Non comunicable diseases

Association between the condition of living alone and the presence of depressive symptoms in adults in Peru: an analysis of nationally representative survey data

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Keywords

Loneliness • Depression • Social Determinants of Health • Home environment • Peru

Summary

Introduction. *Depression is a major public health problem that affects quality of life, social functioning, and overall well-being. Among the social factors potentially related to depressive symptoms, living alone has gained increasing attention, although findings have been inconsistent across settings. In Peru, where household composition and social support dynamics may differ from those reported in other contexts, evidence on this association remains limited. Therefore, this study aimed to determine the association between living alone and depressive symptoms in Peruvian adults.*

Methods. *This observational, cross-sectional, and analytical study used secondary data from the 2022 Demographic and Family Health Survey (ENDES), conducted in 30,087 Peruvian adults aged 18 years old and older. The dependent variable was the presence of moderate to severe depressive symptoms (yes/no), measured by the Patient Health Questionnaire-9 (PHQ-9), while the independent variable was living alone (yes/no). Generalized linear models of the Poisson family and log link function, were used to estimate crude and adjusted prevalence ratios (PRs). The analyses were performed in Stata v18.0 with a significant level of 5%.*

Results. *Moderate to severe depressive symptoms was identified in 7.9% of participants, while 7.5% lived in single-person households. In the crude analysis, living alone were associated with a higher probability of presenting depressive symptoms (PR: 1.60; 95% CI: 1.33-1.92; p < 0.001). However, after adjusting for confounding variables, the association ceased to be significant (aPR: 1.01; 95% CI: 0.82-1.24; p = 0.928).*

Conclusion. *Unlike studies where living alone is associated with a higher prevalence of depressive symptoms, in the Peruvian context, no statistically significant association was observed in the adjusted analysis. This finding suggests that other social and cultural determinants may be associated with depressive symptoms among adults living alone in Peru. Understanding these differences is key to the design of mental health prevention and intervention strategies adapted to the specific characteristics of the population.*

Introduction

Depression, defined by the World Health Organization WHO as a "low mood or loss of interest in or pleasure in performing activities, which persists for a prolonged period" [1], affects approximately 280 million people in the world [2]. In Peru, the Epidemiological Bulletin of the National Center for Epidemiology, Prevention and Control of Diseases (CDC) reported 13,105 cases between 2016 and 2021, with Lima concentrating the highest number of episodes (40.1%) [3]. Depression has a high global impact, as it increases the risk of suicide [4], and each year approximately 726,000 people take their own lives; and in 2021, suicide was the third leading cause of death in young people aged 15 to 29 years [5]. In addition, jointly with anxiety disorders, the economic consequences are alarming, with an estimated loss of 12 billion days of lost productivity each year, which is equivalent to almost a thousand billion dollars for the world economy [6]. In the Peruvian context, mental health disorders represent the second largest contributor to years of healthy life lost (DALYs), with 9.8%, equivalent to 17.7 years lost per thousand inhabitants. Of these, disability is responsible for 99.4%, with depression being one of the main mental disorders involved, with a prevalence of 30.1% [7].

Depression is a mental health disorder influenced by genetic, biological, environmental, and psychological factors [8], and living alone stands out as a factor that can contribute to its development or aggravation [9-12]. For instance, a study conducted in South Korea in 2022, using data from the National Health and Nutrition Examination Survey, analyzed 21,618 individuals between the ages of 20 and 80, where it was observed that the prevalence of depressive symptoms was higher in those who lived alone (17.6%) than in those who lived with others (11.1%) [13]. In a U.S. nationally representative survey conducted in April 2020, the weighted prevalence of depressive symptoms was 31.7%, and participants with depressive symptoms were more

likely to live alone (21.5% vs 16.3%; $p = 0.05$) [14]. Conversely, a systematic review published in 2022 that included seven studies (six cohort and one case-control) with a total of 123,859 participants, reported that living alone is associated with an increased risk of depression compared to living together (OR: 1.42; 95% CI 1.19-1.70) [15]. In this sense, international evidence suggests that loneliness may be a key risk factor for depression.

