BMC Public Health

RESEARCH

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Home-based digital counselling by frontline community workers for anxiety and depression symptoms in rural Sindh, Pakistan: the *mPareshan* intervention

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Abstract

Background There is limited evidence that interventions for improving mental well-being can be integrated sustainably into primary health care in Pakistan. We piloted '*mPareshan* digital intervention' locally, adapted from WHO mhGAP and delivered by trained and supervised women lay workers to learn if it was feasible and possibly effective in reducing anxiety and depression prior to proposing implementation on a larger scale.

Methods Using Generalized Anxiety Disorder-7 (GAD-7) and Patient Health Questionnaire-9 (PHQ-9), a baseline household survey was conducted by independent data collectors to measure anxiety and depression. We trained 72 government Lady Health Workers (LHWs) and Lady Health Supervisors (LHSs) in District Badin, Sindh to screen and counsel adult men and women (> 18 years) with mild and moderate symptoms of anxiety and depression. Supervised by LHSs, these screen positive participants (SPs) received 6 counselling sessions by LHWs through the *mPareshan* app during their routine household visits. The app had interactive audio/video psychoeducation features. Severe anxiety and depression cases were referred to nearest available mental health service.

Results Of the 366 individuals surveyed at baseline, 75% had minimal anxiety, 23% had mild to moderate anxiety, and 2% had severe anxiety. 74% had minimal depression, 24% had mild to moderate depression, and 2% had moderately severe to severe depression. 98 participants (53 men and 45 women, mean age 43.2 years) screened positive for mild and moderate anxiety and/or depression and were eligible for the *mPareshan* intervention. Six SPs did not complete the intervention for various reasons. Of the 92 SPs who completed all 6 monthly counselling sessions, their mean PHQ-9 score declined from 7.5 (SD 3.1) to 2.6 (SD 2.2) after intervention. Mean GAD-7 score fell from 6.6 (SD 3.0) to 2.1 (SD 2.2) after 6 sessions. No significant association between sociodemographic variables (age, gender, education, and income levels) and anxiety and depression scores was noted.

Conclusion Preliminary evidence suggests meaningful reduction in anxiety and depression using this locally adapted digital counselling intervention delivered by lay health workers in a rural setting of Sindh, Pakistan. An appropriately powered randomized control trial is needed to test effectiveness of this task-shifting model.

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Trial registration Registered as non-randomized, pretest-posttest, feasibility trial on 14/07/2022 with Registration number ACTRN12622000989741 at the Australian New Zealand Clinical Trial Registry (https://www.anzctr.org.au/Default.aspx).

Keywords Anxiety, Depression, Mental health, Task-shifting, Primary health care, Lady health workers, Digital counselling

Background

Mental health issues account for 13% of the global disease burden [1]. In 2019, mental disorders contributed to 4.9% of the global Disability-Adjusted-Life-Years (DALYs) [2]. It is noteworthy that 82% of the global population suffering from mental disorders in 2019 were from the lower- and middle-income countries (LMICs) [1]. LMICs have an inequitably higher prevalence of mental health disorders, with a significant treatment gap [3].

Globally, anxiety and depression are the most common mental health disorders with 31% and 29% prevalence respectively [1]. The COVID-19 pandemic exacerbated this burden, increasing global anxiety and depression by more than 25% in 2020 [4]. According to a recent systematic review, anxiety and depression prevalence rates in South Asia went up to 41.3% and 34.1%, respectively, during the COVID-19 pandemic [5]. Adequately treating these disorders remains a challenge worldwide [6]. However, the treatment gaps are higher in LMICs, where 80–95% of individuals with anxiety and depression do not receive appropriate mental health care due to limited availability of service providers [7–9]. Additional barriers in LMICs include the cost of mental healthcare, and the distance to reach mental health facilities [10–12].

In Pakistan, an LMIC, 4% of the total disease burden is attributed to mental health disorders [13]. With the current population at 240 million, Pakistan has one of the lowest psychiatrists to inhabitant ratio in the region [14, 15]. There are only two trained psychiatrists per one million of population [16]. Reported prevalence rates for anxiety and depression range from 22 to 60% in Pakistan [17–19]. The pandemic has worsened the mental health crisis in Pakistan, with a rise in depression, anxiety, and stress [20–22]. The number of suicides being committed have also increased since the pandemic [23, 24].

The growing prevalence of these disorders in Pakistan can be attributed to factors such as political turmoil, insecurity, natural disasters, social disturbances, and poverty [10, 18, 25–27]. Approximately 62% of Pakistan's total population is living in rural areas [28]. Some studies have shown that rural areas in Pakistan have higher prevalence of mental disorders compared to urban areas [25, 29]. The rural population faces poverty, unemployment, constrained resources, hindrance to healthcare access which create barriers for mental healthcare and a significant treatment gap [30–35]. There is increasing evidence linking poverty and mental ill-health [36].

