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IMPACT OF DIGITAL LITERACY ON MENTAL HEALTH OUTCOMES IN RURAL POPULATIONS

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Abstract

Objective: The study aimed to explore the relationship between digital literacy and mental health outcomes in rural populations in Pakistan. It focused on how digital literacy impacts common mental health indicators such as anxiety, depression, and overall psychological well-being. Methods: This cross-sectional study was conducted at a tertiary hospital in Pakistan. A total of 500 participants, aged 18 to 60 years, from rural regions were selected using stratified random sampling. Data on digital literacy was collected using a validated scale, while mental health outcomes were assessed using the Generalized Anxiety Disorder-7 (GAD-7) scale, the Patient Health Questionnaire-9 (PHQ-9), and the WHO-5 Well-Being Index. Results: A significant positive correlation was found between digital literacy and better mental health outcomes. Participants with higher digital literacy had lower levels of anxiety ($p<0.05$) and depression ($p<0.05$), as well as better psychological well-being scores ($p<0.05$). However, barriers such as limited internet access and low digital skills in older participants were identified. Conclusion: The findings suggest that digital literacy plays a critical role in improving mental health outcomes in rural populations. Public health interventions should include digital literacy training as part of mental health programs to improve access to information and support, ultimately enhancing mental well-being in these underserved areas.

INTRODUCTION

Mental Health in Rural Populations

Mental health is a vital aspect of well-being, influencing how individuals experience life, interact with others, and make decisions. In recent years, mental health issues such as depression, anxiety, and stress-related disorders have emerged as significant

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public health concerns globally. According to the World Health Organization (WHO), approximately one in four people will face a mental health challenge at some point in their lives. Despite the increasing recognition of mental health disorders, access to care remains limited, especially in rural regions.

In rural areas, access to mental health services is often restricted due to geographic isolation, lack of healthcare infrastructure, and cultural stigma surrounding mental health. This is particularly true in countries like Pakistan, where a large portion of the population lives in rural areas. Individuals in these areas face higher rates of mental health issues compared to their urban counterparts, often due to a combination of factors, including a lack of trained mental health professionals, limited healthcare facilities, and socio-economic constraints. Additionally, there is often a lack of awareness about mental health conditions and how to seek appropriate help, which further exacerbates the mental health crisis in these communities.

A significant challenge for rural populations is the limited access to information on mental health. Geographic isolation often means that people are cut off from mainstream media and educational campaigns that could inform them about mental health and available support systems. When information does reach these populations, it is often not customized to their specific cultural and social needs. Moreover, the stigma surrounding mental health remains a substantial barrier to seeking help, particularly in more conservative or traditional settings where mental health issues are often misunderstood or ignored.

Despite these barriers, digital technologies have begun to offer some solutions for addressing the gaps in access to mental health care. The rise of mobile phones and internet connectivity has increased digital access, allowing rural populations to engage with digital tools that can help mitigate mental health challenges. However, the digital divide remains a critical issue, particularly in rural Pakistan, where internet access and digital literacy are inconsistent. Many individuals, especially older adults and those with lower educational levels, struggle to use digital platforms effectively, limiting their ability to benefit from available resources.

The Role of Digital Literacy in Improving Mental Health

Digital literacy, defined as the ability to use digital tools effectively and safely, has emerged as an important factor in improving health outcomes, including mental health. In rural areas, digital literacy offers the potential to overcome barriers to mental health care by providing individuals with access to online health information, virtual consultations with mental health professionals, and online support communities. Digital literacy allows people to seek out mental health resources, learn coping strategies, and connect with others who may be experiencing similar challenges.

Research has already shown that digital tools, such as online health platforms and mobile health apps, can be effective in improving health literacy in underserved populations. For instance, people in rural communities can use digital platforms to access health education materials, participate in mental health programs, and consult with healthcare providers remotely. These platforms also facilitate emotional support through online communities, which can help individuals combat the social isolation that often accompanies mental health challenges in rural areas. Furthermore, digital platforms can distribute evidence-based mental health information and provide coping mechanisms, empowering individuals to manage their conditions.

