Programmatic implementation of depression screening and remote mental health support sessions for persons recently diagnosed with TB in Lima, Peru during the COVID-19 pandemic

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Abstract

Background: Few studies have explored a stepped care model for delivering mental health care to persons with TB. Here, we evaluated depression screening and remote low-intensity mental health interventions for persons initiating TB treatment in Lima, Peru during the COVID-19 pandemic.

Methods: We used the PHQ-9 to screen participants for depressive symptoms (PHQ-9≥5). Participants with PHQ-9, 5-14 received remote Psychological First Aid (PFA) or Problem Management Plus (PM+). Participants were re-evaluated six months after intervention completion. We then compared the change in median PHQ-9 scores before and after intervention completion. Those with PHQ-9≥15 were referred to higher-level care.

Findings: We found 62 (45.9%) of 135 participants had PHQ-9≥5 at baseline. Fifty-four individuals with PHQ-9, 5-9 received PFA, of which 44 (81.5%) were re-evaluated. We observed significant reductions in median PHQ-9 scores from 6 to 2 ($r = 0.98$; $p<0.001$). Four participants with PHQ-9, 10-14 received PM+ but were unable to be re-evaluated. Four participants with PHQ-9≥15 were referred to higher-level care.

Conclusions: Depressive symptoms were common among persons recently diagnosed with TB. We observed improvements in depressive symptoms six months later for most participants who received remote sessions of PFA.

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44 **Key Words:** Depression, Mental Health, Tuberculosis, Psychological First Aid, Peru

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Impact Statement

This report describes one of the first experiences incorporating depression screening and remote mental health support interventions as part of a wider community-based active TB screening program. Our findings reaffirm the high prevalence of depressive symptoms among persons recently diagnosed with TB in northern Lima as well as the urgent need to meet and address the psychosocial needs of members of this vulnerable patient population. Importantly, our observations also provide further practical insight into how depression screening and remote mental health interventions may be integrated into existing TB programs, including community-based active TB screening programs.

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Introduction

Tuberculosis (TB) is a debilitating infectious disease caused by *Mycobacterium tuberculosis*, a human pathogen that affects the lungs and other organs, causing significant morbidity and mortality (World Health Organization 2022b). TB remains a leading cause of mortality due to a single infectious disease after the coronavirus disease (COVID-19) (World Health Organization 2022a). The World Health Organization (WHO) estimated that in 2022 roughly 10.6 million people acquired TB and 1.3 million - 167,000 of which were HIV positive - died from TB (World Health Organization 2023). In the Americas region, Peru has one of the highest TB burdens with an estimated annual TB incidence rate of 130 per 100,000 persons per year and is a hotspot for drug-resistant TB (World Health Organization 2022a).

Mental disorders such as depression are common among persons with TB. It is estimated that about 45% of persons with TB have depression with prevalence estimates exceeding 50% in persons with MDR-TB (Duko *et al.* 2020). Similar depression prevalence estimates have been previously reported among persons with TB and MDR-TB in Peru (Ugarte-Gil *et al.* 2013; Vega *et al.* 2004). Furthermore, comorbid mental disorders have adverse impacts on TB treatment outcomes. Recent systematic reviews and meta-analyses have reported that persons with TB and depressive symptoms have more than four times the odds of poor TB treatment outcomes compared with those without depressive symptoms (Ruiz-Grosso *et al.* 2020). Taken together, the current evidence base suggests that addressing comorbid mental disorders such as depression is integral to improving both mental well-being and treatment success rates among those with TB (Sweetland *et al.* 2018).

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Various mental health interventions have demonstrated promise in improving treatment outcomes in persons sick with TB. For example, across three randomized controlled trials, psycho-emotional interventions (including counseling, self-help groups, and psychotherapy) were associated with an increased likelihood of achieving successful TB treatment outcomes (pooled RR, 95% CI, 1.37, 1.08 – 1.73); however, these studies considered all persons with TB and included those without comorbid mental disorders (van Hoorn *et al.* 2016). A more recently published systematic review by Farooq et al. considered two pharmacological and 11 psychosocial interventions for addressing common mental disorders such as depression among persons with TB (n = 4,326) in various low- and middle-income countries (Farooq *et al.* 2021). They reported that persons with TB who receive some kind of psychosocial intervention generally have higher TB treatment adherence and cure rates compared with those who do not receive the intervention or when compared with the pre-intervention period. More recently, a large interventional study conducted by Pasha et al. in Pakistan evaluated the implementation of screening for anxiety/depression and subsequent delivery of a series of counseling sessions throughout the TB treatment period among 3,500 persons with TB disease. They found that those who completed at least four sessions had significantly higher rates of completing TB treatment compared with those who completed less than four sessions (Pasha *et al.* 2021).