According to the last national census carried out in Peru in 2017, the most common type of household is nuclear (53.9%), followed by extended (20.6%) and one-person (16.8%). Other types of households such as those without a nucleus (6.2%) and composite households (2.5%) have lower percentages. During the 2007-2017 intercensal period, one-person households increased by 74.2%, with an average annual growth rate of 5.7%. In this type of household, the predominant age group is 25 to 49 years old (35.9%), followed by those over 60 years old (35.3%) and a smaller percentage those between 50 and 59 years old (17.2%), 18 to 24 years old (10.2%) and those from 6 to 17 years old (1.4%) [16]. Due to the high prevalence of mental health disorders in our country, it is necessary to consider not only the axes of treatment, but also to explore the influence of other factors, such as living alone, as has been seen in the aforementioned studies. Thanks to the Demographic and Family Health Survey (ENDES), developed by the National Institute of Statistics and Informatics (INEI), reliable and representative data are available at the national level that allow the analysis of both the prevalence of depression and the housing conditions of the population [17]. In this sense, the objective of this study was to estimate the relationship between the condition of living alone and the prevalence of depressive symptoms in the Peruvian population, using nationally representative data from the ENDES.

Methods

Design and population

Observational, cross-sectional, analytical study using secondary data from ENDES 2022. The survey was conducted from January to December 2022, selecting 36,650 households nationwide, of which 35,287 were interviewed, covering urban and rural areas of the 24 departments of Peru, the Constitutional Province of Callao, and the main geographical regions (Metropolitan Lima, Coast, Highlands, Jungle) [18]. Databases and methodological details are available on the INEI website [19] and the National Open Data Platform [20].

Sample

A two-stage cluster sampling was implemented by the INEI. In the first stage, primary sampling units (clusters) were selected using the 2017 Population and Housing Census (CPV 2017) as a reference. In the second stage, secondary sampling units (dwellings) were selected from the sampling frame updated through the mapping and registration of buildings and dwellings [18]. Data were collected by direct interview, conducted by trained personnel, using tablets or printed formats. Three questionnaires were applied: Household (to the head, spouse, or any adult resident), Individual (to all women aged 12-49), and Health (to one household member aged ≥ 15). This study included 30,087 participants aged ≥ 18 who completed the Health Questionnaire (Fig. 1) [17].

Variables

- **Exposure:** Living alone was defined as residing without other family members or a spouse [13], classified as "lives alone" if only one person resided in the household, otherwise "does not live alone."
- **Outcome:** The dependent variable of this study is depression (yes or no), which, according to the

Fig. 1. Flowchart of study participants.

