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Innovation in addressing depression and anxiety symptoms in rural Honduran communities: a cross-sectional pilot study

Innovación en el abordaje de los síntomas de depresión y ansiedad en comunidades rurales hondureñas: un estudio piloto transversal

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Abstract / **Introduction**. Due to limited information on mental health in rural areas, this study innovates by applying validated tools previously unused in rural Honduras to assess levels of anxiety and depression among rural residents of Ojojona, Honduras. **Methods.** The Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder Scale-7 (GAD-7) were used to assess depression and anxiety, respectively. Twenty-one participants were obtained through convenience sampling and door-to-door surveys. **Results.** The prevalence of depression and anxiety was 47.7% and 47.6%, respectively. 29% have co-occurring depression and anxiety. **Conclusion.** Additional research is needed to effectively understand the high prevalence of mental health disorders in rural Honduran communities and improve access to healthcare and health research technology in rural areas.
Keywords GAD-7, Mental health, PHQ-9, Prevalence, Rural community

Resumen / **Introducción**. Debido a la información limitada sobre la salud mental en zonas rurales, este estudio innova al aplicar herramientas validadas previamente no utilizadas en comunidades rurales de Honduras para evaluar los niveles de ansiedad y depresión entre los residentes rurales de Ojojona, Honduras. **Métodos.** Se utilizó el Cuestionario Sobre La Salud del Paciente-9 (PHQ-9) y la Escala del Trastorno de Ansiedad Generalizada-7 (GAD-7) para evaluar la depresión y la ansiedad, respectivamente. Se obtuvieron 21 participantes mediante muestreo por conveniencia y encuestas puerta a puerta. **Resultados.** La prevalencia de depresión y ansiedad fue 47.7% y 47.6%, respectivamente. 29% tiene depresión y ansiedad concurrentes. **Conclusión.** Se necesitan investigaciones adicionales para comprender eficazmente la alta prevalencia de trastornos de salud mental en las comunidades rurales hondureñas y mejorar el acceso a la asistencia médica y a la tecnología para la investigación de la salud en áreas rurales.
Palabras Clave Comunidad rural, GAD-7, PHQ-9, Prevalencia, Salud mental

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INTRODUCTION

The World Health Organization states that about 280 million people live with depression and 301 million people suffer from anxiety disorders (World Health Organization, 2023a, 2023b). Many struggle with depression and anxiety symptoms without a formal diagnosis. There is a consensus that chronic emotional and physical stress can serve as contributing or exacerbating factors for mental disorders (National Institute of Mental Health, 2024; Yale Medicine, 2024). This partially explains the frequency in which mental health conditions present themselves as comorbidities to common physical ailments including diabetes, cardiovascular disease, and stroke (Anxiety and Depression Association, 2021; Daré et al., 2019). Other causes of emotional stress include limited financial

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resources, feelings of isolation, having experienced loss, and physical, emotional, or sexual abuse (Figure 1).

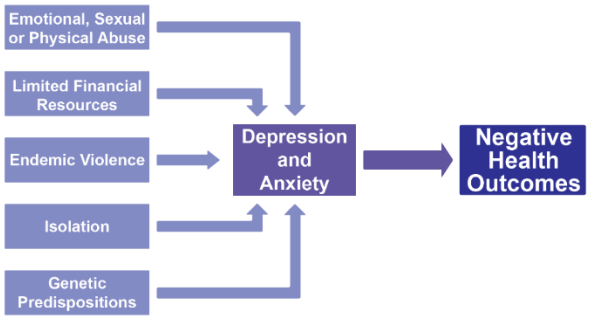

Figure 1. Pathways linking adverse factors, depression and anxiety, and negative health outcomes.

In countries such as Honduras, these stressors are compounded by pervasive violence and most notably in the sexual form, which have profound emotional and mental impacts on victims and survivors. These violent acts are widespread and generate mental disorders (Corea Del Cid, 2021). These factors produce stress and anxiety, such that more than 30% of the Honduran inhabitants have suffered a depressive episode (Médicos Sin Fronteras, 2020).

In a 2001 study, about 35% of the Honduran population had a positive screening test for mental disorders, with depression being the most prevalent one (26.4%), followed by anxiety disorders (26%) (Chirinos-Flores et al., 2002). Additionally, there is limited access to mental health care in Honduras, with only 0.78 psychologists per 100,000 population, compared to 29 in the United States (U.S.), 3.7 in Mexico, 22 in Argentina, 31 in Cuba, and 12 in Brazil (per 100,000 people) (World Health Organization, 2021). Many services are offered only in urban areas, and most rural health users do not seek mental health care unless the severity of their symptoms requires hospitalization (World Health Organization, 2008).

