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ORIGINAL ARTICLE

Depression, suicide attempts, and exposure to physical attacks: a nationwide cross-sectional survey in Mexico

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Abstract

Aim This study investigated the relationship between direct exposure to physical attacks and mental health (depression and suicide attempts) in the Mexican adult population. It also examined biological sex as a possible effect modifier.

Subject and methods A representative sample of 13,391 adults from the 2021 National Health and Nutrition Survey of Mexico (ENSANUT) was analyzed. Poisson regressions were used to estimate crude and adjusted prevalence ratios.

Results Victims of physical violence more than doubled the prevalence of depression (adjusted prevalence ratio = 2.59, 95% CI 2.11–3.19) and more than sextupled the prevalence of suicide attempts (adjusted prevalence ratio = 6.67, 95% CI 3.25–13.69) compared to non-victims. Sex was not a significant effect modifier.

Conclusion Direct exposure to physical attacks is associated with a higher prevalence of depression and suicide attempts in the Mexican adult population. The impact of attacks on these mental health outcomes is similar in men and women.

Keywords Exposure to violence · Depression · Attempted suicide · Crime victims · Social determinants of health · Mexico

Introduction

Depression is a mental health disorder and a public health problem that affects more than 300 million people worldwide, representing an increase of 18.4% between 2005 and 2015 (World Health Organization 2017). In addition, it is estimated that 16% of people with depression present at least one suicide attempt in their lifetime (Handley et al. 2018). In Latin America, the number of suicides has grown substantially in the past decade; currently, 45,800 suicide deaths are estimated each year (Mascayano et al. 2016). As for Mexico, the prevalence rates of depression and suicide attempts are 4.5% and 0.7%, respectively (Belló et al. 2005; Borges et al. 2018).

There is a growing awareness of the importance of the social environment in understanding mental health problems (Sederer 2016). Specifically, exposure to violence has been linked to both depression (Harding et al. 2022) and suicidal behavior (MacIsaac et al. 2017). Although much of this research has been conducted on adolescents (Sui et al. 2021), there is also evidence that violence impacts the mental health of adult victims (Tan and Haining 2016; Wu et al. 2019; Holliday et al. 2021; Kovess-Masfety et al. 2021). However, most of these studies have been conducted on specific groups of adults (e.g., war veterans or survivors of armed conflict); therefore, studies exploring these phenomena in the general population are needed.

Traditionally, violence has primarily been studied from a criminal perspective, where the focus is on trying to stop it after it has happened (tertiary prevention). However, public health provides an alternative approach by tracking

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the frequency of violent acts, determining the causes, and developing effective strategies to prevent them (Prothrow-Stith and Davis 2010; Haegerich and Dahlberg 2011). The World Health Organization recognizes three types of violence: self-inflicted (i.e., intentionally inflicted upon oneself), interpersonal (inflicted upon others, such as domestic violence or bullying), and collective (committed by larger groups, such as civil conflict or state-sponsored violence) (Krug et al. 2002). It is important to understand that these forms of violence are interconnected and can have a significant impact on mental health (Haegerich and Dahlberg 2011). A public health approach to studying violence involves a shift away from a strictly biomedical model and recognizing the complex social, economic, and community factors that contribute to it (Krug et al. 2002; Williams and Donnelly 2014; Bhavsar et al. 2020). For example, according to diathesis-stress models, the impact of interpersonal violence on mental health can be exacerbated by an increase in stress responses (i.e., sensitization hypothesis; Hedtke et al. 2008). However, there may also be a reciprocal relationship between exposure to violence and mental health, and both are influenced by various protective and risk factors at various levels (Tol 2020). The multilevel factors that may influence both exposure to violence and psychopathology include gender (World Health Organization 2017; World Health Organization 2019), age (Hernández-Vásquez et al. 2020), socioeconomic status (Kivimäki et al. 2020), and binge drinking (Edwards et al. 2020).