Community Health Workers (CHWs) often serve as the first point of contact for individuals seeking healthcare in the developing world [37]. Utilizing CHWs in delivering mental healthcare through a task-sharing approach, including mobile health (mHealth) programs, has proven to be an effective evidence-based implementation strategy for decreasing the mental health burden across diverse socio-geographical settings, including LMICs [38–45]. The use of digital innovation through mHealth and technology-assisted applications and programmes has an immense capacity to promote and strengthen healthcare through these CHWs. These innovations utilize the ubiquity of cell phones to enhance the functionality of the health systems [46]. mHealth is cost-effective and offers extensive population-based outreach given its higher penetration and accessibility [41, 44, 47]. Use of such digital technology has also increased after the COVID-19 pandemic [48–50]. App-based interventions reduce barriers associated with traditional in-person interventions and offer efficient use of time by minimizing delays in initiating contact with the healthcare system [51–53]. These interventions have notably improved mental health outcomes, like anxiety and depression, in countries like the Dominican Republic, Brazil, Peru, Tanzania, India, Gambia and through web-based applications that eliminate geographic restrictions [40, 42, 54–58].

In Pakistan, women CHWs are already working in a government-mandated Lady Health Worker Programme (LHW-P) since 1994 [59]. They offer healthcare promotion, family planning, disease prevention and rehabilitation services to rural areas and urban slum residents [60]. The LHW-P covers about 85% of the rural population through a network of 115,000 Lady Health Workers (LHWs). LHWs must have at least eight years of formal education and receive 15–18 months of training to deliver their services [61–63]. These LHWs are local, well-respected, understand the norms and cultural sensitivities, and can be the agents of change in their communities. Each LHW typically covers 100 to 150 households (around 1,000 individuals) per month. LHWs are supervised by Lady Health Supervisors (LHSs) who typically oversee 20–25 LHWs and have monthly meetings to ensure delivery of services by the LHWs in their communities [63, 64]. Previous studies in Pakistan have utilized both the LHW-P and technology-assistance to implement interventions like community case management of childhood pneumonia and diarrhoea, and to alleviate

perinatal depression [64–66]. If LHWs are additionally trained to provide mental health services, they can potentially address the mental health service gap in their communities and reduce the stigma associated with seeking mental health care [67].

The aim of this pilot study in rural Sindh, Pakistan was to establish point prevalence of anxiety and depression within a sample population and assess change in anxiety and depression scores using a home-based mHealth intervention (*mPareshan*) delivered by LHWs.

Methods

Setting

Badin is a rural coastal district in Pakistan's southern province of Sindh with a total population of 1.8 million. The district has an average literacy rate (ability to read and write) of 24% with an approximate household size of 6 persons [68]. Badin has one of the highest suicide rates in Sindh with a poor mental health care infrastructure [69]. In terms of healthcare configuration in Pakistan, Talukas (also known as Tehsils) are larger administrative units within a district. Union Councils (UCs) are smaller administrative units within these Talukas. Badin comprises of 5 Talukas and 49 Union Councils and is served by 1100 LHWs working under the supervision of 36 LHSs [62]. Each LHW typically caters to 100–150 households (HH) in their "catchment" area, which translates into 1000 people per area [64].

Study design

The *mPareshan* pilot study (2021–2023) was conducted in 5 Talukas of Badin using a non-randomized, pre- and post-test design with mixed methods of data collection (including quantitative and qualitative inquiries, before and after intervention). This paper is reporting on the quantitative data only, which was collected from household surveys. The complete protocol of the *mPareshan* study detailing all data collection methods is available elsewhere [63].

Baseline household survey

Sampling strategy and sample size calculation

For the baseline household (HH) survey, the sample size was calculated using OpenEpi (version 3.01, http://www.openepi.com/). Assuming a 30% prevalence of depressi on and anxiety symptoms among adults with 1.8 million population in Badin, at a 5% level of significance and 80% power, 323 people were required to assess point prevalence of depression and anxiety. Catering to 10% refusals, the final sample size was 366 individuals [63]. A systematic random sampling approach was used to select the latter (1 consenting adult > 18 years per HH) from the LHW-P household list, which served as the sampling frame. Sampling strategy proportionate to population density was used to select HHs from all five Talukas.

Data collection and study instruments

Trained data collectors conducted the baseline REDCap-based HH survey of residents in District Badin to screen for anxiety and depression symptoms using standardized psychometric scales of Patient Health Questionnaire-9 (PHQ-9) [70] and Generalized Anxiety Disorder-7 (GAD-7) [71], which are locally validated and tested in Pakistan [72, 73]. The Urdu versions of PHQ-9 and GAD-7 demonstrate strong reliability (Cronbach's alpha: 0.91 and 0.92, respectively), unidimensional factor structure, good construct validity and are suitable for screening and monitoring depression and anxiety in primary healthcare settings in Pakistan [72, 73]. PHQ-9 has 9 items rated on a scale of 0 to 3. The maximum possible score is 27 and the minimum score is 0. Scores of 5, 10, 15, and 20 represent cut-off points for mild, moderate, moderately severe, and severe depression, respectively. Scores less than 5 indicate minimal depression. PHQ-9 has 88% sensitivity and 88% specificity for detecting major depression at a cutoff score of 10 [70]. GAD-7 has 7 items, and each item is rated on a sliding scale of 0–3 based on frequency of occurrence of the symptoms. The maximum possible score is 21 and the minimum score is 0. Scores of 5, 10, and 15 are taken as the cut-off points for mild, moderate, and severe anxiety, respectively. Scores less than 5 indicate minimal anxiety. GAD-7 has 89% sensitivity and 82% specificity for detecting generalized anxiety disorder at a cut-off score of 10 [71]. Translated versions of the scales were used in the HH survey.