While multiple studies have shown that psychiatric conditions affect the Honduran population (Corea Del Cid, 2021; Chirinos-Flores et al., 2002; Martínez-Martínez et al., 2021; Médicos Sin Fronteras, 2020; Paz Fonseca et al., 1999; World Health Organization, 2008; World Health Organization, 2021; Wulsin et al., 2002), many researchers have faced challenges adapting foreign screening guidelines and have focused primarily on urban or mixed populations. The Honduras Secretary of Health collects national data which consists mainly of simplified aggregated data, such as the number of psychiatric consultations per year. Since public health services only reach a little over half of the population (Chirinos-Flores et al., 2002), these data likely underestimate the true prevalence of mental health conditions. The available data also excludes people who are experiencing anxiety or depression symptoms and who are either uninterested in receiving care or have barriers limiting their ability to request care in accessible regions. Furthermore, data is needed to establish the current prevalence of depressive and anxiety disorders in Honduras, especially in rural populations. The main study aim was to identify the prevalence and risk factors of depression and anxiety symptoms among a rural Honduran community by use of validated scales, including the General Anxiety Disorder-7 (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9). These tools have never been used in a study together in Honduras. The research project's secondary goal was to create a pilot framework for novel international student and residency collaboration.

METHODS

This was a pilot study with the aim to set the foundation for the development of a model for student global collaborative research. The initiative, “Global Health Collaboration Project” (GHCP), is a joint research organization that aims to spearhead student-led research projects providing data to support decision-makers to make informed decisions. The teams consist of students and faculty from Florida State University (FSU), Florida Agricultural and Mechanical University (FAMU) and Universidad Nacional Autónoma de Honduras (UNAH), led by the Honduran faculty and students. Both of the GHCP founding universities, FSU and FAMU, have been collaborating since 2020. For this study, we trained 11 U.S. and 7 Honduran students in a 20-minute session on the research instrument, survey methods, safety protocols, and cultural and trauma sensitive information, using a non-validated manual to help them handle potential participant reactions.

Convenience sampling was used with a door-to-door household visit technique, with 3 main groups consisting of U.S. and Honduran students per group, alternating between households. The village local Integrated Health Center (CIS) was part of each household visit to promote study participation before the survey application. All study material (consent form, study questionnaires, and sensitivity training) were provided in Spanish and approved by the Institutional Review Boards (IRBs) at FAMU and FSU. Study participants had the right to choose not to answer a question in any of the survey´s sections or leave the study at any point in time. They were also informed that participation was voluntary, and that they could withdraw from the study without prejudicism.

Alongside CIS healthcare workers, groups were organized and included U.S. and Honduran members, with at least one faculty member from the U.S. and one Honduran physician in each group. The study participants were enrolled in the study once we obtained their written informed consents, and they met the inclusion criteria. The inclusion criteria were the following: 1) individuals must be at least 18 years of age at the time of the study, 2) individuals must provide informed consent before survey implementation, 3) individuals must reside in a rural Honduran community, and 4) individuals must be able to answer the study questions. The exclusion criteria

included: 1) individuals who cannot communicate efficiently, 2) individuals with extreme cognitive impairment, and 3) individuals who do not cooperate in completing the informed consent procedure and the questions provided by the study. Data collection took about 4 hours; the survey was administered in-person to twenty-one adults in Spanish on March 9, 2023. The data collected involved data entry and storage through FSU's Research Electronic Data Capture (REDCap).

The FAMU-IRB-approved study protocol, number 2016794-3 [020-23], included a consent form which eligible participants completed before the application of the survey. The study occurred in a rural village in the municipality of Ojojona, Honduras. This municipality is in the Honduran department of Francisco Morazán, approximately 55.05 km from the Honduran capital. It comprises 10 villages with a pooled estimated population of about 11,784 inhabitants, with 57.6% living in rural housing and 42.4% in urban housing. The municipality of Ojojona includes a public health center, the San Juan Bosco Integrated Health Center of Ojojona (CIS Ojojona), funded by the Honduran government. It has been reported that 84.96% of the municipality's population depends on public health care. The CIS Ojojona receives patients from all 10 villages, when the local rural nurse cannot assist their health care issues (González Rodríguez, 2023).