An important aspect to consider is the possible role of gender-based violence. In populations highly exposed to trauma, being female was associated with higher odds of attempted suicide (Kovess-Masfety et al. 2021). However, it is unclear whether gender moderates the relationship between exposure to violence and mental health. That is, although it is known that the prevalence of depression and suicide attempts is higher in women (World Health Organization 2017; World Health Organization 2019), it is unclear whether the strength of the association between violence and mental health varies by sex. It is possible that this is the case, as it has been found, for example, that women (but not men) exposed to childhood maltreatment are more likely to develop psychopathology over their lifetime (MacMillan et al. 2001). Likewise, it has been observed that exposure to intimate partner, sexual, and peer/school violence is associated with greater psychopathology in women, but not in men (Romito and Grassi 2007). In short, while some data suggest that the link between these variables is stronger in women (Thompson et al. 2004; Matthay et al. 2018), others have failed to find a significant interaction (Sui et al. 2021). Thus, it seems justified to examine whether gender moderates the association between exposure to violence and psychopathology.

Therefore, there is a need to study the relationship between exposure to violence and mental health in the general population, considering the possible role of gender as an effect modifier. The present study had the following objectives: (a) to examine whether there were significant associations between direct exposure to physical attacks and both depression and suicide attempts, and (b) to analyze whether these associations were moderated by biological sex. The present research is particularly relevant to the Mexican context, which presents high rates of violence, especially in relation to organized crime (Institute for Economics & Peace 2020).

Method

Study design and data sources

A cross-sectional secondary analysis was conducted on the 2021 National Health and Nutrition Survey (ENSANUT, Spanish initials), prepared by the National Institute of Geography and Statistics and the National Institute of Public Health of Mexico. The data obtained in the survey are freely accessible and are available at the following link: https://ensanut.insp.mx/encuestas/ensanutcontinua2021/descargas.php

The sampling was probabilistic, stratified, and by clusters, representative at the national level (Romero Martínez et al. 2021). A total of 12,619 households were surveyed. The units of analysis were residents of urban and rural households. Trained staff interviewed selected individuals directly. Data were included for persons over 20 years of age, leading to a total of 13,391 individuals for the present study.

Study variables

Outcome variables *Current depressive symptomatology* was measured with the Depression Scale of the Center for Epidemiologic Studies, Brief Version (CESD-7; Herrero and Gracia 2007). It consists of seven items that are answered with a Likert-type scale ranging from 0 (*rarely or none of the time*) to 3 (*most or all of the time*). Through a confirmatory factor analysis with the WLSMV method, this unidimensional scale showed adequate fit (CFI = .996, RMSEA = .053), as well as good reliability ($\alpha = .83$, $\omega_{categorical} = .85$) in the present data. A previously validated cutoff of ≥ 9 was considered indicative of clinically significant symptomatology (Salinas-Rodríguez et al. 2013). *Past-year suicide attempt* was measured with two questions: "Have you ever hurt, cut, or poisoned yourself on purpose with the intention of taking your life away?" and "Did it happen in the last twelve months?" These questions were combined to create a single dichotomous variable. It should be noted that, although the

limitations of measuring suicide attempts through single items are well known, this is still a common practice in the field (Millner et al. 2015; Hom et al. 2016; Ammerman et al. 2021). Since this is a secondary data analysis, we had to restrict ourselves to the data provided by the ENSANUT. This should be taken into consideration to interpret the results with caution.

Exposure to violence It was measured with a single dichotomous question: "In the last 12 months, have you been the victim of an incident in which you were physically attacked?" Similar questions have been used before to estimate the national prevalence of interpersonal violence victimization in Mexico, so it can be considered a consensus operationalization of this phenomenon in the country (Valdez-Santiago et al. 2013).

Other variables Sex, age, socioeconomic status (SES), and binge drinking were included as possible confounders. To create a proxy of SES, a wealth index was calculated with principal component analysis using housing and household characteristics (Vyas and Kumaranayake 2006); this index was later categorized into tertiles at the household level. With regard to binge drinking, it was measured with a single dichotomous question: "In the last 30 days, did you have ___ or more drinks of alcohol on at least one occasion?" The blank space was filled with "four" for females and "five" for males, according to established definitions of binge drinking (National Institute on Alcohol Abuse and Alcoholism 2023).