Even before the COVID-19 pandemic, there had been a significant interest in implementing remote mental health interventions for various common mental health issues in low-and middle-income countries (LMICs) (Fu *et al.* 2020). A recent systematic review and meta-analysis of randomized controlled trials (n = 4,104 across 22 trials) found that psychological interventions delivered across various digital modalities (e.g., websites, smartphone apps,

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103 computers, audio-devices, and text messages) were moderately effective in addressing
104 common mental disorders (pooled Hedges' g = 0.60, 95% CI 0.45 – 0.75) when compared
105 with control interventions or usual care, and the vast majority of these interventions were
106 used to address depression and substance use disorders (Fu *et al.* 2020). Since the start of the
107 pandemic, systematic reviews of remote mental health interventions have reported adaptive
108 transitions to implementing synchronous telemental health tools. However, the vast majority
109 of studies were conducted in high-income countries, and commonly cited barriers to scaling
110 up remote mental health interventions in LMICs include a lack of information technology
111 resources and infrastructure in mental health services, socio-economic inequalities affecting
112 access to remote mental health services, and reduced technological literacy (Witteveen *et al.*
113 2022).

114

115 Despite these challenges, research suggests that designing and delivering remote mental
116 health interventions may be effective in addressing comorbid mental disorders among
117 persons with TB. However, to our knowledge, none has evaluated the implementation of
118 depression screening and delivery of remote mental health interventions embedded within the
119 context of a wider community-based active TB screening program. Furthermore, few studies
120 have reported on the use of a stepped care model for allocating different low-intensity mental
121 health support interventions based on different depressive symptom severities at the time of
122 initial screening (Bower and Gilbody 2005; Walker *et al.* 2018). Thus, the aim of this study
123 was to evaluate remote low-intensity mental health interventions, specifically Psychological
124 First Aid and Problems Management+, on depressive symptoms among people initiating
125 treatment for pulmonary TB as part of a community-based active TB screening program in
126 Lima, Peru during the COVID-19 pandemic.

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Methods

Study design and context

We conducted a secondary analysis of data collected as part of a mental health program run by the non-profit organization Socios En Salud based in Lima, Peru. This program screened persons with active TB for depressive symptoms and subsequently provided low-intensity mental health interventions during their TB treatment period between 2019 and 2021. This mental health program was incorporated as part of a wider community-based active TB screening program called "TB Móvil" (TB-M), which SES first implemented in collaboration with the Ministry of Health (MINSA) of Peru in 2019 to identify persons with active TB across various districts of Metropolitan Lima (Galea *et al.* 2022; Yuen *et al.* 2021). Persons diagnosed with TB through the TB-M program were referred to participate in the SES mental health program. The mental health program was implemented remotely in parallel to the TB-M program between September 2020 and June 2021 during the early phases of the COVID-19 pandemic.

Intervention procedures

Participant enrollment and data collection

Participants were eligible for depressive symptom screening if they satisfied the following inclusion criteria: individuals were recently diagnosed with TB through the TB-M program and had subsequently initiated treatment; were referred by TB-M program staff members for further mental health evaluation; were 18 years or older; and were residents of communities and districts of northern Lima that were a part of the TB-M program catchment area. SES

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psychologists contacted individuals who were referred by TB-M program staff by telephone and then invited them to be screened for depressive symptoms within 30 days of initiating TB treatment. Those who did not start TB treatment during this period were excluded. Participant sociodemographic (e.g., age, sex, highest level of educational attainment, and region of birth), clinical, and microbiological data (e.g., TB disease diagnosis, sputum smear microscopy status, GeneXpert results, and rifampin resistance status) were obtained from the TB-M program's database.