Validated and reliable outcomes

1. The Patient Health Questionnaire-9 (PHQ-9) is a 9-item questionnaire used for screening, diagnosing, monitoring, and measuring depression severity. It scores each of the nine DSM-5 criteria as "0" (not at all) to "3" (nearly every day). A score may range from 0-27. A higher score means more depression symptoms (Kroenke et al., 2001).
2. The Generalized Anxiety Disorder Scale (GAD-7) is a 7-item questionnaire used for screening, diagnosing, monitoring, and measuring the severity of anxiety over the past two weeks on a 4-point scale, "0" (not at all) to "4" (nearly every day). A score may range from 0-28. A higher score means more anxiety symptoms (Spitzer et al., 2006).

In this study, the internal consistencies (Standardized Cronbach´s alphas) for the PHQ-9 and the GAD-7 were 0.70 and 0.80, respectively. The prevalence of depression and anxiety was defined as having a score of 5 or more on either scale, based on assessment guidelines for PHQ-9 and GAD-7, when used in Spanish-speaking populations (Manea et al., 2015; Martinez et al., 2023). Concurrent (comorbid) depression and anxiety were defined as participants having both prevalent depression and anxiety.

Independent variables

Sociodemographic variables and some risk factors related to anxiety and depression symptoms in other studies (González et al., 2018; Rajan et al., 2024; Villarreal-Zegarra et al., 2023) were considered.

Table 1. Characteristics of the study population, n=21.

Characteristics (n=21)	n (%)
Age	
Age years, mean SD; range	47.0 ± 7.5 (29-71)
Age categories	
29-44	10 (47.6)
45-71	11 (52.4)
Gender	
Male	5 (23.8)
Female	16 (76.2)
Marital status	
Single-divorced-never married	7 (33.3)
Married or cohabiting	14 (66.7)
Education	
Primary school	7 (33.4)
Secondary	10 (47.6)
Vocational training	2 (9.5)
University	2 (9.5)
Employment/Occupation	
Housekeeper	5 (23.8)
Unemployed	6 (28.6)
Health-related worker	3 (14.3)
Other /unknown	7 (33.3)
Family history of mental disorder	7 (33.3)
Ever diagnosed with a mental disorder	4 (19.1)
Experienced feelings of grief due to loss	7 (33.3)
Medical history of current diagnoses	
Hypertension	8 (38.1)
Diabetes mellitus	3 (14.3)

Characteristics (n=21)	n (%)
Skin disorders	3 (14.3)
Allergies	2 (9.5)
Gastrointestinal	2 (9.5)
Circulatory (venous insufficiency)	2 (9.5)
Genito-urinary	1 (4.8)
Thyroid	1 (4.8)
Number of chronic diseases	
0-1	16 (76.2)
> 2 (multimorbidity)	5 (23.8)
Tobacco use	2 (9.5)
Alcohol use	5 (23.8)
Types of social support	
Family, friends, or neighbors' support	16 (76.2)
Religious leader support	7 (33.3)
Number of supports	
1	14 (66.7)
2 or 3	7 (33.3)
Self-care	
Keeping busy or spending time outside	12 (57.1)
Spending time with family or friends	5 (23.8)
Other	4 (19.1)
Barriers to healthcare access	
Waiting time too long	2 (9.5)
Received no good treatment or does not trust doctor	3 (14.3)
Healthcare costs too much	8 (38.1)
Being too busy	3 (14.3)
Taking care of others	1 (4.8)
Lack of transportation	2 (9.5)

The sociodemographic variables were age, gender, marital status, education, employment/occupation, and family history of mental disease. Additional factors included diagnosis of mental illness, currently dealing with grief, tobacco and alcohol use, social support, stress/depression management, and barriers to healthcare access. Medical diagnoses were recorded as binary (yes/no) for hypertension, diabetes mellitus, skin disorders, allergies, gastrointestinal, circulatory, genitourinary, and thyroid diseases and were counted from 0 to 5. Multimorbidity (comorbidity) was defined as the presence of 2 or more diagnoses.