Data analysis

We used R (version 4.0.3), together with the *survey* package (version 4.0) to analyze the data. All the results reported, except for the absolute frequencies, took the sampling design into account. The primary sampling units, strata, and weighting factors were specified using the *svydesign* function. First, we computed all the variables' absolute frequencies and weighted percentages. Next, we examined the bivariate associations between exposure to violence (as well as the covariates) and both depression and suicide attempts. We used the Rao–Scott chi-square test to assess these associations. A $p < .05$ was considered as statistically significant.

Crude and adjusted prevalence ratios (*PR*) and their 95% CI were obtained from Poisson regression models. This approach is preferable to the traditional calculation of odds ratios, especially when the prevalence of the outcome is high, as in the case of depressive symptomatology (Martinez et al. 2017). An association was considered to be statistically significant when the CI did not include 1. Finally, the interaction between exposure to violence and sex was tested by adding a product term to each adjusted model. Specifically, this implies multiplying sex and exposure to violence (both coded as 0 or 1) and adding these values as a new variable in the multiple regression model. This procedure allowed us to test whether sex is a significant moderator; conceptually, this would be similar to fitting the regression model in males and females separately, but it allows an explicit and more efficient test of the moderation hypothesis (Jose 2013). A significant result in the Wald test ($p < .05$) would indicate an effect modification by sex.

Finally, it is worth clarifying some points about the statistical assumptions of the tests performed. First, to date, the number of tools available for the evaluation of assumptions when working with complex samples is limited (Heeringa et al. 2017). Second, all our study variables were categorical, so the usual techniques for examining the distribution of numerical variables (e.g. skewness, kurtosis, normality tests) are not applicable. Third, our data come from a national survey that aims to replicate the population structure; therefore, it would be counterproductive to apply outlier detection and elimination strategies. Fourth, due to the large sample size, it is possible to resort to the central limit theorem to assume certain properties that give robustness to our inferences (e.g., the asymptotic normality of the sampling distributions) (Lumley et al. 2002; Kwak and Kim 2017).

Ethical considerations

For ENSANUT 2021, authorization was obtained from the Bioethics, Research and Biosafety Commissions of the National Institute of Public Health of Mexico (CI-450-2021). Likewise, the voluntariness of participation in each questionnaire was recorded by means of informed consent forms.

Results

Population characteristics

Data from 13,391 individuals were included in the analyses. The mean age was 43.63 ($SD = 16.32$), and there was a slightly larger proportion of women. The prevalence of current depressive symptomatology was 12.3%, while the prevalence of past-year suicide attempts was 0.6%. Direct exposure to physical violence had a prevalence of 2.9%. Further details about the population characteristics are presented in Table 1.

Bivariate associations with depression and suicide attempts

There was a clear association between exposure to physical violence and both depression and suicide attempts ($ps < .001$). The prevalence of depressive symptomatology was 28.3% in exposed individuals, while the unexposed

Table 1 Characteristics of the study population

Variable	*n*	Weighted % (95% CI)
Physical attack		
No	13,048	97.1 (96.7–97.5)
Yes	343	2.9 (2.5–3.3)
Sex		
Man	5232	47.8 (46.7–49.0)
Woman	8159	52.2 (51.0–53.3)
Age ($M = 43.63$, $SD = 16.32$)		
20–29	2710	23.5 (22.4–24.5)
30–39	2776	22.9 (21.8–24.0)
40–49	2762	19.9 (18.9–20.9)
50–59	2241	14.9 (14.0–15.7)
≥ 60	2902	18.9 (17.8–19.9)
Socioeconomic tertile		
High	4418	38.5 (36.5–40.5)
Medium	4481	31.6 (29.9–33.3)
Low	4492	29.9 (28.1–31.7)
Binge drinking		
No	11,322	82.4 (81.5–83.4)
Yes	2069	17.6 (16.6–18.5)
Current depressive symptoms		
No	11,539	87.7 (86.9–88.4)
Yes	1852	12.3 (11.6–13.1)
Suicide attempts in last year		
No	13,320	99.4 (99.2–99.6)
Yes	71	0.6 (0.4–0.8)