Data preparation and handling

For this secondary data analysis, we accessed non-identifiable information on TB-M program participants from the SES informatics system. To describe the socio-demographic and clinical characteristics, we considered the following variables among all participants evaluated for depressive symptoms: age, sex, highest educational level attained, region of birth, BK results, Gene Xpert results, chest radiography status, and rifampin resistance status. We considered the age of participants as a continuous variable. The highest level of education attained was categorized into three groups: primary, secondary, and post-secondary. We defined region of birth as being born inside or outside of the Lima region. Clinical variables like BK and GeneXpert results were considered as binary variables - negative or positive.

The main variables analyzed in this study were depressive symptoms at baseline and follow-up as well as the type of remote mental health intervention provided by mental health professionals.

Depressive symptom screening and definitions

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SES psychologists interviewed participants using the validated Spanish version of the Patient Health Questionnaire 9 (PHQ-9), a depression screening instrument widely used in clinical practice and research (Calderón *et al.* 2012). The score evaluates the number and frequency of nine depressive symptoms and ranges from 0 (i.e., experiencing no depressive symptoms none of the time) to 27 (i.e., experiencing all depressive symptoms nearly every day). The PHQ-9 uses different score ranges to classify different depressive symptom severities. They include: minimal (PHQ-9 ≤4), mild (PHQ-9, 5-9), moderate (PHQ-9, 10-14), moderately severe (PHQ-9, 15-19), and severe (PHQ-9 score ≥20) (Kroenke *et al.* 2001).

Mental health interventions

The mental health interventions offered as part of the SES mental health program were originally developed before the pandemic and subsequently underwent revisions at the onset of the pandemic. Here, we describe the mental health interventions that were delivered during the early phases of the pandemic period specifically. Between September 2020 and June 2021, remote mental health support sessions were offered to participants identified with signs and symptoms of depression. Those with PHQ-9 scores 5-9 received one session of Psychological First Aid (PFA), and those with PHQ-9 scores from 10-14 received five support sessions of Problem Management Plus (PM+) (Dawson *et al.* 2015). People with PHQ-9 scores ≥15 received one session of PFA before being promptly referred for higher-level mental health care at public health care institutions. The remote PFA and PM+ support sessions and referral process for patients with severe depressive symptoms are further described in detail below.

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Psychological First Aid (PFA). The remote PFA sessions provided basic psychological support in emergent and stressful situations. The primary aim of the remote PFA support sessions was to help participants restore their emotional balance according to three principles: (1) observe the person's problem, needs, and possible solutions; (2) listen carefully to the person and help him/her feel supported and address his/her basic needs; (3) connect the individual to public or private mental health institutions if further specialized care was needed (International Federation of Red Cross and Red Crescent Societies 2020). This intervention was administered on an individual basis by SES psychologists via a telephone call, consisting of a single session lasting approximately 45 minutes.

Problem Management Plus (PM+). PM+ is a low-intensity, trans-diagnostic psychological intervention recommended by the WHO in treating common mental disorders in many resource-limited settings (Hamdani *et al.* 2018; World Health Organization 2016). Previous studies have shown that it is effective in reducing symptoms of anxiety and depression (Hamdani *et al.* 2018; Rahman *et al.* 2016). Its primary advantage is that it can be delivered widely by trained non-specialists such as community health workers, volunteers, and psychology students. The PM+ intervention has previously been adapted for use in the general Peruvian population (Coleman *et al.* 2021). The intervention consisted of five remote 90-minute sessions that were delivered on an individual basis every week. In the first session, participants were oriented and motivated to participate and receive psychoeducation and learn basic stress management and control strategies. In the second session, participants learned problem-solving techniques for life problems and were introduced to behavioral activation techniques. In the third and fourth sessions, they were introduced to techniques for strengthening social support and continued to practice problem-solving techniques,

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behavioral activation procedures, and relaxation exercises. In the last session, all learned strategies were reviewed and demonstrated by participants as a means of assessing understanding for future use and application.