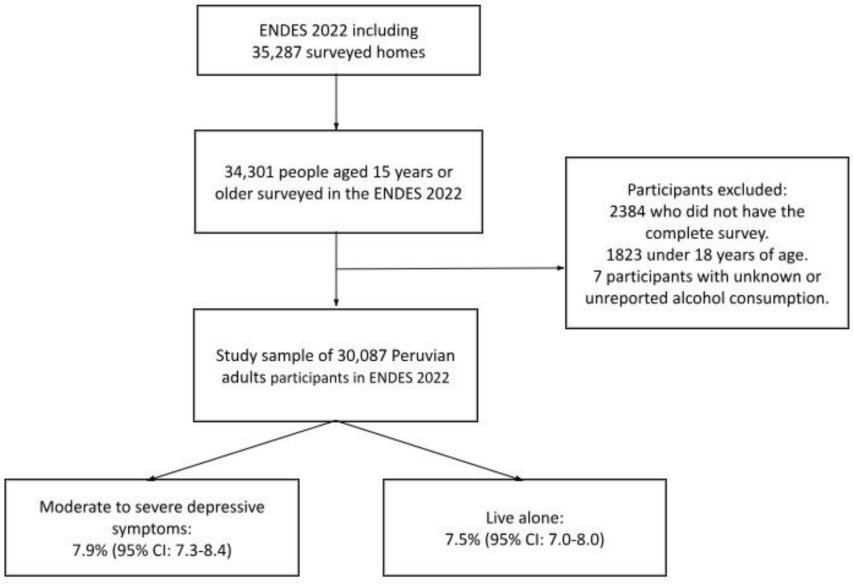
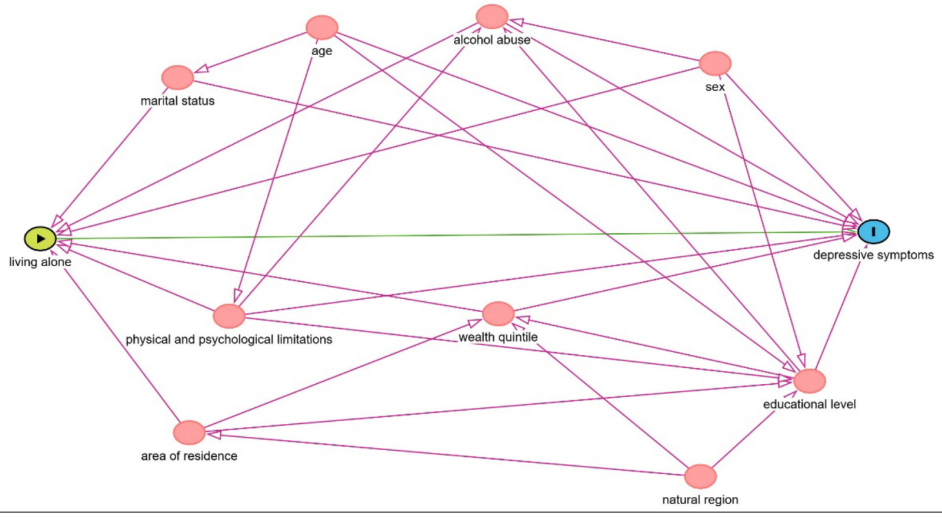


Fig. 2. Directed Acyclic Graph of the association between the condition of living alone and the presence of depressive symptoms.



WHO, is defined as the loss of interest or pleasure in activities for prolonged periods of time. In ENDES 2022, the Patient Health Questionnaire-9 (PHQ-9) was used to explore depressive symptoms in the last 14 days prior to the survey. This questionnaire assesses the severity of depressive symptoms through 9 questions, each with a score ranging from 0 to 3: 0 represents «none,» 1 «several days,» 2 «more than half the days,» and 3 «almost every day». The total score obtained ranges from 0 to 27, allowing participants to be classified into different levels of depressive symptoms: no symptoms (0-4), mild (5-9), moderate (10-14), moderately severe (15-19) and severe (20-27) [21]. A score ≥ 10 identified moderate to severe symptoms. This tool has been validated for Peru [22] and used in previous ENDES-based studies [23, 24].

- **Covariates:** The descriptive analysis included the following variables: sex (male or female); age group (18-24 years, 25-44 years, 45-60 years, and 60 years or older); educational level (no education or initial, primary, secondary, or higher education); marital status (married or cohabiting, single, widowed, divorced or separated); area of residence (urban or rural); natural region (Metropolitan Lima, coast, highlands, jungle); wealth quintile (very poor, poor, medium, rich, very rich); physical and psychological limitations (without limitations or with limitations), defined based on a positive response to one or more of the following: difficulty seeing even with glasses, hearing even with hearing aids, speaking or communicating, moving or walking, understanding or learning, and relating to others due to thoughts, feelings, or behaviors; and alcohol abuse in the last 12 months (yes or no), assessed by the *Composite International Diagnostic Interview* (CIDI 1.1) of the World Health Organization, which determines alcohol abuse according to the criteria of the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (DSM-IV), as previously reported [25] in another study.