Assessment was done in a demarcated and relatively secluded space inside the community participant's home, and the consent process was explained first. The first consenting adult in the household was the study participant for the baseline survey. Survey was conducted in the local language, Sindhi, and privacy of the participant was ensured to the extent possible. Data collectors of the HH survey were neutral, independent and unrelated to LHWs (who then later delivered the intervention to eligible participants). This community in Badin is familiar and quite used to participate in HH surveys and were duly informed prior to conducting the survey. The baseline HH survey comprised of information on sociodemographics and anxiety and depression screening through PHQ-9 and GAD-7. Those testing positive (screen positive - SP) for mild and moderate symptoms of anxiety and depression were then subsequently recruited to receive the *mPareshan* digital intervention through the LHWs. Survey answers were collected and electronically entered by data collectors using REDCap software on tablets.

Intervention

Sample size of participants for intervention

Following the baseline, the *mPareshan* app intervention sample size for participant recruitment was calculated using MedCalculator version 19.8 (MedCalc Software, Ostend, Belgium). Assuming a mean difference of 1.5 in PHQ-9 scores between pre- and post-intervention (pre-intervention mean score = 11.61, post-intervention mean score = 10.1), and a standard deviation of 5.6 for the mean difference, the minimum sample size needed with 5% significance and 80% power was determined to be 112. Accounting for 10% attrition rate and including some additional participants, the anticipated sample for recruiting participants for the intervention was 123 [63].

Inclusion criteria for intervention participants

The inclusion criteria for SPs were individuals aged 18 and over, who were residents of Badin and showed 'mild' and 'moderate' symptoms of depression and/or anxiety based on PHQ-9 and GAD-7 scores. They were excluded if they had 'minimal' symptoms of depression and anxiety, were undergoing any pharmacological treatment/therapy for mental health issues or were exhibiting severe or moderately severe anxiety/depression symptoms with danger signs (self-harm, harm to others, suicidal ideation).

Health worker training

After the baseline survey, LHSs and LHWs catering to those HHs where the SPs resided were mapped and given a customized 3-day training adapted from WHO mhGAP 2.0 guide [74, 75]. The training was conducted to increase health workers' mental health awareness, their communication and mental health counselling skills [76]. The pre- and post-training assessments showed that this training enhanced mental health-related knowledge and skills of the LHSs and LHWs [76]. Training was delivered through presentations, role-plays, videos, and group discussions over three days. In addition to mental health awareness, the LHWs responsible for delivering the intervention participated in a digital training session. This session assisted them to navigate the *mPareshan* app, utilizing dummy participant data to practice importing and exporting information to servers. Under the supportive supervision of LHSs and training facilitators, LHWs demonstrated their ability to use the app, although no formal pre-post assessment of digital literacy was conducted.

The mPareshan app features

The app had three main segments: tracking, counselling, and referral (Fig. 1). The tracking segment was responsible for recording participant recruitment/retention and information related to participants' consent. The referral segment identified potential danger signs such as suicidal ideation, self-harm, and harm to others, based on a two-week recall period. It then recommended appropriate referrals to the nearest mental health facility. If the participant did not need referral (had mild and/or moderate symptoms), then the LHW directed them to the counselling segment, which offered the 6 counselling sessions.

Counselling sessions (lasting around 20 min) involved imparting psychoeducation through audio and video clips, breathing exercises, and skill development for managing anxiety and depression symptoms. Each of the 6 sessions featured distinct content (Fig. 2). The initial two sessions raised awareness about the causes and signs of anxiety and depression. Sessions 3, 4, and 5 created