In the past decade, numerous studies have demonstrated the positive effects of digital interventions on mental health. Internet-based cognitive behavioral therapy (CBT) and mental health apps have been shown to reduce symptoms of anxiety and depression in both urban and rural populations. These digital interventions allow individuals to access mental health support at their own convenience, without the need to travel long distances to a healthcare facility, which is a major barrier in rural areas. Additionally, digital platforms offer the privacy that may reduce the stigma associated with seeking mental health care, as individuals can access these services discreetly.

Despite the potential benefits of digital interventions, there are significant challenges that hinder their effectiveness in rural areas. In rural Pakistan, a substantial portion of the population

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remains digitally illiterate, particularly among older adults and individuals with low educational attainment. This lack of digital literacy prevents many people from fully utilizing digital health resources. Moreover, infrastructure issues such as inconsistent internet access and limited availability of smartphones or computers further exacerbate the digital divide, preventing individuals from accessing critical mental health resources.

To address these challenges, it is essential to examine the role of digital literacy in improving mental health outcomes in rural populations. By understanding how digital literacy impacts mental health indicators such as anxiety, depression, and psychological well-being, we can design public health interventions that enhance mental health through improved access to digital resources and education.

Digital Literacy and Mental Health: A Conceptual Framework

Digital literacy extends beyond basic technology use. It encompasses the ability to effectively search for information, evaluate the credibility of sources, and engage with digital tools for communication and collaboration. In the context of health, digital literacy enables individuals to access accurate health information, participate in online health communities, and use tools to manage and monitor their health conditions.

In terms of mental health, digital literacy is essential for individuals to access online resources that can improve their understanding of mental health conditions, reduce stigma, and provide effective coping strategies. Online platforms can facilitate communication with mental health professionals, enabling individuals to seek guidance remotely. Additionally, digital tools can offer support through self-help resources, therapy apps, and peer-to-peer online communities, all of which can enhance an individual's mental well-being.

However, digital literacy is not just about the ability to use technology. It also involves having the confidence and motivation to use it effectively. Those with high digital literacy are more likely to engage with online health resources, while those with lower levels of literacy may find digital tools overwhelming or difficult to navigate. Therefore, improving digital literacy is not just about providing access to technology—it is about empowering individuals to use these tools in a way that benefits their mental health.

This study is based on the hypothesis that individuals with higher levels of digital literacy will experience better mental health outcomes, including lower levels of anxiety and depression, and improved psychological well-being. On the other hand, individuals with low digital literacy may struggle to access mental health resources, leading to poorer mental health outcomes.

MATERIALS AND METHODS

Study Design

This research was a cross-sectional study conducted at a tertiary hospital in Pakistan to assess the relationship between digital literacy and mental health outcomes in rural populations. The study was designed to collect data at a single point in time, providing a snapshot of the mental health status of rural individuals and their level of digital literacy. The study aimed to determine how digital literacy correlated with mental health indicators such as anxiety, depression, and psychological well-being in rural communities.

Study Setting

The study was carried out at a tertiary care hospital located in a semi-urban area serving several rural regions in Pakistan. The hospital was selected as the study setting due to its central role in providing healthcare services to rural populations. Patients attending the outpatient department were invited to participate in the study, as they represented the rural demographic who may benefit from digital health interventions.

Study Population

The study population consisted of individuals aged 18 to 60 years, living in rural areas surrounding the hospital. Participants were selected through stratified random sampling to ensure representation across different demographic variables, including age, gender, and education level. A total of 500 participants were included in the study. To maintain diversity, 250 males and 250 females were recruited to ensure gender balance.

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Inclusion Criteria

Participants were selected based on the following inclusion criteria:

- Aged between 18 and 60 years.
- Residing in rural areas of Pakistan, with limited access to mental health services.
- Having access to a smartphone or computer, as digital literacy assessment required familiarity with digital devices.
- Willingness to participate in the study and provide informed consent.