For the adjusted analysis, covariates were selected based on an epidemiological criterion using a Directed Acyclic Graph (Fig. 2) constructed in DAGitty v3.1 to identify relevant variables and relationships. This systematic approach ensured proper control of confounding factors. The final adjustment set included age group, alcohol abuse, educational level, marital status, physical and psychological limitations, sex, and wealth quintile.

Statistical processing and analysis:

A univariate analysis was performed to describe the characteristics of the study population, reporting the absolute and relative frequencies of all the variables of interest. Likewise, the tabulation of the dependent variable in relation to the exposure variable and the selected covariates was carried out, to evaluate the distribution of the outcome in the population studied.

Subsequently, regression analyses were performed using generalized linear models of the Poisson family, using a logarithmic linkage function. These models allowed us to calculate prevalence ratios (PRs) along with their 95% confidence intervals (CIs). Both crude prevalence ratios (which evaluated only the association between living alone and depression) and adjusted (aPR, considering adjustment for possible confounding variables) were estimated. Additionally, the corresponding *p values* were reported to determine the statistical significance of the associations.

All statistical analyses were performed using the Stata v18.0 software, incorporating the weights and the complex sample design of the survey using the svy command.

Ethical considerations

This study used anonymized secondary data from the publicly accessible ENDES 2022 database. As these data do not allow the identification of the participants, there are no associated risks for the respondents. For

these reasons, the project was exempted from ethical evaluation by the Universidad Científica del Sur, through Resolution No. 070-DACMH-DAFCS-U. CIENTIFICA-2025.

Results

After applying the selection criteria, 30,087 participants were included, of which 52.4% were women. The largest age group was 25 to 44 years old (42.8%), and 43.3% had a secondary education level. Most of the participants were married or cohabiting (63.8%), and 81.9% resided in urban areas, mainly in Metropolitan Lima (37.6%). The predominant wealth quintile was the middle, with 21.3%. Regarding physical and psychological limitations, 97.6% of the participants reported no limitations, and 96% did not present alcohol abuse. Additionally, 7.5% of the participants lived in one-person households (Tab. I).

Overall, the percentage of moderate to severe depressive symptomatology was 7.9%. The highest prevalence was observed in women (11.2%), in the age group of 60 years or older (14.2%), and in those without education (18.1%). Among widowed, divorced or separated people, the prevalence was 14%. By area of residence, the highest percentage was in rural areas (8.4%), and, by natural region, in the highlands (10.2%). As for the wealth quintile, the highest prevalence corresponded to the lowest quintile (9.3%). Participants with physical and psychological limitations had a prevalence of 15.8%, those who consumed alcohol excessively 12.2%, and those who lived alone 12.1% (Tab. II).

It was identified that in the study population, living alone was associated with a higher probability of moderate to severe depressive symptoms (PR: 1.60; 95% CI: 1.33-1.92; $p < 0.001$). However, the association was lost after adjustment for confounding variables. (aPR: 1.01; 95% CI: 0.82-1.24; p: 0.928) (Tab. III).

Tab. I. Characteristics of the population of adults over 18 years of age, Peruvians, participants of the ENDES 2022 included in the study (N=30,087).