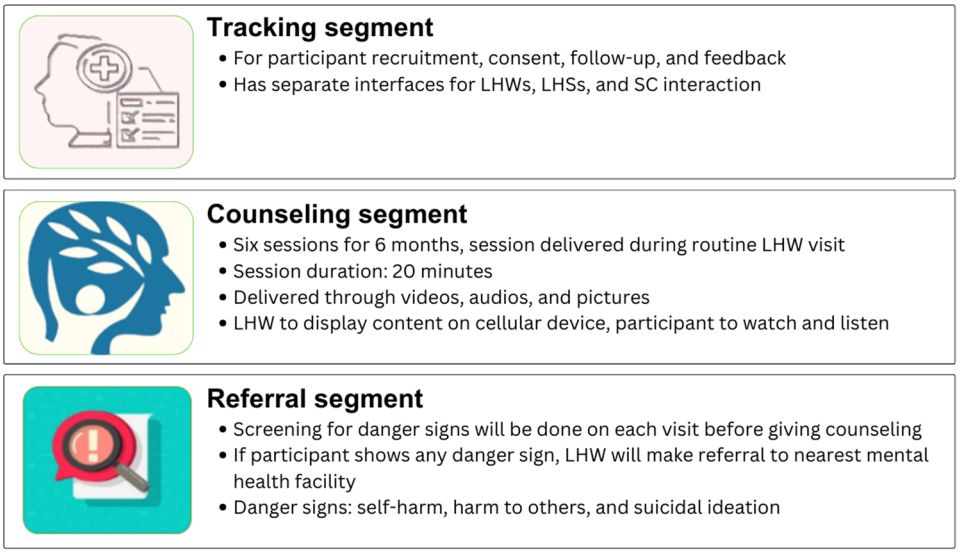

Fig. 1 *mPareshan* app segments and active ingredients

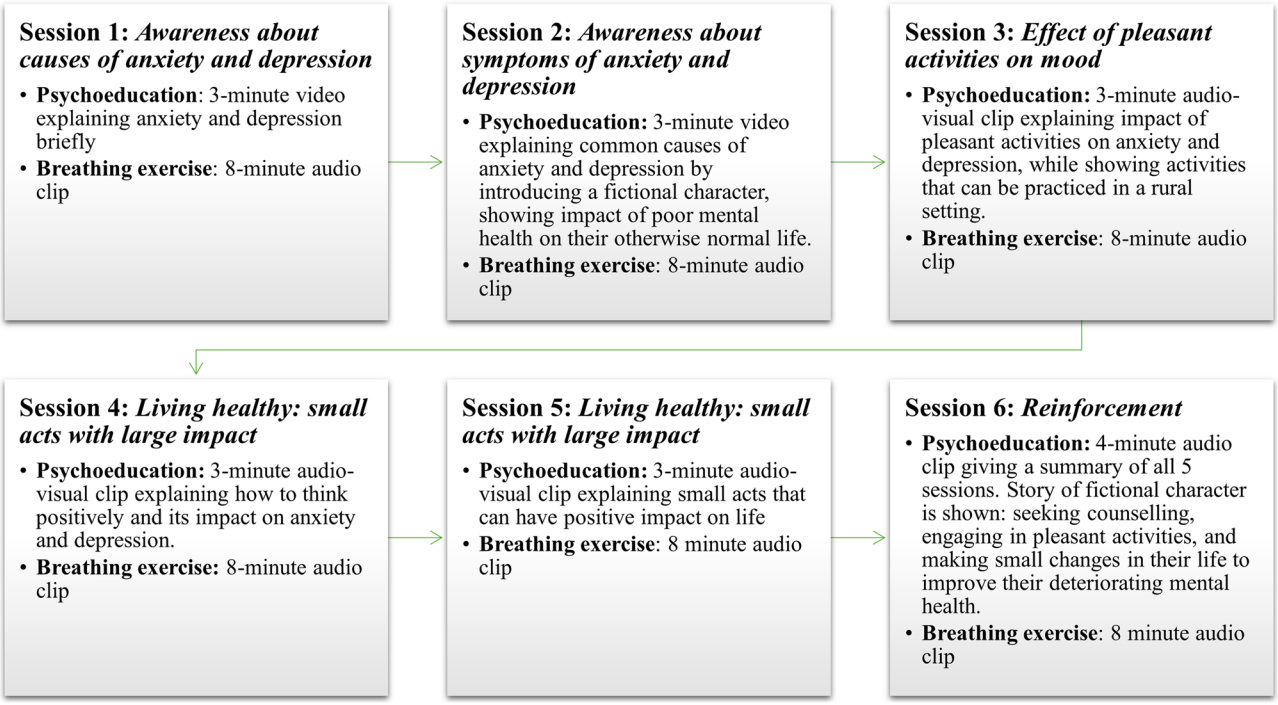

Fig. 2 Content overview of *mPareshan* mental health counselling sessions

awareness about coping skills, focusing on enjoyable pleasant activities and lifestyle adjustments. The final (6^{th}) session served as a recall of prior sessions.

The *mPareshan* app was developed by the authors in consultation with the Aga Khan University's Digital Health Resource Centre. We adapted the psychoeducation content for the *mPareshan* app from publicly available online sources, tailoring it to the specific needs and cultural context of Badin district. Following a rigorous pre-testing process, we refined the content to ensure its relevance and effectiveness, ultimately incorporating it into the app's counselling sessions. Prior to intervention, pre-testing and validation of the app was done in the field. Important feedback received included adding local language (Sindhi) audio narration to the psychoeducation sessions, contextualizing character attire to better reflect the real-life Sindhi community and accompanying the breathing exercise audios with pictorial images. These changes were incorporated into the app before final rollout.