Statistical analysis

Using SAS Software, a 15% attrition was calculated with an initial sample size of 70. Descriptive statistics such as percentages (%) and means ± standard deviation (SD) were calculated; the median and interquartile range (IQR) were also calculated for the outcomes (PHQ-9 and GAD-7 scores). In bivariate analyses, parametric tests (t-test and ANOVA) were used to assess differences in the outcomes by the independent variables because we tested differences on means for both outcomes, as they are usually tested in clinical and population studies, and the normality tests for the outcomes were accepted (Kolmogorov-Smirnov D=0.1596, P>0.15 and D=0.1499, P>0.15; PHQ-9 and GAD-7 respectively) (Villarreal-Zegarra et al., 2023). Two linear regression models with the backward elimination procedure (p=0.10) were used, including variables with bivariate P values at 0.30. Due to the small sample, the statistical significance was set at p=0.10. SAS version 9.4 was used for all analyses (SAS Institute, Inc., Cary NC).

RESULTS

Study participants (n=21) had a mean (SD) age of 47.0 (± 7.5) (range 29-71); 76.2% were women; 33.4% had completed primary school education, 33% had a family history of mental disorders, and 19.1% had been ever diagnosed with a mental disorder. Twenty-four percent used alcohol, 9.5% used tobacco, and 33.3% were currently dealing with grief loss. The most frequent medical diagnosis was hypertension (38.1%), and 23.8% had two or more comorbidities. Healthcare costs were the most frequent barrier to access healthcare (Table 1).

Regarding the mental health assessment outcomes, participants had a mean PHQ-9 of 4.9 ± 4.2 (range 0-15; median=4.0, IQR 1.0-7.0); 52.3%, 38.1%, 4.8%, and 4.8% had none (score 0-4), mild (5-9), moderate (10-14) or moderately severe (15-19) depression, respectively. Thus, they had 47.7% prevalent depression. They had a mean GAD-7 of 5.3 ± 4.3 (range 0-18; median=4.0, IQR 3.0-7.0); 52.4%, 33.3%, 9.5%, and 4.8% had minimal (score 0-4), mild (5-9), moderate (5-14) or severe (≥15) anxiety, respectively. Therefore, they had 47.6% prevalent anxiety. GAD-7 and PHQ-9 scores were highly correlated (Pearson r=0.73, p=0.0002). Concurrent depression and anxiety were present in 28.6% of participants.

In bivariate analyses at P 0.10, ever diagnosed with a mental disorder was associated with higher GAD-7 and PHQ-9 total scores. Alcohol use was associated with lower PHQ-9 scores (Table 2).

Table 2. Bivariate analyses, testing differences in the outcome scores across the participants' characteristics (n=21).

Characteristics	PHQ-9 scores Mean ± SD	p-value	GAD-7 scores Mean ± SD	p-value
Age categories				
29-44	4.9 ± 4.7	0.99	5.4 ± 5.1	0.94
45-71	4.9 ± 3.9		5.3 ± 3.8	
Gender				
Male	3.4 ± 2.9	0.37	5.6 ± 2.4	0.87
Female	5.4 ± 4.5		5.3 ± 4.8	
Marital status				
Single-divorced-never married	5.7 ± 5.2	0.54	6.1 ± 6.2	0.55
Married or cohabiting	4.5 ± 3.8		4.9 ± 3.2	
Education				
Primary school	3.6 ± 3.6	0.29	4.9 ± 3.3	0.48
Secondary	4.6 ± 4.0		4.5 ± 3.6	
Vocational training	6.0 ± 4.2		7.0 ± 0.0	
University	10.0 ± 7.1		9.5 ± 12.0	
Employment/Occupation				
Housekeeper	6.0 ± 6.0	0.82	5.2 ± 7.3	0.72
Unemployed	5.5 ± 5.0		7.0 ± 3.9	
Health-related worker	4.1 ± 2.3		5.0 ± 3.5	
Other /unknown	3.7 ± 3.1		4.1 ± 2.3	
Family history of mental disorder				
No	4.9 ± 4.0	0.97	4.4 ± 4.7	0.14
Yes	4.9 ± 5.1		7.3 ± 2.9	
Ever diagnosed with a mental disorder				
No	4.2 ± 2.9	0.10	4.5 ± 3.1	0.07
Yes	8.0 ± 7.6		8.8 ± 7.4	
Experienced feelings of grief due to loss				
No	4.5 ± 4.3	0.54	5.1 ± 4.5	0.70
Yes	5.7 ± 4.3		5.9 ± 4.3	
Tobacco use				
No	5.3 ± 4.3	0.24	5.6 ± 4.5	0.43
Yes	1.5 ± 0.7		3.0 ± 0.0	
Alcohol use				
No	5.9 ± 4.3	0.05	5.6 ± 4.8	0.67
Yes	1.8 ± 1.6		4.6 ± 2.6	
Comorbidities				
0-1	4.5 ± 4.1	0.44	5.2 ± 4.7	0.79
≥2 (multimorbidity)	6.2 ± 4.8		5.8 ± 3.3	
Supports				
Family, friends, or neighbors' support				
No (others)	4.2 ± 3.3	0.68	6.4 ± 4.0	0.54
Yes	5.1 ± 4.6		5.0 ± 4.5	
Religious leader support				
No (others)	4.9 ± 5.0	0.94	4.4 ± 4.9	0.18
Yes	5.0 ± 2.4		7.1 ± 2.3	