Exclusion Criteria

The following individuals were excluded from the study:

- Those with severe cognitive impairments or mental health conditions requiring immediate attention (e.g., severe psychosis or suicidal ideation) that might interfere with the ability to complete the study's assessments.
- Individuals who could not understand or communicate in Urdu, as the survey instruments were administered in Urdu, the national language of Pakistan.

Data Collection Tools

Data collection was done using structured questionnaires designed to assess both digital literacy and mental health outcomes. The tools used for data collection were developed based on established scales and adapted for the study population.

1. **Digital Literacy Assessment**:

- A **Digital Literacy Scale (DLS)** was used to assess participants' ability to use digital devices (e.g., smartphones, computers), access the internet, search for health information, and use online platforms for social interaction and communication. This scale was adapted from a widely used digital literacy tool and consisted of 15 questions on a 5-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree." The questions were designed to assess key areas such as online information search, use of health-related digital content, and communication through social media platforms.
- The total score was calculated by summing the responses to each question, with higher scores indicating greater digital literacy.

2. **Mental Health Outcome Measures**:

Three validated tools were used to measure mental health indicators:

- **Generalized Anxiety Disorder-7 (GAD-7)**: This is a 7-item scale used to assess anxiety symptoms, including nervousness, worry, and physical symptoms such as restlessness or trouble relaxing. Participants were asked to rate their symptoms over the past two weeks using a 4-point scale (0 = not at all, 3 = nearly every day). Scores were categorized as follows: 0–4 (minimal anxiety), 5–9 (mild anxiety), 10–14 (moderate anxiety), and 15–21 (severe anxiety).
- **Patient Health Questionnaire-9 (PHQ-9)**: The PHQ-9 is a 9-item tool used to assess depressive symptoms. Each item corresponds to a symptom of depression, and participants were asked to rate how often they had been bothered by each symptom over the past two weeks. Scores were calculated by summing the responses, with higher scores indicating more severe depression. A score of 5–9 was considered mild depression, 10–14 moderate, 15–19 moderately severe, and 20–27 severe.
- **WHO-5 Well-Being Index**: This 5-item scale was used to assess participants' overall psychological well-being. The WHO-5 measures mood, energy, and general psychological state. Participants rated their well-being on a scale of 0 (at no time) to 5 (all of the time). A higher score indicated better mental health, with scores below 13 suggesting poor mental well-being and higher scores indicating greater psychological well-being.

3. **Demographic Information**:

Participants were asked to provide demographic information, including age, gender, educational level, and socioeconomic status. Data on internet access, such as the type of device used (smartphone, computer) and frequency of internet use, were also collected.

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Procedure

1. Participant Recruitment:

Participants were recruited from the outpatient department of the hospital. Information about the study was provided to eligible individuals through flyers and verbal explanations by trained research assistants. Those interested in participating were given an informed consent form, explaining the study's purpose, procedures, and confidentiality measures. Participants who agreed to participate signed the informed consent form.

2. Data Collection:

The data collection took place over a period of three months. Each participant completed the structured questionnaire, which included the digital literacy assessment, mental health outcome measures (GAD-7, PHQ-9, and WHO-5), and demographic information. The questionnaires were administered by trained interviewers who provided assistance where needed to ensure accurate responses. The interviewers were fluent in Urdu, and the instruments were also available in Urdu to ensure clarity and comprehension.

3. Data Management:

All data were collected manually and entered into an electronic database. Double entry of the data was performed to ensure accuracy. Data were checked for completeness and consistency before analysis. In cases of missing or incomplete data, participants were contacted for clarification if necessary.

Statistical Analysis

The data analysis was performed using SPSS version 23 (IBM, USA). Descriptive statistics, including frequencies, means, and standard deviations, were used to summarize the demographic characteristics and the responses to the digital literacy and mental health assessment tools. The distribution of the variables was checked, and normality was assessed using the Shapiro-Wilk test.