Referral process and criteria for further specialized mental health care

SES psychologists referred participants with PHQ-9 ≥15 for higher-level mental health care at public health care institutions. The referral process included identifying public health care facilities closest to the participant's home, contacting the local facility, and arranging appropriate follow-up to ensure that the referral process was successful. In areas without access to mental health facilities, participants were referred to a nearby health care center instead. Those experiencing mental health problems other than depression were referred to specialized public mental health services operated by the MINSA of Peru.

Depression re-evaluation

Among those who had received and completed remotely administered sessions of PFA or PM+, SES psychologists contacted those same participants six months later and invited them to be re-evaluated for depressive symptoms using the PHQ-9 questionnaire.

Data collection and statistical analysis

SES psychologists uploaded data collected from participants to the SES electronic data system. These included PHQ-9 scores at the time of enrollment/baseline and at the time of follow-up, type of remote mental health support sessions received (PFA or PM+), and

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whether participants were referred to primary care facilities or public health centers for higher-level mental health care. Continuous variables of characteristics of people with TB were reported as medians with interquartile ranges (IQR), and categorical variables were reported as frequencies with percentages. We reported the overall proportion of people initiating treatment for TB with PHQ-9≥5 at the time of study enrollment. For participants who were re-evaluated, we used the Wilcoxon's paired sign-rank test to compare the within-person change in median PHQ-9 scores between baseline and the six-month follow-up. We reported the relevant effect size ("r") estimate and accompanying p-value (Kerby 2014; Rosenthal 1994). All statistical analyses were conducted using Stata/SE 17.0 (Stata Corp., College Station, TX) with a significance level of 0.05.

Results

During the pandemic, we identified a total of 161 individuals who were referred for mental health evaluation after being assessed by the TB-M program (Figure 1). After excluding 26 participants, a total of 135 (83.9%) eligible participants underwent depressive symptom screening at baseline. Among all persons with TB who had undergone depressive symptom screening at baseline, the median age was 38.9 years (IQR: 28.4 years) and the majority were male (76 of 135 participants, 56.3%) (Table 1). Most participants were born in the Lima region (101 of 130 participants, 77.7%) and completed secondary education (91 of 129 participants, 70.5%). Microbiologically, 106 (81.5%) of 130 participants were tested for TB using sputum samples. Of those who had available GeneXpert MTB complex results (n = 100), 90 (90.0%) were positive; 10 (11.1%) of 90 participants with information on rifampicin resistance were resistant to rifampin.

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Among 135 participants who underwent screening for depression at baseline, 62 (45.9%) had PHQ-9≥5 (Table 1). Persons with TB and PHQ-9≥5 at baseline tended to be younger compared with those with PHQ-9<5; albeit the comparison was not statistically significant (median age and IQR for participants with depressive symptoms vs. without at baseline: 37.2 years [22.0 years] vs. 41.6 years [30.5 years], p = 0.581) (Table 1). Furthermore, we did not find any statistically significant difference in the proportion of participants with PHQ-9≥5 at baseline neither by sex (p = 0.055) nor by education level (p = 0.816; Table 2). However, those with PHQ-9≥5 at baseline were more likely to be born within Lima compared with those with PHQ-9 scores <5 (PHQ-9≥5 vs. <5 for the region of birth within Lima: 50 [70.4%] vs. 51 [86.4%], p = 0.035). We did not find a statistically significant difference in baseline depression status for those who had microbiological confirmation of their TB compared with those diagnosed based on clinical/radiological findings (p = 0.652).

Of the 62 participants who were found to have PHQ-9≥5 at baseline, almost all had PHQ-9, 5-9 (54 [87.1%]); 4 (6.5%) participants had PHQ-9, 10-14; 3 (4.8%) had PHQ-9, 15-19; and 1 (1.6%) had PHQ-9≥20 (Table 2; Figure 1). Among the 54 participants who were found to have PHQ-9, 5-9, 44 (81.5%) were re-evaluated six months after completing remote PFA support sessions. The majority of participants re-evaluated six months later no longer had clinically significant depressive symptoms, as evidenced by PHQ-9 scores <5 (n = 38 [86.4%]); only 6 (13.6%) had PHQ-9, 5-9. We observed a statistically significant reduction in the within-person change in the median PHQ-9 scores at baseline and during the six-month follow-up after completing the remote PFA support sessions (median PHQ-9 score and IQR

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289 at baseline and at follow-up: 6 [3] and 2 [3], respectively, ($r = 0.98$; $p<0.001$; Table 3).
290 Remote PM+ support sessions were delivered to four participants who were initially found to
291 have PHQ-9, 10-14; however, they all refused re-evaluation six months later, and, therefore,
292 a comparison could not be made. All participants who were found to have PHQ-9≥15
293 successfully received a single remote session of PFA and were immediately referred to
294 higher-level mental health care.