Characteristics		n	% (95% CI)*
Sex			
	Female	17,247	52.4 (51.4 - 53.4)
	Male	12,840	47.6 (46.6 - 48.6)
Age group (years)			
	18 to 24 years old	4,236	15.7 (15.1 - 16.5)
	25 to 44 years old	16,368	42.8 (41.9 - 43.6)
	45 to 60 years old	6,532	28.4 (27.6 - 29.3)
	60 years and older	2,951	13.0 (12.4 - 13.7)
Level of Education			
	No education	1,207	3.5 (3.2 - 3.8)
	Primary	6,873	19.2 (18.5 - 20)
	High school	12,942	43.3 (42.3 - 44.2)
	Higher	9,065	34.0 (33.1 - 35.0)
Marital status			
	Married or cohabiting	20,508	63.8 (62.8 - 64.7)
	Single	3,969	16.3 (15.5 - 17.0)
	Widowed, Divorced or Separated	5,610	20 (19.2 - 20.8)
Area of Residence			
	Rural	10,627	18.1 (17.7 - 18.6)
	Urban	19,460	81.9 (81.4 - 82.3)
Natural Region			
	Metropolitan Lima	3,513	37.6 (36.5 - 38.6)
	Coast	8,422	25.9 (24.8 - 27)
	Highlands	10,878	24.1 (23.2 - 25.1)
	Jungle	7,274	12.5 (11.8 - 13.1)
Wealth quintile			
	Very poor	9,688	18.3 (17.7 - 19)
	Poor	7,708	20.2 (19.4 - 21)
	Middle	5,624	21.3 (20.4 - 22)
	Rich	4,083	20.5 (19.7 - 21.4)
	Very rich	2,984	19.7 (18.8 - 20.8)
Physical and psychological limitations			
	No limitations	29,516	97.6 (97.3 - 98.0)
	With limitations	571	2.4 (2.1 - 2.7)
Alcohol abuse			
	No	29,003	96 (95.5 - 96.3)
	Yes	1,084	4.1 (3.7 - 4.5)
Living alone			
	No	27,776	92.5 (91.9 - 93.0)
	Yes	2,311	7.5 (7.0 - 8.0)

*Estimates include weights and sample characteristics from ENDES 2022.

Discussion

The aim of this research was to evaluate the association between the condition of living alone and the presence of depressive symptoms in Peruvian adults, using data from ENDES 2022. It was found that 7.9% of the participants presented moderate to severe depressive symptoms, while 7.5% of the respondents lived in a one-person household. In this population, living alone was initially associated with an increased likelihood of moderate to severe depressive symptoms. However, after adjusting for confounding variables, this association ceased to be significant. These results differ from what has been reported in other studies conducted in international contexts, where living alone has been consistently associated with a higher prevalence of depressive symptoms. The absence of this significant association in the Peruvian context could reflect cultural, social, or community support differences in the Peruvian population, highlighting the need to explore specific factors that may be related to this association in different settings.

In the Peruvian adult population, 7.9% had moderate to severe depressive symptoms, consistent with previous research in various contexts, although with some variations. In an epidemiological study in Argentina, depressive disorder prevalence exceeded 8.7%, similar to our finding [26]. Another study in four cities of Argentina, Chile, and Uruguay reported a 14.6% prevalence of major depressive episode, ranging

Tab. II. Frequency of moderate to severe depressive symptomatology according to characteristics of the population of adults over 18 years of age, Peruvians, participants of the ENDES 2022 included in the study (N=30,087).

Characteristics		Moderate to severe depressive symptomatology	
		No (n=27,927)	Yes (n=2160)
		n (%)*	n (%)*
Total		27927 (92.1)	2160 (7.9)
Sex			
	Female	15,615 (88.8)	1,632 (11.2)
	Male	12,312 (95.8)	528 (4.2)
Age group (years)			
	18 to 24 years old	3,971 (92.6)	265 (7.4)
	25 to 44 years old	15,510 (94.9)	858 (5.2)
	45 to 60 years old	5,959 (90.7)	573 (9.3)
	60 years and older	2,487 (85.9)	464 (14.2)
Level of Education			
	No education	1,001 (82)	210 (18.1)
	Primary	6,247 (89.4)	629 (10.6)
	High school	12,068 (91.9)	874 (8.1)
	Higher	8,616 (95)	449 (5)
Marital status			
	Married or cohabiting	19,363 (94)	1,145 (6)
	Single	3,687 (92.2)	282 (7.8)
	Widowed, Divorced or Separated	4,877 (86)	733 (14)
Area of Residence			
	Rural	9,812 (91.6)	815 (8.4)
	Urban	18,115 (92.3)	1,345 (7.8)
Natural Region			
	Metropolitan Lima	3,264 (92.4)	249 (7.6)
	Coast	7,909 (93.3)	513 (6.7)
	Highlands	9,918 (89.8)	960 (10.2)
	Jungle	6,836 (93.4)	438 (6.6)
Wealth quintile			
	Very poor	8,916 (90.8)	772 (9.3)
	Poor	7,140 (91.7)	568 (8.3)
	Middle	5,235 (92.3)	389 (7.7)
	Rich	3,831 (92)	252 (8)
	Very rich	2,805 (93.8)	179 (6.2)
Physical and psychological limitations			
	No limitations	27,462 (92.3)	2,054 (7.7)
	With limitations	465 (84.2)	106 (15.8)
Alcohol abuse			
	No	26,953 (92.3)	2,050 (7.7)
	Yes	974 (87.9)	110 (12.2)
Living alone			
	No	25,887 (92.5)	1,889 (7.5)
	Yes	2,040 (87.9)	271 (12.1)