Delivery workflow of the intervention

SPs received these six counselling sessions over the course of 6 months. Prior to commencement of each 20-minutes counselling session, the LHW requested the SP to be seated in a comfortable, secluded, and preferably less crowded place in the home, ensuring privacy and confidentiality as much as possible. LHWs often asked them to sit on a prayer mat during counselling and when performing breathing exercises as this represented a dedicated, private space for SPs. They were provided details of the counselling intervention before beginning of the session, and their consent to participate in the session was recorded in the tracking segment of the app. Informed written consent was also taken from them at the start of the counselling intervention (verbal consent where needed, with a witness present). At the end of each session, the participant was instructed to practice breathing exercises as homework until the next session. The LHW ensured that the participant felt comfortable. If the SP felt uncomfortable at any point in time, the session was discontinued. Completion of counselling segment redirected the LHW to the section on feedback where she checked all activities that were performed in the session and recorded her written comments. Once submitted to the server by the LHW, the session got locked and was passed on to her LHS for review. The LHS logged in from her portal to review all the feedback provided by LHW and submitted it to the Study Coordinator (SC) for a final check. The subsequent session got unlocked for the LHW after 15 days of completion of the previous session. These sessions coincided with LHWs' scheduled monthly household visits in their catchment area. The content of the sessions was contextually designed to work in a rural setting and be culturally appropriate. The sessions had standardized identical content for all participants to minimize variability. However, if the SP required more time to comprehend, then the LHW provided the

needed attention. Workflow of delivering the intervention through the *mPareshan* App is provided in Supplementary Material.

Endline household survey to assess outcome measures

An endline household survey with the SPs was conducted by a different set of independent data collectors who were not involved at the baseline survey. This was done after completion of the 6-month intervention to assess the change in their anxiety and depression scores. The main outcome measures were the PHQ-9 and GAD-7 scales. Both scales were used to categorize participants based on the severity of depression and anxiety symptoms. Changes in the SP's scores from baseline to endline were analysed to determine the effectiveness of the intervention.

Data analysis

Sociodemographic characteristics and point prevalence were analysed and presented using frequency percentages. Depending on distribution of PHQ-9 and GAD-7 data, we used paired t-tests or McNemar's Chi-Square tests to evaluate change in scores of anxiety and depression from baseline to endline. One-way ANOVAs or Kruskal-Wallis Tests were used to determine correlation or difference in distribution of sociodemographic variables across anxiety and depression categories. *P*-value of < 0.05 was considered significant. Data was exported from REDCap software to Statistical Package for the Social Sciences (SPSS) Version 21 (IBM Corp). All data was entered, cleaned, coded, and analysed using SPSS.

Results

Point prevalence of anxiety & depression

In February 2022, 366 participants were surveyed in a REDCap-based HH survey in District Badin, Sindh (1 adult per HH). This baseline survey population had a mean age of 42 years (SD 12.4) and consisted of 197 men (53.8%) and 169 women (46.2%). Their mean GAD-7 score was 2.5 (SD 4.1) and mean PHQ-9 score was 2.9 (SD 4.7). Among these, 276 (75%) had minimal anxiety (score < 5 on GAD-7) and required no further assessment, while 7 (2%) were excluded because they had severe anxiety (score > 14 on GAD-7) and were referred to next level of care. Eighty-three participants (23%) had symptoms of mild and moderate anxiety (Fig. 3a). Among the same 366 participants, 271 (74%) had minimal depression (score < 5 on PHQ-9), requiring no further assessment, while 7 (2%) were excluded due to having moderately severe and severe depression (score > 14 on PHQ-9), and referred to a specialist. Eighty-eight participants (24%) had mild and moderate depression (Fig. 3b).

Recruitment

While 83 participants had mild and moderate anxiety, and 88 had mild and moderate depression (Fig. 3), the total number of participants who had mild and moderate anxiety and/or depression was 98 (26.8%) (Table 1). These 98 individuals were invited to take part in the 6-month digital counselling intervention. Table 2 shows the characteristics of the 98 SPs who participated in the intervention. Their mean age was 43.2 years (SD 11.5), with almost equal representation of men and women. Majority of them were illiterate and poor.