295

296 **Discussion**

297 During the COVID-19 pandemic, we found that almost half of all persons recently diagnosed
298 with TB as part of a community-based active TB screening program exhibited depressive
299 symptoms (PHQ-9≥5). Furthermore, our findings also indicate that implementing a stepped
300 care model for mental health screening and care delivery was associated with overall
301 improvements in median PHQ-9 scores six months later.

302

303 Overall, we found that 45.9% of all persons with TB in our sample had depressive symptoms
304 at the time of TB treatment initiation. We recognize that this prevalence estimate was
305 determined using a liberal PHQ-9 cutoff score of 5. Nonetheless, our prevalence estimate is
306 much higher than that recently reported in the general Peruvian population during the
307 pandemic period (~20%) (Zegarra-López *et al.* 2022). Our estimate is consistent with the
308 pooled depressive symptom prevalence estimate among persons with TB (Duko *et al.* 2020).
309 In our program, most participants with depressive symptoms exhibited mild depression,
310 defined by PHQ-9, 5-9 (54/62 [87.1%]). Most were contacted by SES psychologists within

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the first 30 days following TB diagnosis, a period that also coincides with the initiation of TB treatment. The high prevalence at baseline may be related to an increased incidence of new depressive symptoms or an acute worsening of pre-existing depression or some other unassessed mental disorders within our study population. While our data limits our ability to differentiate between these two possibilities, the high prevalence of depressive symptoms may be due to a variety of acute psychosocial stressors related to receiving a TB diagnosis and/or transitioning to receiving TB treatment (Sweetland *et al.* 2017). In particular, the perceived stigma associated with a TB diagnosis is notably high among persons with TB, and its sequelae (e.g., discrimination) are common means by which persons with TB may develop and experience depressive symptoms (Chen *et al.* 2023; Lee *et al.* 2017; Mohammedhussein *et al.* 2020; Sweetland *et al.* 2017). Thus, our findings suggest that the integration of early depression screening within TB screening programs could be useful in identifying a large sample of patients who may benefit from concurrent mental health care during their TB treatment, especially around the time of TB diagnosis and initiation of TB treatment.

Previous studies addressing comorbid mental and health concerns among persons with TB disease have primarily focused on delivering mental health interventions to those who screen positive for depressive symptoms, regardless of their symptom severity at the time of initial screening (Farooq *et al.* 2021). However, few studies have implemented a stepped care model of first screening for mental disorders and subsequently delivering severity-appropriate mental health interventions. In Nepal, Walker et al. conducted a feasibility and acceptability pilot study for a psychosocial support package among patients with MDR-TB (Walker *et al.* 2018). Their package involved providing all patients with information and educational materials and initially screening them for symptoms of anxiety and depression using the

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Johns Hopkins Symptom Checklist. For those who screened positive for either anxiety or depression, they were subsequently referred for depressive symptom screening using the PHQ-9. Those who had PHQ-9 scores less than 10 were re-screened on a monthly frequency. Those who had PHQ-9, 10-19 received a series of counseling sessions based on behavioral activation originally evaluated in India for treating depression. Those who had PHQ-9>19 or who expressed suicidal intent were referred for higher-level psychiatric and medical care. Although this study concluded that, overall, it was feasible to design and implement a stepped care model for mental health care within a National Tuberculosis Program, it suffered a couple of key limitations, including (a) utilization of a complex two-step screening system that likely resulted in fewer number of patients receiving the counseling intervention; and (b) inability to evaluate the potential impact of the mental health intervention on changes in depression and anxiety severity in relation to the time of initial screening. Our present study utilized the PHQ-9 as the only standardized screening tool and implemented a stepped care model with different severity-appropriate virtual mental health support sessions. Although we were unable to re-evaluate enough participants who received remote PM+ sessions, we were able to re-evaluate a high proportion (~80%) of those who completed remote PFA sessions and gain a sense of the possible mental health impact associated with providing severity-specific mental health interventions.