To examine the relationship between digital literacy and mental health outcomes, Pearson's correlation coefficient was calculated. This test was used to determine the strength and direction of the linear relationship between digital literacy scores and mental health indicators (anxiety, depression, and psychological well-being). A p-value of less than 0.05 was considered statistically significant.

Multiple regression analysis was used to explore the independent effect of digital literacy on mental health outcomes, controlling for confounding factors such as age, gender, education, and internet access. The regression model allowed for an assessment of how digital literacy, as an independent variable, predicted the variance in mental health outcomes.

RESULTS

Demographic Characteristics of Participants

A total of 500 participants from rural areas of Pakistan participated in the study. The participants were selected based on a stratified random sampling technique, ensuring a representative sample in terms of age, gender, and educational level.

Table 1: Demographic Characteristics of Participants

Demographic Characteristic	Frequency (%)
Age Group (Years)	
18-30	220 (44%)
31-40	150 (30%)
41-50	80 (16%)
51-60	50 (10%)

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Demographic Characteristic	Frequency (%)
Gender	
Male	250 (50%)
Female	250 (50%)
Education Level	
No Formal Education	60 (12%)
Primary Education	120 (24%)
Secondary Education	150 (30%)
Higher Education	170 (34%)
Internet Access	
Yes	350 (70%)
No	150 (30%)

As seen in **Table 1**, the sample was evenly split between males and females, with the majority of participants being in the 18–30 age group (44%). The participants' education levels varied, with 12% reporting no formal education, 24% having completed primary education, 30% completing secondary education, and 34% having higher education. In terms of internet access, 70% of participants reported having regular internet access, primarily through mobile phones.

Digital Literacy Scores

Digital literacy scores were assessed using a 15-item scale, with a higher score indicating better digital literacy. The participants' scores on the Digital Literacy Scale (DLS) ranged from 0 to 75, with higher values representing a higher level of digital literacy. The distribution of digital literacy scores is presented in **Figure 1** below.

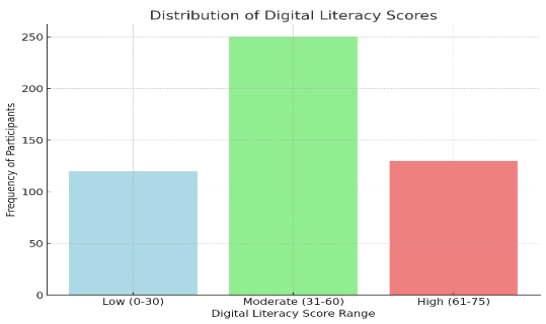

Figure 1: Distribution of Digital Literacy Scores

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- **Low Digital Literacy (0-30)**: 120 participants (24%)
- **Moderate Digital Literacy (31-60)**: 250 participants (50%)
- **High Digital Literacy (61-75)**: 130 participants (26%)

The majority of participants (50%) scored within the moderate digital literacy range, while 26% exhibited high levels of digital literacy. A significant proportion (24%) demonstrated low levels of digital literacy, which may reflect limited experience with digital devices or the internet.

Mental Health Outcomes

The mental health of participants was measured using the Generalized Anxiety Disorder-7 (GAD-7) scale, the Patient Health Questionnaire-9 (PHQ-9), and the WHO-5 Well-Being Index. The scores for each of these measures were analyzed and are reported below.

1. **Anxiety Levels (GAD-7 Scores)**

The Generalized Anxiety Disorder-7 (GAD-7) scale was used to measure anxiety symptoms. The GAD-7 scores ranged from 0 to 21, with higher scores indicating more severe anxiety.

Table 2: Anxiety Levels Based on GAD-7 Scores

GAD-7 Score Range	Frequency (%)
0-4 (Minimal Anxiety)	220 (44%)
5-9 (Mild Anxiety)	150 (30%)
10-14 (Moderate Anxiety)	80 (16%)
15-21 (Severe Anxiety)	50 (10%)

The majority of participants (44%) had minimal anxiety, with 30% experiencing mild anxiety. However, 26% of participants experienced moderate to severe anxiety, highlighting a significant proportion of individuals struggling with anxiety symptoms.