Table 2 Bivariate Associations Between Exposure and Outcome Variables

Variable	Depression		Suicide attempts	
	Weighted %	*p*	Weighted %	*p*
Physical attack		<.001		<.001
No	11.9		0.5	
Yes	28.3		4.0	
Sex		<.001		.029
Man	7.6		0.4	
Woman	16.7		0.8	
Age		<.001		<.001
20–29	9.3		1.5	
30–39	11.2		0.5	
40–49	14.1		0.5	
50–59	13.6		0.3	
≥ 60	14.7		0.0	
Socioeconomic tertile		<.001		.090
High	8.2		0.4	
Medium	13.6		0.5	
Low	16.3		0.9	
Binge drinking		.467		<.001
No	12.5		0.4	
Yes	11.7		1.5	

The *p*-values correspond to chi-square tests with the Rao–Scott correction

group's prevalence was 11.9%. Similarly, the prevalence of suicide attempts in victimized participants was 4.0%, which, compared to the 0.5% prevalence of the unexposed group, shows a clear relationship between these variables (Table 2).

Table 2 also presents the bivariate associations between the study covariates and both outcomes. Being female was associated with both depression and suicide attempts. Also, the lower the SES, the larger the prevalence of depression. Regarding age, there were different patterns for each variable. For depression, there was a sustained increasing trend with age. For suicide attempts, on the other hand, there was a sustained *decrease*; people in the youngest group reported the highest prevalence. The bivariate association between binge drinking and depression was non-significant; for suicide attempts, this relation was significant and in the expected direction.

Crude and adjusted prevalence ratios

The prevalence of depression in individuals who were exposed to physical violence was 2.38 times that of unexposed individuals. When gender, age, SES, and alcohol use were statistically controlled, this value increased so that the prevalence in the exposed group was 2.59 that in the unexposed group ($aPR = 2.59$; 95% CI 2.11–3.19). Similarly, the prevalence of suicide attempts in the exposed group was eight times that of the unexposed one. After accounting for possible confounders, this value decreased but was still relevant ($aPR = 6.67$; 95% CI 3.25–13.69). The covariates showed similar patterns in the crude and adjusted models. The only exception was binge drinking, which became significantly associated with a higher prevalence of depression. Further details about the crude and adjusted models are presented in Table 3.

Sex as an effect modifier

An exposure-by-sex product term was added to both adjusted models to examine evidence of gender as an effect modifier. This interaction was not significant, either for depression ($p = .176$) or suicide attempts ($p = .980$). Thus, no evidence of sex as an effect modifier was found for any of the outcome variables. In other words, even though both exposure to violence and female sex were associated with depression and suicide attempts, the relationship between the exposure and outcome variables was similar in men and women.

Table 3 Crude and adjusted prevalence ratios obtained from robust Poisson regression models