*Estimates include weights and sample characteristics from ENDES 2022.

from 5.6% to 18.2% [27]. In 27 European countries, prevalence averaged 6.38%, with values between 2.58% and 10.33% [28]. In the U.S., the overall prevalence was 18.5%, with state and county variations [29]. Differences in prevalence may be related to factors such as study design, cultural and socioeconomic conditions, health system differences, measurement instruments, and underreporting due to stigma, limited diagnostic access, or self-perception. In addition, the prevalence of 7.9% found in this study is within the range of previous research. Therefore, it is essential to consider the specific context when interpreting the results and designing mental health strategies.

By comparison, cross-national census-based data show substantial between-country differences in the prevalence of single-person households. In Northern Europe, single-person households account for about 44.7% of all households in Finland and 39.8% in Sweden; similarly high proportions are observed in Germany (42.3%) and France (34.7%), while the share is lower in Spain (25.7%) and the United States (28.4%) [30]. In several Asian settings, the proportion tends to be lower, such as China (13.7%, 2010 data), Indonesia (7.9%, 2020), Thailand (10.0%, 2021) and Viet Nam (8.7%, 2019) [31]. Likewise, in Latin America, census outputs indicate markedly lower levels, including Chile (17.8% of households, 2017) [32] and Brazil (18.8%, 2022) [33]; analyses of Mexico's 2023 census microdata likewise suggest that one-person households account for about 14.0% of households [34]. The differences in the percentages of individuals residing alone may be associated with cultural, economic, and demographic factors between regions. In Northern Europe, the high percentages could be related to stronger social welfare systems and a high quality of life that facilitate independence. In contrast, in Asia and Latin America, traditional family values and economic constraints seem to play a predominant role in the decision to live alone.

Although studies carried out in other countries have found an association between living alone and the presence of moderate to severe depressive symptoms [13-16], the present study did not show such a relationship in the Peruvian population (aPR: 1.01; 95% CI: 0.82-1.24; p: 0.928). This discrepancy could be explained by a variety of contextual, cultural, and sociodemographic factors that influence the characteristics and lifestyles of people living alone in different regions. For instance, a study conducted in Spain on lifestyles found that people who lived alone were less sedentary and spent more time on physical activity compared to those who lived with others. This pattern was attributed to greater flexibility in the organization of their time, as they did not depend on coordination with other members of the household. In addition, the same study observed that alcohol consumption was lower in people who lived alone, which could be related to lower social pressures to consume alcohol in group contexts [35]. In this sense, these behaviors could be associated with the lower prevalence of depressive symptoms in people who live alone in certain contexts, highlighting the importance of exploring lifestyles as possible protective factors in future studies.

However, other mechanisms related to housing conditions could also influence the relationship between living alone and depressive symptoms. A study conducted in Korea showed that both the economic burden of housing costs (OR: 1.92; 95% CI: 1.13-3.24)

Tab. III. Association between living alone and the presence of moderate to severe depressive symptomatology in the population of adults over 18 years of age, Peruvians, participants of the ENDES 2022 included in the study (N=30,087).