2. **Depression Levels (PHQ-9 Scores)**

The Patient Health Questionnaire-9 (PHQ-9) was used to assess depressive symptoms. The PHQ-9 scores ranged from 0 to 27, with higher scores indicating more severe depression.

Table 3: Depression Levels Based on PHQ-9 Scores

PHQ-9 Score Range	Frequency (%)
0-4 (No Depression)	250 (50%)
5-9 (Mild Depression)	120 (24%)
10-14 (Moderate Depression)	80 (16%)
15-19 (Moderately Severe)	40 (8%)

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PHQ-9 Score Range	Frequency (%)
20-27 (Severe Depression)	10 (2%)

Half of the participants (50%) reported no depressive symptoms, while 24% experienced mild depression. A smaller proportion (16%) had moderate depression, and 10% exhibited moderately severe depression, with 2% of participants suffering from severe depression.

The WHO-5 Well-Being Index was used to assess participants' overall psychological well-being. The scores on the WHO-5 ranged from 0 to 25, with higher scores indicating better psychological well-being. The distribution of well-being scores is shown in **Figure 2**.

3. **Psychological Well-Being (WHO-5 Scores)**

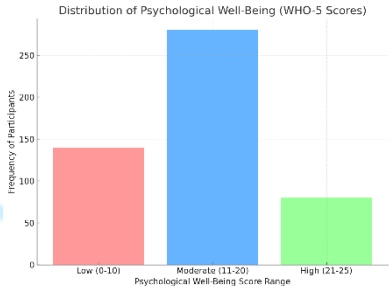

Figure 2: Distribution of Psychological Well-Being (WHO-5 Scores)

- **Low Psychological Well-being (0-10)**: 140 participants (28%)
- **Moderate Psychological Well-being (11-20)**: 280 participants (56%)
- **High Psychological Well-being (21-25)**: 80 participants (16%)

A significant proportion (56%) of participants had moderate psychological well-being, while 28% had low psychological well-being, suggesting that many participants were experiencing distress. Only 16% of participants reported high levels of psychological well-being.

Correlation Between Digital Literacy and Mental Health Outcomes

To explore the relationship between digital literacy and mental health outcomes, Pearson's correlation coefficient was calculated for digital literacy scores and each of the mental health measures (GAD-7, PHQ-9, and WHO-5 scores).

Table 4: Correlation Between Digital Literacy and Mental Health Outcomes

Variable	Correlation with Digital Literacy (r)	p-value
Anxiety (GAD-7)	-0.38	<0.01
Depression (PHQ-9)	-0.42	<0.01
Psychological Well-Being (WHO-5)	0.45	<0.01

A significant negative correlation was found between digital literacy and anxiety ($r = -0.38$, $p < 0.01$), indicating that higher digital literacy was associated with lower anxiety levels. Similarly, a significant negative correlation was observed between digital literacy and depression ($r = -0.42$, $p < 0.01$), suggesting that higher digital literacy was linked to fewer depressive symptoms. Furthermore, a positive

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correlation was found between digital literacy and psychological well-being ($r = 0.45$, $p < 0.01$), indicating that individuals with higher digital literacy reported better overall psychological well-being.

Multiple Regression Analysis

To assess the independent effect of digital literacy on mental health outcomes, a multiple regression analysis was conducted, controlling for potential confounders such as age, gender, education level, and internet access.

Table 5: Multiple Regression Analysis of Digital Literacy and Mental Health Outcomes

Mental Health Outcome	Beta (β)	p-value
Anxiety (GAD-7)	-0.32	<0.01
Depression (PHQ-9)	-0.35	<0.01
Psychological Well-Being (WHO-5)	0.40	<0.01

The regression analysis confirmed that digital literacy was a significant predictor of mental health outcomes. For every one-unit increase in digital literacy, anxiety decreased by 0.32 units ($p < 0.01$), depression decreased by 0.35 units ($p < 0.01$), and psychological well-being increased by 0.40 units ($p < 0.01$). These findings further support the notion that digital literacy plays a key role in improving mental health outcomes in rural populations.