Variable	Depression		Suicide attempts	
	Crude	Adjusted	Crude	Adjusted
Physical attack				
No	Ref.	Ref.	Ref.	Ref.
Yes	2.38 (1.94–2.92)	2.59 (2.11–3.19)	8.07 (3.93–16.55)	6.67 (3.25–13.69)
Sex				
Man	Ref.	Ref.	Ref.	Ref.
Woman	2.19 (1.90–2.52)	2.39 (2.09–2.74)	2.05 (1.06–3.94)	3.30 (1.79–6.06)
Age				
20–29	Ref.	Ref.	Ref.	Ref.
30–39	1.21 (0.98–1.49)	1.21 (0.98–1.49)	0.33 (0.12–0.89)	0.36 (0.13–0.99)
40–49	1.52 (1.25–1.85)	1.57 (1.30–1.90)	0.33 (0.16–0.71)	0.40 (0.18–0.86)
50–59	1.47 (1.21–1.80)	1.53 (1.26–1.86)	0.20 (0.07–0.57)	0.27 (0.09–0.78)
≥ 60	1.58 (1.30–1.92)	1.78 (1.47–2.14)	0.02 (0.00–0.13)	0.03 (0.00–0.22)
Socioeconomic tertile				
High	Ref.	Ref.	Ref.	Ref.
Medium	1.66 (1.40–1.97)	1.67 (1.41–1.99)	1.30 (0.53–3.22)	1.45 (0.60–3.50)
Low	2.00 (1.69–2.35)	2.04 (1.73–2.39)	2.26 (1.05–4.84)	2.47 (1.16–5.27)
Binge drinking				
No	Ref.	Ref.	Ref.	Ref.
Yes	0.93 (0.78–1.12)	1.42 (1.18–1.71)	3.67 (1.97–6.84)	4.08 (2.23–7.47)

Discussion

Our study showed an association between direct exposure to physical violence and two mental health outcomes: depression and suicide attempts. Specifically, those exposed to violence had more than twice the prevalence of depression, as well as more than six times the probability of having had a suicide attempt, compared to the non-exposed group. On the other hand, no evidence was found that the strength of these associations differed between men and women.

Our estimate of the prevalence of depression was 12.3%, which is higher than the 4.5% previously reported (Belló et al. 2005). This is explained by how depression was measured in the study by Belló et al. (2005), as well as in other previous studies that found prevalence estimates similar to that of these authors (Slone et al. 2006; Bromet et al. 2011). These antecedent investigations sought to approximate the diagnostic criteria of a major depressive disorder, while the measurement made in the present work with the CESD-7 sought to identify cases with clinically significant symptomatology, without this necessarily constituting a major depressive disorder (Salinas-Rodríguez et al. 2013). Depressive symptomatology, despite being considered a threshold or mild form of depression, is still significantly disabling for the person presenting it, so its identification contributes to instituting early interventions (Ayuso-Mateos et al. 2010). In fact, primary care reduces the risk of developing major depression (Salinas-Rodríguez et al. 2013). For this reason, the present study focused on clinically significant depressive symptomatology, following the operationalization used in other epidemiological studies at the national level in Mexico (Cerecero-García et al. 2020; Valencia et al. 2022). Regarding the prevalence of suicide attempts in the past year, it was 0.6% in our data, a result similar to that of another Mexican nationwide study, which found a prevalence of 0.7% (Borges et al. 2018).

As for the relationship between exposure to violence and depression, our results coincide with those found in previous studies. For example, Harding et al. (2022) conducted a study on the general Brazilian population and, similar to our findings, found that exposure to violence was associated with increased odds of depression. On the other hand, this association may be stronger in specific populations. For example, Kovess-Masfety et al. (2021) found, in a highly traumatized population in Afghanistan, that exposure to violence increased the odds of depression by a factor of five to 11.

Regarding the association between violence and suicide attempts, previous studies are often limited to specific populations (e.g., female victims of intimate partner violence; MacIsaac et al. 2017). Some large studies suggest that exposure to direct interpersonal violence among people with suicidal ideation increases the odds of suicide attempts by 54–161% depending on the type of violence (Afzali et al. 2017). Likewise, in another study with female war veterans, it was observed that exposure to sexual violence implied an increase of between 136 and 156% in the odds of suicide attempts (Holliday et al. 2021). In our

study, direct exposure to any type of interpersonal violence was observed to more than sextuple the prevalence of suicide attempts (i.e., an increase of more than 500%), implying a greater association than that observed in other studies. This suggests that, in populations highly exposed to violence such as the Mexican population (Institute for Economics & Peace 2020), the impact of violence on suicide attempts may be greater. This coincides, in part, with what has been observed in the severely victimized population of Afghanistan, where exposure to violence can quadruple and even almost septuple the odds of suicide attempts (Kovess-Masfety et al. 2021).