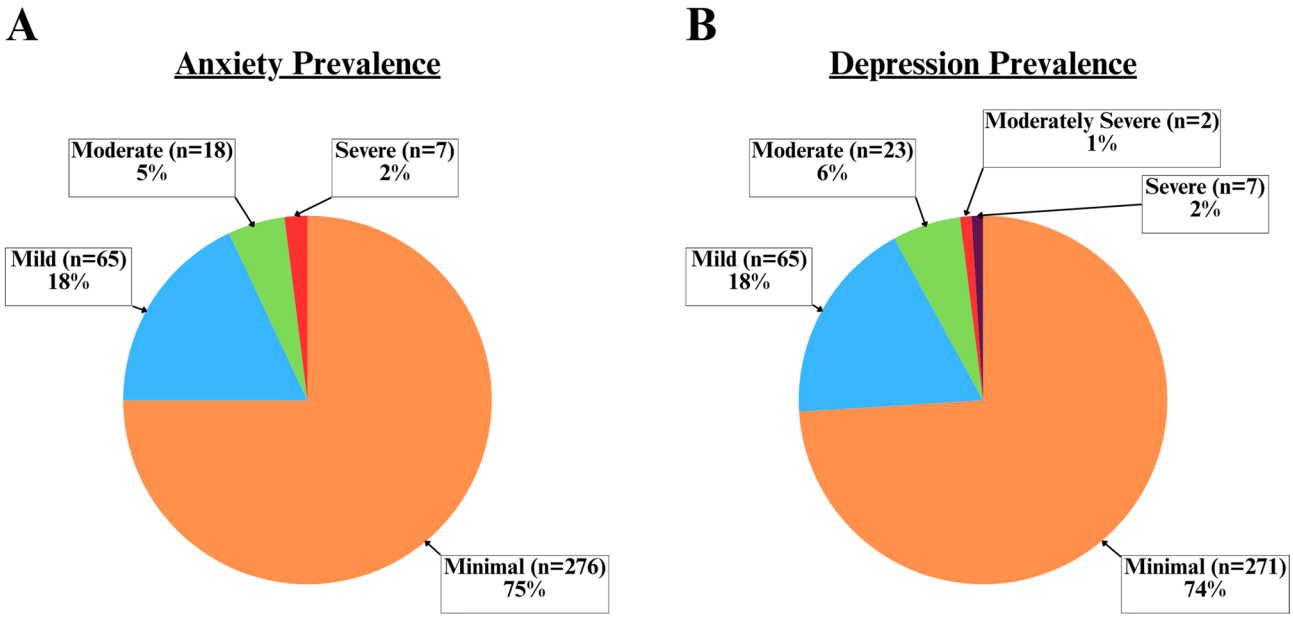

Fig. 3 **(a** and **b)** Point prevalence of anxiety and depression (*n*=366)

Table 1 Categorization of anxiety and depression symptoms among screen positive (SP) participants*

Depression (PHQ9)*	Minimal	Mild	Moderate	Total
Anxiety (GAD7)*				
Minimal	259 (excluded)	*16*	*1*	*17*
Mild	*12*	*44*	*8*	*64*
Moderate	*0*	*5*	*12*	*17*
Total	*12*	*65*	*21*	*98*

*Of the 366 individuals subjected for baseline assessment (PHQ 9, GAD 7) those having mild and moderate anxiety and/or depression were considered Screen Positive and eligible for app-based counselling intervention *N*=98. Participants with (i) Minimal anxiety and depression (*N*=259) (ii) Severe anxiety and/or depression (*N*=9) were excluded from the intervention

Anxiety and depression scores before and after the six-month intervention

Out of 98 screen-positive participants invited to complete all six counselling sessions, 92 (93.9%) successfully completed the sessions. The remaining 6 participants did not complete the sessions due to various reasons, including outmigration, referral to further care due to symptom severity, or unavailability of endline assessment data.

The mean GAD-7 score for the 92 participants was 6.6 (SD 3.0) before intervention. After receiving the 6 sessions, the mean score dropped to 2.1 (SD 2.3) [t = 12.2 ($p < 0.001$)]. Similarly, the mean PHQ-9 score was 7.5 (SD 3.1) before the intervention, which reduced to 2.6 (SD 2.2) after the six sessions concluded [t = 14.1 ($p < 0.001$)]. The change in frequencies of GAD-7 and PHQ-9 categories (minimal, mild, moderate) were all significant with SPs having mild and moderate anxiety and depression transitioning to the minimal category (Table 3).

Correlation of anxiety and depression scores with age, gender, education, and income levels

At baseline, the SP's age had no correlation with either their mean anxiety scores ($R = 0.06$, $p = 0.57$) or their mean depression scores ($R = -0.05$, $p = 0.62$). Their mean ages across the '*minimal*, *mild*, *and moderate*' anxiety and depression categories also did not differ (GAD-7: F = 0.32 (df = 2), $p = 0.73$; PHQ-9: F = 0.37 (df = 2), $p = 0.69$). SP's age did not correlate with the change in anxiety scores after the intervention ($R = -0.16$, $p = 0.12$), or the change in depression scores ($R = -0.05$, $p = 0.66$). We found no difference between men and women's anxiety and depression scores at baseline ([GAD7: Mean difference (SE) = −0.002 (0.60), t = −0.005, $p = 0.99$]; [PHQ9: Mean difference (SE) = 0.18 (0.63), t = 0.29, $p = 0.77$]). Likewise, there was no difference in terms of change in anxiety score during the intervention ($p = 0.76$), or the change in depression scores ($p = 0.73$) when stratified for gender. In terms of SP's literacy levels, their baseline anxiety scores were not significantly different across their education levels ($p = 0.10$), nor were their depression scores ($p = 0.13$). Similarly, anxiety scores were the same across different income category levels in SPs ($p = 0.44$), as were depression scores ($p = 0.94$). We also looked at whether the change in anxiety and depression scores after the intervention was associated with SP's education and income levels. Neither the anxiety score change (F = 1.17, $p = 0.33$) nor the depression score change (F = 1.62, $p = 0.14$) differed across education levels. Likewise, SP's income levels were also not associated with change in anxiety scores (F = 0.86, $p = 0.50$) or change in depression scores (F = 0.42, $p = 0.79$), after the intervention.