Number of supports				
1	5.6 ± 4.8	0.30	5.4 ± 5.2	0.89
2 or 3	3.6 ± 2.8		5.1 ± 5.2	
Self-care				
Keeping busy or time outside	5.7 ± 4.4	0.51	6.4 ± 4.6	0.30
Spending time with family or friends	3.0 ± 1.4		2.8 ± 2.7	
Other	5.0 ± 6.2		5.3 ± 4.8	

*P-values were obtained by the t-test and ANOVA. PHQ-9 = Patient Health Questionnaire-9; GAD-7 = Generalized Anxiety Disorder Scale.

In multivariate linear regression analyses (backward elimination procedure at P 0.10), a history of mental disorder and having religious leader support were associated with higher GAD-7 scores. In addition, the history of mental disorder was also associated with higher PHQ-9 scores; by contrast, alcohol use was associated with lower PHQ-9 scores (Table 3).

ANALYSIS AND DISCUSSION

Our study found that a considerable proportion of the study population scored positively for generalized anxiety disorder (GAD) and for major depressive disorder (MDD), with fewer of the population meeting the criteria for both. This shows a substantial burden of mental health conditions affecting this rural population. These proportions are higher than those reported in earlier studies, including rural areas such as Olancho and Yoro in 2016 and Tegucigalpa in 1999 (González et al., 2018; Paz Fonseca et al., 1999; Valladares et al., 2018). A comparison with a 2002 study in Santa Ana, located near our study site, suggests an increase in mental health disorder prevalence over time (Chirinos-Flores et al., 2002). However, our results are lower than a 2021 study on hospitalized patients, likely due to the differences in patient status (Martínez-Martínez et al., 2021).

Our study also reported a higher co-occurrence of mental disorders and chronic non-communicable diseases than previous studies. We found that over half of the participants had at least one comorbidity, compared to 38.6% in a 2016 study (González et al., 2018). This finding may be because we evaluated a wider scope of chronic diseases.

Contrary to other studies that associate religious coping and reduced anxiety (Stewart et al., 2019), our findings align more with research from China, where religious beliefs were linked to more severe symptoms of depression and anxiety (Li et al., 2024). However, further research that includes diverse spiritual practices is needed to fully understand the broader impact of religious coping on mental health, as the reasons for this discrepancy are beyond the scope of our study.

Alcohol use in our study was associated with lower depression symptom scores, likely due to its short-term anxiolytic effects, which provide temporary relief from negative emotions. However, alcohol consumption can worsen depression and anxiety over time by depleting serotonin levels, leading to a cycle of masking where symptoms are temporarily hidden but eventually exacerbated (Grant et al., 2009). This masking is particularly problematic, as it may prevent individuals from recognizing or addressing underlying mental health issues. A limitation of our study is that we did not quantify alcohol consumption, which would have allowed for a more detailed analysis of its impact on mental health.

Our study utilized self-report instruments, which are commonly used in clinical settings to assess mental health, particularly for anxiety and depression. These tools are essential for identifying specific disorders and guiding treatment. In Honduras, a variety of tools, including SRQ, the Spanish MINI 500, and structured interviews, have been used for mental health research (Chirinos-Flores et al., 2002; Paz Fonseca et al., 1999; Soto-Carvo, 2018; Valladares et al., 2018). However, there are no culturally specific tools for nationwide clinical assessments. We chose the PHQ-9 and GAD-7 because of their efficiency (with a sensitivity and specificity of 77% and 100%, respectively), when compared to structured interviews (SCID) with DSM-IV criteria (Wulsin et al., 2002) and due to their internal consistencies (Standardized Cronbach´s alphas for the PHQ-9 and the GAD-7 were 0.70 and 0.80, respectively). Concurrent validity for PHQ-9 and SRQ allows comparison with previous Honduran studies (Paz Fonseca et al., 1999; Soto-Carvo, 2018; Valladares et al., 2018). Further, research should use clinically structured interviews to make major depressive and anxiety disorder diagnoses after positive screenings.