More broadly speaking, our findings and programmatic experience are consistent with overall global patterns of shifting toward remote means of delivering mental health care and support at the onset of the COVID-19 pandemic. This shift has been described by a recent umbrella review of 38 systematic reviews of studies on remote mental health interventions and care delivery during the pandemic (Witteveen *et al.* 2022). In particular, there was a greater shift

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toward synchronous modalities of remote mental health care delivery (e.g., use of videoconferencing platforms and telephone calls) than asynchronous means (e.g., self-help apps, websites, or digital tools) (Witteveen *et al.* 2022). This shift is also consistent with our programmatic approach with the use of telephone calls and videoconferencing means to deliver remote PFA sessions and PM+ sessions. However, despite these adaptive changes, these reviews also highlighted limited access to remote mental health care and services among members of vulnerable populations and communities as a chief barrier and disparity; this included a paucity of studies reporting on remote mental health interventions from LMICs, particularly during the early phase of the pandemic (Witteveen *et al.* 2022). Our study adds to a growing need for research that evaluates innovative and integrated ways of meeting the psychosocial needs of vulnerable patient populations like those with TB in resource-limited settings.

Our programmatic experience and findings have implications for integrating mental health care and TB care. We show that low-intensity mental health interventions such as PFA and PM+ support sessions can be administered virtually to persons recently diagnosed with TB during the pandemic era. This type of care delivery modality is in line with the wider and accelerated shifts toward adapting and utilizing telehealth-based technologies during the pandemic (Moreno *et al.* 2020; Witteveen *et al.* 2022). Low-intensity psychosocial interventions such as PFA are first-line psychosocial interventions that can be administered in high-stress mental health crises and delivered by trained non-specialist personnel. This may greatly expand service coverage in settings with limited resources and fewer formally-trained mental health professionals (Pollock *et al.* 2020); these lessons may also be applicable in high-income settings. Furthermore, integrated TB and mental health screening in high-risk

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populations, settings, or communities offers an opportunity to detect a higher number of individuals with both TB and mental health issues. This may be particularly important during times when acute psychosocial stressors and TB-associated stigma are likely to be most severe.

Our study has several notable limitations. First, although we observed statistically significant reductions in the median PHQ-9 scores from baseline to six months following completion of PFA sessions, we are limited in our ability to infer to what extent the mental health interventions may have contributed to these reductions. On one hand, remote PFA sessions could have improved depressive symptoms by providing immediate psychosocial support to persons with newly diagnosed TB during what is often a significant and traumatic life event and transition (Hermosilla *et al.* 2023). On the other hand, we also considered other plausible explanations, which include but are not limited to natural improvements in depressive symptoms with time, improvements in TB disease because of ongoing treatment, the beneficial impacts of other unmeasured psychosocial and/or clinical factors (i.e., residual confounding), or a combination of these factors. In a similar vein, we were unable to compare changes in median PHQ-9 scores over time with a control group, as every participant who had PHQ-9≥5 at baseline was offered mental health support. Second, we were unable to re-evaluate slightly less than 20% of those who had PHQ-9 scores 5-9 at baseline six months after completing PFA support sessions. Assuming those with higher PHQ-9 scores are less likely to follow-up, this could have led to an overestimation of the change in median PHQ-9 scores between baseline and follow-up. Finally, we were unable to assess the association between completing the mental health interventions and TB treatment outcomes, including known mediators such as treatment adherence. Previous studies have demonstrated a positive

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correlation between emotional support during TB treatment and improved treatment adherence and success rates (Ruiz-Grosso *et al.* 2020). Therefore, future mental health interventions could include regular, monthly follow-up depression assessments throughout the TB treatment period, particularly at the start of TB treatment when depressive symptoms are likely to be most severe.