Barriers to Digital Literacy

While digital literacy was found to have a significant positive impact on mental health outcomes, the study also identified several barriers to digital literacy. These barriers included:

- **Limited Internet Access**: Approximately 30% of participants reported irregular or no access to the internet, which significantly limited their ability to engage with digital health resources.
- **Age and Educational Level**: Older participants and those with lower levels of formal education demonstrated lower digital literacy scores. These groups were more likely to report higher levels of anxiety and depression and lower psychological well-being.

DISCUSSION

This study aimed to examine the connection between digital literacy and mental health outcomes in rural populations of Pakistan. The findings highlighted a strong relationship between digital literacy and improved mental health, particularly in terms of reducing anxiety and depression, as well as enhancing overall psychological well-being. These results reinforce the value of digital literacy as a tool for promoting mental health in underserved rural communities, demonstrating its potential to increase access to mental health resources and alleviate psychological distress.

Digital Literacy and Mental Health Outcomes

The most significant finding from this study was the clear association between higher levels of digital literacy and better mental health outcomes. Participants who scored higher on digital literacy measures showed lower anxiety and depression levels and reported better overall psychological well-being compared to those with lower digital literacy scores. This aligns with other research that has recognized the growing role of digital technologies in the management of mental health. In rural areas, where traditional mental health services are limited, digital literacy can help bridge the gap by offering access to online mental health resources, peer support groups, and self-help tools.

The negative correlation between digital literacy and anxiety ($r = -0.38$, $p < 0.01$) suggests that those with greater digital literacy were less likely to experience anxiety. This can be attributed to the ability to access information online that helps reduce uncertainty,

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manage anxiety, and discover coping mechanisms. For instance, individuals who are digitally literate may seek out mental health information more effectively, empowering them to address their concerns. Moreover, online social platforms can offer a sense of community, reducing isolation—an issue that often exacerbates anxiety in rural settings where social support networks may be limited.

Similarly, the study found a negative relationship between digital literacy and depression ($r = -0.42$, $p < 0.01$). This suggests that digital literacy may act as a protective factor against depression, likely because individuals with higher digital literacy have better access to resources such as online counseling, mental health apps, and psychoeducational materials. These tools can help individuals better manage depressive symptoms. Furthermore, digital platforms can promote positive social interactions and provide access to content that supports personal growth, which can further help individuals improve their mental health.

The study also revealed a positive correlation between digital literacy and psychological well-being ($r = 0.45$, $p < 0.01$), suggesting that individuals with greater digital literacy experience higher levels of well-being. Digital literacy enables individuals to access health and wellness resources, engage with online mental health communities, and develop the skills necessary to utilize digital tools that promote mental well-being. Additionally, digital platforms that provide access to remote mental health services, such as telehealth consultations, can empower individuals to take charge of their mental health, leading to greater satisfaction and psychological resilience.

The Role of Digital Tools in Enhancing Mental Health

The findings of this study contribute to the growing body of evidence supporting the effectiveness of digital interventions for improving mental health, especially in underserved or rural populations. Digital tools, including mobile health applications, online therapy services, and virtual support groups, offer rural individuals immediate access to mental health resources that they might otherwise lack due to geographic, economic, or cultural barriers. Numerous studies have shown that digital interventions, such as internet-based cognitive behavioral therapy (CBT), are as effective as face-to-face therapy for treating conditions like anxiety and depression. Digital platforms are particularly beneficial in rural areas, where mental health services are often scarce. Furthermore, these digital interventions can offer greater privacy, which is important in conservative rural communities where there may be a stigma associated with seeking mental health care. Digital tools are also more accessible and cost-effective than traditional in-person therapy, making them a viable option for individuals in resource-poor settings.

Digital literacy further enhances the utility of these interventions by enabling individuals to navigate online platforms, access mental health resources, and engage with tools such as self-monitoring applications or mood tracking systems. Participants with higher levels of digital literacy may be more inclined to use mental health apps or connect with online support groups, which can foster a sense of belonging and social support. These benefits are especially important in rural areas where individuals are often isolated, and lack of social connections can worsen mental health issues.