Live alone		Bivariate analysis			Adjusted analysis*		
		PR	95% CI	*p-value*	aPR	95% CI	*p-value*
	No	Ref.			Ref.		
	Yes	1.60	1.33 - 1.92	<0.001	1.01	0.82 - 1.24	0.928

*Adjusted for: sex, age group (years), education level, marital status, wealth quintile, physical and psychological limitations, and alcohol abuse. Estimates include the weights and ENDES 2022 sample specifications.
PR: Prevalence ratio. 95% CI: 95% confidence interval. aPR: adjusted Prevalence ratio.

and the number of housing quality items perceived as inadequate (OR: 1.31; 95% CI: 1.19-1.45) were significantly associated with depressive symptoms in one-person households. In contrast, in non-one-person households, only the number of housing quality items perceived as inadequate showed a significant association (OR: 1.34; 95% CI 1.15-1.55) [9]. This suggests that, in addition to psychological or social factors related to loneliness, economic and material aspects are strongly associated with mental health outcomes among those who live alone. These findings highlight the importance of considering cultural, social, and economic differences between populations when analyzing the relationship between living alone and depressive symptoms. It is possible that, in the Peruvian context, factors such as community support, extended family networks, or the lifestyle of those who live alone may be associated with lower levels of depressive symptoms [36-39]. However, this interpretation should be understood as a hypothesis rather than a conclusion derived from the present data, as these variables were not directly measured in this study. Therefore, further research, including qualitative studies, is needed to better understand how these contextual and social dynamics may relate to depressive symptoms among individuals living alone in the Peruvian population.

This investigation, as it is based on secondary data from the ENDES 2022, has some inherent limitations. Among them, the possibility of registration and/or typing errors that could generate information biases. In addition, variables may be affected by memory biases, as respondents may not accurately recall events leading up to the survey. Also, as it is a cross-sectional design, it is not possible to establish cause-and-effect relationships, since the variables studied were not monitored over time. Furthermore, although ENDES uses a probabilistic sampling design and survey weights were applied, some degree of selection bias cannot be entirely ruled out, as the health module is administered to one selected individual per household. However, one of the main strengths of this study lies in the quality of the data used. The ENDES 2022, prepared by the INEI, provides reliable and representative information at the national level, both on depression and on the housing conditions of the Peruvian population, which ensures an objective database that accurately reflects the national reality. This study represents a starting point for future research that allows us to delve into this topic. The fact that we have not found a significant association between living alone and depressive symptoms in the Peruvian context, in contrast to what has been reported in studies carried out in other settings, highlights the importance of investigating other contextual, cultural or social factors that could be modulating this relationship.

Conclusion

In conclusion, after adjusting for potential confounders, the present study did not identify a significant association between living alone and the presence of moderate to severe depressive symptoms in Peru. This finding, in contrast to studies conducted in other countries, suggests that factors such as lifestyle, housing conditions, and cultural or social particularities may be associated with this relationship. These results highlight the need to further explore these contextual factors to better understand how they influence mental health in different environments.

Acknowledgments

None.

Conflicts of interest statement

The authors affirm that they have no financial conflicts of interest or personal relationships that could have influenced the content of this article.

Data availability statement

The primary data used for this secondary analysis are available on the INEI website: https://proyectos.inei.gob.pe/iinei/srienaho/index.htm.

Authors' contributions

PCN: Conceptualization, Methodology, Writing - Original draft, Writing - Review & editing, Visualization, Project administration. ACZ: Conceptualization, Methodology, Writing - Original draft, Writing - Review & editing, Visualization, Project administration. AHV: Conceptualization, Methodology, Formal analysis, Writing - Review & editing. DA: Conceptualization,

Methodology, Formal analysis, Visualization, Writing - Review & editing, Supervision, Project administration.

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