In conclusion, we found that depressive symptoms were common among people with TB who were identified by a community-based active TB screening program. We also observed significant improvements in depressive symptoms six months later among most participants who received remote sessions of PFA. Future studies are needed to rigorously evaluate the feasibility and utility of frequent depression assessments during the TB treatment period as well as the impact of severity-appropriate, low-intensity psychosocial interventions on TB treatment outcomes regarding cost, programmatic scalability, and acceptability among persons with TB.

Author Contribution Statement

CC is the corresponding author. CC, JS, and JG designed and oversaw the implementation of the mental health interventions. DP, MT, JP, LL, SK, and CY designed and oversaw the implementation of the community-based active TB case finding program "TB Móvil." LR devised the analytical approach and carried out the data analysis. CC and JS drafted the primary version of the manuscript. ALC, CC, JS, DP, MT, JP, LL, SK, CY, and GR revised

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and edited subsequent versions of the manuscript. All authors reviewed and approved the final version of the manuscript.

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Conflict of Interest Statement

All authors have no conflicts of interest to declare.

Ethics Statement

The study was reviewed and approved by the Ethics Review Committee of SES. Confidentiality was maintained throughout the study. All collected data were kept confidential and used only for study purposes.

Data Availability Statement

The anonymized version of the data analyzed in this study is available upon request.

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580 **Table 1. Baseline participant characteristics, by baseline depressive symptom status (N**

581 **= 135)**

Characteristics		Baseline depressive symptom status, no. % (column)		p-value
	Total no. (%), N = 135[a]	PHQ-9 scores <5 (n = 73)	PHQ-9 scores ≥5 (n = 62)	
Age, years, median (IQR) (n = 135)	135 (100.0)	41.6 (30.5)	37.2 (22.0)	0.581
Gender (n = 135)				0.055
Male	76 (56.3)	47 (64.4)	29 (46.8)	
Female	59 (43.7)	26 (35.6)	33 (53.2)	
Highest educational level achieved (n = 129)				0.816
Primary or less	24 (17.8)	14 (20.6)	10 (16.4)	
Secondary	91 (70.5)	46 (67.7)	45 (73.8)	
Post-secondary	14 (10.9)	8 (11.8)	6 (9.8)	
Region of birth (n = 130)				0.035
From Lima	101 (77.7)	50 (70.4)	51 (86.4)	
Outside of Lima	29 (22.3)	21 (29.6)	8 (13.6)	
TB diagnosis methodology (n = 130)				0.652
Microbiological confirmation	106 (81.5)	54 (79.4)	52 (83.9)	
Clinical/radiological criteria	24 (18.5)	14 (20.6)	10 (16.1)	
BK results (n = 100)				0.159
Negative	53 (53.0)	33 (60.0)	20 (44.4)	
Positive	47 (47.0)	22 (40.0)	25 (55.6)	
GeneXpert MTB Complex Detection Status (n = 100)				0.021
Negative/not detected	10 (10.0)	9 (16.4)	1 (2.2)	
Positive/detected	90 (90.0)	46 (83.6)	44 (97.8)	
Rifampin resistance status[b] (n = 90)				0.076
Sensitive	49 (54.4)	25 (54.3)	24 (54.5)	
Resistant	31 (34.4)	19 (41.3)	12 (27.3)	
Indeterminant	10 (11.1)	2 (4.3)	8 (18.2)	

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[a] Total number may be less than 135 due to missing data
[b] Numbers and percentages reported only among participants with a positive GeneXpert test result

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584 **Table 2. Breakdown of depressive symptom severity at baseline among persons with TB**

Baseline depressive symptom severity	**PHQ–9 score range**	**No. (%)**
None/ minimal	0 – 4	73 (54.1)
Mild	5 – 9	54 (40.0)
Moderate	10 – 14	4 (3.0)
Moderately severe	15 – 19	3 (2.2)
Severe	≥20	1 (0.7)
Total		**135 (100.0)**

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586 **Table 3.** Comparisons of median PHQ-9 scores at baseline and six months following
587 completion of remote PFA support sessions in persons with TB (n = 44)