Discussion

This is the first example of frontline women lay workers in Pakistan delivering a home-based task-shifting mental health digital counselling intervention, to improve mental well-being in primary care. We have shown that the *mPareshan* intervention was able to make a meaningful reduction in symptoms of anxiety and depression in a sample of adult rural population in Sindh, Pakistan. The preliminary findings of this study indicated that the intervention is effective in reducing anxiety and depression, with a drop of 4.4 points on the 7-item GAD scale and 4.9 points on the 9-item PHQ scale. Most participants who initially exhibited mild or moderate anxiety and depression shifted to minimal levels of symptom scores following the intervention.

In our baseline household survey involving 366 adult participants, we observed a point prevalence of mild to moderate anxiety in 23% and mild to moderate depression in 24% of the sample. Other studies in Pakistan have used the PHQ-9 and GAD-7 to establish prevalence rates in other subsets of the population. This includes pregnant women in a rural, low-income subdistrict having around 35% mild to moderate depression [77].

After completing six sessions of *mPareshan*, 69% of participants reported a significant reduction in anxiety, with their scores dropping to minimal levels. Similarly, 73% of participants experienced a notable decrease in depression scores. The significant reduction in mean anxiety and depression scores indicates the intervention's efficacy in improving mental well-being in this sample of rural population in Pakistan. A recent systematic review looking at the effectiveness of non-specialist delivered digital interventions for mental health also shows that similar interventions have worked successfully in reducing mental health issues for service users [78]. Another systematic review that pooled the effect sizes of such digital mental health interventions in LMICs found that they were moderately to highly effective in reducing depression and anxiety symptoms [7].

We showed that the low-intensity nature of this intervention works in the real-life setting. By reducing symptoms to minimal levels, the *mPareshan* digital intervention may help decrease the demand for further

Table 2 Characteristics of individuals screening positive on the GAD-7 and PHQ-9 scale ($n = 98$)

N (%)	
Age (years)	
< 40	45 (45.9)
41– 60	44 (44.9)
>60	9 (9.2)
Gender	
Male	53 (54.1)
Female	45 (45.9)
Marital Status	
Married	89 (90.8)
Widowed	7 (7.1)
Separated	1 (1)
Never married	1 (1)
Educational level	
No schooling	53 (54.1)
Less than primary (can read and write)	10 (10.2)
Till primary school	13 (13.3)
Middle school (till 8th)	3 (3.1)
Matriculation	5 (5.1)
Intermediate	8 (8.2)
Bachelors	2 (2.0)
Masters	3 (3.1)
Others	1 (1.0)
Income (PKR)	
Less than 20,999	78 (79.6)
Between 21,999 and 30,999	9 (9.2)
Between 31,999 and 50,999	7 (7.1)
Greater than 51,999	1 (1)
None	3 (3.1)
Relationship with household head	
Head	54 (55.1)
Spouse	34 (34.7)
Son/Daughter	5 (5.1)
Son-in-Law/Daughter-in-Law	2 (2)
Parent	2 (2)
Brother/Sister	1 (1)
Occupation	
Laborer	38 (38.8)
Farmer	22 (22.4)
Housewife	20 (20.4)
Shopkeeper	2 (2)
Salaried Job	9 (9.2)
Unemployed	5 (5.1)
Others	2 (2)
Drug Use	
Yes	47 (48.0)
No	51 (52.0)
Health-seeking behaviour	
Visited faith healer in last 3 months	46 (46.9)
*Events in the last 3 months**	
Domestic violence/family conflict	12 (12.2)
Death in household	27 (27.6)
Traumatic brain injury	2 (2)
History of chronic illness	
No history	57 (58.2)
Hypertension	16 (16.3)
Others	15 (15.3)
Diabetes	5 (5.1)
Cardiovascular disease	5 (5.1)

*Independent events

psychiatric assessments, thereby optimizing resource allocation. Other studies have also emphasized the efficacy of low-intensity digital interventions, in addressing mental healthcare delivery. These include low intensity mHealth interventions for maternal mental health in Spain [79], Qatar [80], as well as a low-intensity cognitive behavioural therapy intervention for adolescent mental health in England [81].

Despite a significant portion of our study population lacking formal education (54%) and falling into the lowest income category (80%), the *mPareshan* intervention demonstrated significant reductions in anxiety and depression scores. The intervention was effective across socio-economic groups, indicating that its benefits are not impacted by income or literacy levels. These findings are particularly relevant for rural areas of Pakistan, where access to education and economic resources may be limited.

The intervention's effectiveness was not influenced by gender. Contrary to existing literature, which often reports higher prevalence of anxiety and depression among women [82–84], our study found similar anxiety and depression scores between men and women. This discrepancy may be attributed to the trust and familiarity that LHWs have established in the community, enabling both men and women to openly report their symptoms. The absence of delivery bias, where men might be less likely to report to women health workers, suggests that the LHWs' community presence helped mitigate potential gender-based reporting differences. However, the small sample size of our study may also contribute to this finding. Larger population-based studies are needed to accurately assess gender differences in mental health prevalence in Pakistan, particularly given the existing evidence suggesting higher prevalence of depressive disorders among women in the country [85].