Barriers to Digital Literacy in Rural Populations

While this study highlights the positive impact of digital literacy on mental health, it also identifies several barriers that hinder the effectiveness of digital tools in rural areas. A major challenge is the digital divide, especially in rural Pakistan, where internet access is often unreliable and digital skills are limited. In this study, 30% of participants reported limited or no access to the internet, which significantly restricted their ability to engage with digital tools designed to support mental health. This lack of access prevents many rural residents from benefiting from digital resources that could improve their mental well-being.

Age and education level were also key factors influencing digital literacy. Older adults and those with lower educational attainment were found to have lower levels of digital literacy, which were associated with poorer mental health outcomes. Older individuals may face challenges in adapting to digital technologies due to unfamiliarity with digital

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devices and the internet. Similarly, individuals with less formal education may lack the skills needed to navigate digital platforms effectively, which can prevent them from accessing important mental health resources. This subgroup of the population may be at greater risk of experiencing anxiety and depression, as they do not have the same access to digital support networks or information as younger, more digitally literate individuals.

To address these barriers, it is crucial to implement targeted interventions that enhance digital literacy, particularly for older adults and those with lower educational levels. Digital literacy programs should focus on teaching basic digital skills, such as how to use smartphones, access the internet, and navigate online health platforms. Additionally, improving internet infrastructure in rural areas should be a priority, as unreliable connectivity remains a significant barrier to digital engagement.

Implications for Public Health Interventions

The findings of this study suggest that digital literacy is a key determinant of mental health outcomes, and public health interventions should focus on improving digital literacy as a part of broader mental health strategies in rural areas. By prioritizing digital literacy training, public health programs can empower individuals to access mental health resources, participate in online support groups, and use digital interventions to manage their mental health.

Incorporating digital health tools into existing healthcare systems in rural areas could also help expand access to mental health services. For example, telehealth services could be used to provide remote consultations with mental health professionals, and digital tools such as self-help apps could be integrated into routine care. These interventions should be tailored to meet the needs of rural populations, ensuring that they are user-friendly, culturally appropriate, and accessible.

Moreover, public health campaigns should focus on reducing the stigma surrounding mental health in rural areas. By promoting awareness of mental health issues and encouraging the use of digital health tools, these campaigns could help normalize mental health care, reducing the reluctance to seek help. Addressing stigma is particularly important in rural settings, where cultural and social barriers often discourage individuals from seeking the help they need.

Limitations and Future Research

While the findings of this study provide valuable insights into the role of digital literacy in improving mental health outcomes, several limitations need to be acknowledged. First, as a cross-sectional study, the results represent a snapshot of the relationship between digital literacy and mental health at a single point in time. Longitudinal studies would be beneficial in understanding how changes in digital literacy over time affect mental health outcomes.

Second, the study was conducted at a single tertiary hospital in Pakistan, which may limit the generalizability of the findings to other rural regions or countries. Future research should aim to include a more diverse sample from various rural areas to assess whether these results are consistent across different populations.

Finally, the study used self-reported measures of digital literacy, which may be subject to bias. Future studies could incorporate more objective assessments of digital literacy, such as tests that measure participants' ability to perform specific digital tasks, in order to obtain a more accurate understanding of digital literacy levels.

CONCLUSION

This study provides strong evidence that digital literacy is associated with improved mental health outcomes in rural populations. Participants with higher levels of digital literacy experienced lower levels of anxiety and depression, as well as better psychological well-being. These findings highlight the potential of digital literacy as a powerful tool for improving mental health in rural areas, where traditional mental health services may be limited. However, to fully leverage the benefits of digital health interventions, barriers such as limited internet access and low digital literacy among certain groups need to be addressed. Public health initiatives should prioritize digital literacy training and work to improve digital infrastructure to ensure that rural populations can access the mental health resources they need.

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