitizers.                                        | 1 | 2 | 3 | 4 | 5 |
| 3  | I usually staying 2 m away from other people when outside my home       | 1 | 2 | 3 | 4 | 5 |
| 4  | I always wear mask when going outside my home.                           | 1 | 2 | 3 | 4 | 5 |
| 5  | I go outside despite having symptoms that could be due to Covid-19*     | 1 | 2 | 3 | 4 | 5 |
| 6  | Friends and relatives frequently visit me at home.                       | 1 | 2 | 3 | 4 | 5 |
| 7  | I avoid going to social gatherings (birthday parties, marriages, funerals, etc. in Covid-19 pandemic. | 1 | 2 | 3 | 4 | 5 |
| 8  | I isolate myself if I contact with an individual from Covid-19 outbreak area. | 1 | 2 | 3 | 4 | 5 |
| 9  | I take protective measures if I meet with a person with Covid-19 symptoms. | 1 | 2 | 3 | 4 | 5 |
| 10 | The doctors need to be consulted in response to Covid-19 symptoms.       | 1 | 2 | 3 | 4 | 5 |
| 11 | The hospital needs to be visited in response to critical conditions.     | 1 | 2 | 3 | 4 | 5 |

Note: * The statement was reversed as it was a negative item.

Section D: Personal information

1. Age (in years): ____________________________.
2. Gender:  ☐ Male  ☐ Female.
3. Programme of study:  ☐ BS/MA (16 years)  ☐ MS/MPhil (18 years)  ☐ PhD.
4. What is the name of the university where you have enrolment as a student?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Thank you for your valuable time and participation!