Besides selecting reliable and valid tools, choosing the cut-off score was also a consideration to best represent the study population. Since the purpose of our study was to identify the prevalence of MDD and GAD symptoms and not to identify the study population treatment, we considered any category of MDD, starting from mild, with a cut-off of 5, as our cut-off limit. Regarding the cut-off for anxiety, for there to be a “no prevalence” indication for anxiety, the cut-off must be between 0-4. However, since anxiety is not proportionate to the threat, a score of 1, 2, 3, or 4, could still be classified as minimal symptoms of anxiety from GAD (Spitzer et al., 2006). This could have been a missed opportunity which may be considered a limitation when attempting to identify the prevalence of anxiety symptoms.

Table 3. Linear regression models, predictors for PHQ-9 and GAD-7 scores.

	PHQ-9		GAD-7	
	β (SE)	p-value	β (SE)	p-value
Intercept	5.17 (0.87)	<0.0001	2.70 (1.14)	0.0298
Ever had a mental disorder	5.64 (1.94)	0.0095	6.05 (2.14)	0.0112
Religious leader support			4.44 (1.78)	0.0227
Alcohol use	-5.63 (1.79)	0.0057		

*Backward elimination procedure; β coefficient, SE=standard error. PHQ-9 = Patient Health Questionnaire-9; GAD-7 = Generalized Anxiety Disorder 7-item Scale.

Aside from possible language barriers, another factor to consider is masking, which may be common in women due to gender differences in symptom expression for anxiety or masking due to the stigma of being perceived as weak, if one acknowledges the presence of mental health symptoms (Loveridge et al., 2023).

Despite its limitations, our study has several strengths, including its potential for replication in larger populations across rural Honduras and other Latin American countries, where data on mental health is scarce. It contributes valuable information on the prevalence of anxiety and depression in rural areas, offering a more current perspective than studies conducted over a decade ago, which primarily focused on urban or hospitalized patients. Additionally, our study recorded demographic and health-related data, and explored associations with religious and behavioral factors, highlighting the need for further research into mental health risk and protective factors in both rural and urban Honduras.

However, our study has several limitations, including its cross-sectional design, which prevented us from determining causality. The small sample size limited our statistical power and the ability to find significant associations. The door-to-door survey method was time-consuming, reducing our ability to reach the planned sample size. Additionally, the validated questionnaires from the U.S. lacked cultural sensitivity for the Honduran context. We addressed this by incorporating Honduran perspectives through review and sensitivity training, which may help mitigate this issue in future studies with international collaboration.

Overall, these findings highlight the importance of expanding and improving upon resources available in these regions and call for further studies in other rural villages for improved generalization of these findings. Our study successfully created a framework for international collaboration in the field of Global Health on a student and residency level. Continuing to foster relationships between future healthcare professionals may play a vital role in the longevity of our interventions.

Given the lack of data on the specific mental health needs in Central America, further research is crucial to understand and address these issues (Alarcón, 2003). Our findings highlight an unmet need in rural Honduras for diagnosing and treating depression and anxiety symptoms, as there are no active mental health diagnostic guidelines in place (Espinoza-Turcios et al., 2023). These insights could inform public health by supporting the implementation of mental health guidelines in Honduras, in conjunction with active policy work with Honduran healthcare professionals and stakeholders, through a signed Memorandum of Understanding (MoU) with the Honduran government.

Conclusion

This study provides a novel approach to mental health assessment in rural Honduras by applying validated tools previously unused in this setting. The findings show a high prevalence of depression and anxiety in this rural village. One of the limitations in this study was a small sample size that prevents generalization. Prevalence estimates would improve using culturally validated scales for anxiety and depression in Honduras. Large, multi-site longitudinal studies are needed to address unmet needs, especially in remote locations. These efforts could inform policies and interventions to reduce chronic anxiety and depression in underdeveloped communities in rural and urban Honduras.

Author contributions

All authors participated in the research, preparing the manuscript and approved its final version.

Conflicts of interest

None.

Ethics

The study was approved by the Institutional Review Boards (IRBs) at Florida Agricultural and Mechanical University and Florida State University.

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IA use

The authors declare minimal use of artificial intelligence to grammatically prepare the original manuscript.

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