Thus, the use of LHWs in our intervention has shown to be an effective strategy for promoting mental health at the community level. We have explored the challenges encountered during implementation rollout for these LHWs and LHSs in a separate publication [86]. Some issues with LHW workload and internet connectivity were noted. Similar studies have demonstrated the positive impact of such CHWs in improving access to mental

Table 3 Change in anxiety and depression scores after the intervention ($n = 92$)

	Pre-intervention	Post-intervention	Pre-post change in scores (paired t-test)		
	Mean (SD)		Mean Difference (SD)	Test statistic, t (df)	*p*-value
GAD7 total score	6.6 (3.0)	2.1 (2.3)	4.5 (3.5)	12.2 (91)	< 0.001
PHQ9 total score	7.5 (3.1)	2.6 (2.2)	4.9 (3.4)	14.1 (91)	<0.001
GAD7 categories	**N (%)**		**Pre-post change in frequencies (McNemar's Chi-square Test) ǂ**		
			Test statistic (χ2)		***p*-value**
Minimal Anxiety	17 (18.5)	80 (87.0)	55.7		<0.000
Mild Anxiety	59 (64.1)	10 (10.9)	39.1		<0.000
Moderate Anxiety	16 (17.4)	2 (2.2)	*		<0.000*
PHQ9 categories	**N (%)**		**Pre-post change in frequencies (McNemar's Chi-square Test) ǂ**		
			Test statistic (χ2)		***p*-value**
Minimal Depression	11 (12.0)	78 (84.8)	65		<0.000
Mild Depression	60 (65.2)	13 (14.1)	37.1		<0.000
Moderate Depression	21 (22.8)	1 (1.1)	*		<0.000*

*Binomial distribution used

ǂ McNemar's Chi-square test used because categorical data is paired (dependent samples)

health services and enhancing community perceptions of mental health care [38]. Our findings support the use of LHWs not only as a means of delivering mental health interventions but also as a catalyst for broader community engagement and raising mental health awareness [67].

Strengths and limitations

This pioneering study demonstrated feasibility of a home-based, technology-assisted mental health intervention delivered by LHWs in rural Sindh, Pakistan. A culturally adapted approach ensured relevance for low-literacy and low-income populations. High retention and adherence rates (94%) of the SPs further supported the intervention's acceptability. A mixed-methods design provided robust data, further supported by triangulated findings from related publications [76, 86]. The feasibility study design eliminated the need for a control group, focusing rather on proof-of-concept. LHWs' familiarity with households mitigated privacy concerns. Use of different data collectors at baseline and endline reduced social desirability bias.

The small sample size limits generalizability and power to assess population-based prevalence and gender differences. Moreover, the study was primarily designed to assess acceptability and feasibility of this approach (in a before-and-after design) rather than a trial with a control group, hence any conclusions on intervention effectiveness should be drawn with caution. Home-based counselling in a rural setting posed privacy challenges due to large family sizes and limited space. However, privacy and confidentiality for the SPs were maintained to the extent possible, and LHW familiarity within households helped mitigate privacy concerns by reducing curiosity from family members. The intervention was not designed to address severe cases, although only a small number of participants required referral to specialist care. While the findings may not be representative of larger populations or geographic areas, they provide a foundation for future, more appropriately powered trials.

Conclusion

In conclusion, we have found preliminary evidence of meaningful reduction in anxiety and depression scores associated with a locally adapted digital counselling intervention delivered by lay health workers through routine primary health care in a rural setting of Sindh, Pakistan. The digital counselling intervention seems to be sustainable as it was integrated into the routine workload of the LHWs. By leveraging existing community resources and adopting a low-intensity, scalable model, this intervention demonstrates significant potential to mitigate the burden of anxiety and depression in underserved populations. Future research should focus on long-term scalability through an appropriately powered randomized controlled trial to test if this task-shifting mental health intervention is effective compared to usual mental healthcare.

Abbreviations

CHW	Community Health Worker
GAD-7	Generalized Anxiety Disorder-7
HH	Household
LHS	Lady Health Supervisor
LHW	Lady Health Worker
LHW-P	Lady Health Worker Programme
LMIC	Lower and Middle-Income Country
mhGAP	Mental Health Gap Action Programme
PHQ-9	Patient Health Questionnaire-9
REDCap	Research Electronic Data Capture
SC	Study Coordinator
SP	Screen Positive
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-23665-5.

Supplementary Material 1.

Acknowledgements
The authors would like to thank the overall research team members involved in the implementation of this trial. Special gratitude is expressed to the study participants that took part in this intervention and related quantitative and qualitative assessments.

Authors' contributions
All authors (FR, JN, SA, AS, ZM) made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas.

Funding
This study was supported by a grant from the Brain & Mind Institute (BMI), Aga Khan University (Grant Brain & Mind-FR-11E-mPareshan App 83000).

Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Ethical Review Committee of Aga Khan University (ERC#2021-6570-20015). The study adheres to the tenets of the Declaration of Helsinki. All study participants (both for baseline and intervention) provided written informed consent which was given to them in their local language. Illiterate participants provided verbal consent, and their thumb impression were taken along with a witness present to note their consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Received: 11 December 2024 / Accepted: 18 June 2025
Published online: 08 August 2025

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