Baseline PHQ-9				**PHQ-9 at Re-evaluation (Six Months Follow-up)**				**Change in Median PHQ-9**	
Median	Min	Max	IQR	Median	Min	Max	IQR	Effect size (r)	p-value
6	5	9	3	2	0	5	3	0.98	<0.001

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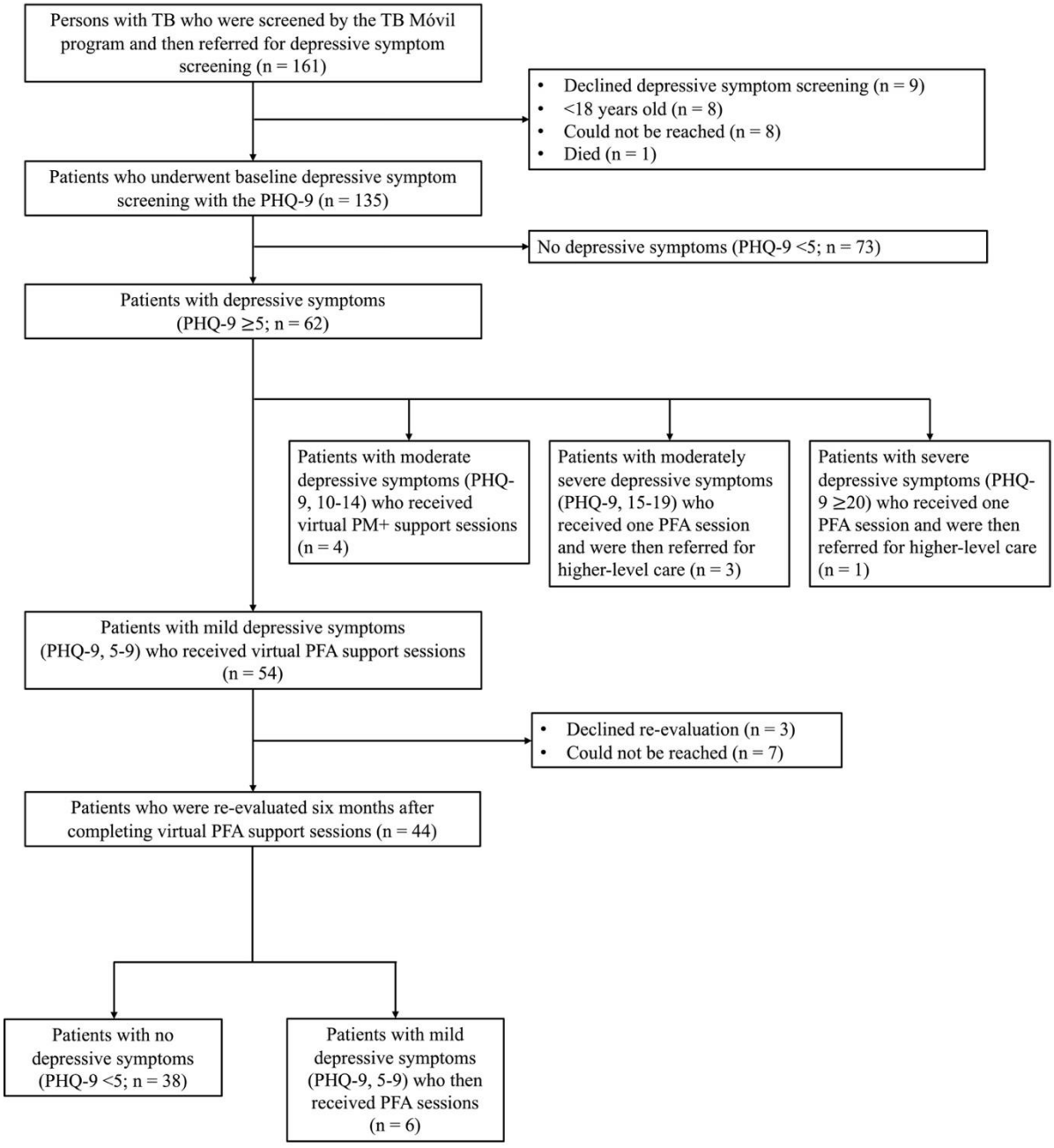
590 **Figure 1. Study flow chart**



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