Based on the idea that gender-based violence places women in a position of social vulnerability to the effects of violence (Glynn et al. 2009), we hypothesized that the relationship between violence and mental health would be moderated by sex (Thompson et al. 2004). However, no evidence of such an interaction was found. That is, although being female is related to higher levels of depression and suicide attempts, the magnitude of the association between violence and these two outcomes does not seem to differ between sexes. This is consistent with the findings of Sui et al. (2021), who found in a sample of adolescents that gender did not moderate the relationship between exposure to violence and mental health. Specifically, this seems to indicate that both men and women are similarly affected by violence. However, it is important to consider that in the present study exposure to violence was measured as a single dichotomous variable related to physical attacks. It is possible that, when considering specific types of violence (e.g., sexual violence), differential patterns may be observed between men and women (Romito and Grassi 2007).

Although it was not the focus of the study, the association between a number of covariates and both outcomes was also examined. Regarding gender and SES, it was observed that women and participants living under less favorable socioeconomic conditions presented a higher prevalence of depression and suicide attempts, which coincides with what is established in the scientific literature (Kivimäki et al. 2020). For age and alcohol use, though, the patterns were different for both outcomes. Older age was related to a sustained increase in the prevalence of depression, a result that supports the findings of previous studies (Hernández-Vásquez et al. 2020). On the other hand, the relationship between age and suicide attempts showed that the highest prevalence corresponded to the youngest group (in the range of 20 to 29 years: 1.5%). This finding is consistent with previous knowledge (World Health Organization 2019). Finally, as for the relationship between binge drinking and psychopathology, this was significant for both depression and suicide attempts after controlling for the other variables. This finding coincides with that reported in previous research (Edwards et al. 2020).

Relevance for public health

Our findings highlight the need to implement both remedial (i.e., focused on victims) and preventive strategies (i.e., focused on the roots of violence). They show that the sum of violence, gender, age-related vulnerability, disadvantaged SES, and binge drinking put people's mental health at risk. Therefore, remedial interventions could prioritize specific subpopulations, especially when limited resources are at stake.

In Mexico, violence can be described as a "wicked problem," given its complexity and the absence of a simple solution (Kazdin 2011). Indeed, violence in Mexico is intertwined with organized crime and politics (Institute for Economics and Peace 2020), and violence rates have escalated dramatically since the beginning of the so-called Mexican Drug War in 2006 (Dell 2015). Thus, to attack the roots of violence, public health interventions must address this problem from different perspectives, in constant dialogue with law, activism, and politics.

Limitations and strengths

This study has some limitations that need to be mentioned. First, the cross-sectional nature of the data prevents us from inferring causality. That is, we cannot ascertain whether exposure to physical violence precedes and influences the onset of depression and suicide attempts. Second, the fact that self-reports were used to measure all the study variables may increase the risk of recall bias and social desirability. Indeed, it is likely that the prevalence rates obtained in this study are underestimations. Third, only one aspect of exposure to violence was measured, ignoring other forms of exposure that are also relevant to mental health (e.g., indirect community violence; Flores Martínez and Atuesta 2018). In fact, only direct exposure to physical violence was included. Moreover, some participants may not have been able to identify some experiences of physical violence as such (e.g., intimate partner physical violence), and thus the present results are probably an underestimation of the phenomenon. Future studies should consider a broader conceptualization of exposure to violence and measure different aspects of it. Fourth, it should be noted that gender was not measured directly in this study, but only indirectly as biological sex. Finally, our assessments of exposure to violence and suicide attempts were dichotomous, implying that they are crude ways of measuring these constructs. However, we believe that this increase in measurement error is compensated for by the size of the data set analyzed, as well as by having a nationally representative sample that allows us to identify trends and associations at the population level. Despite these limitations, this was a nationally representative sample, and several potential confounders were controlled, thus allowing

robust inferences about the mental health correlates of violence victimization in the general population.

The present research analyzed data on the psychological effects of violence in a Latin American country: Mexico. This constitutes a contribution to diversity in science, as most previous studies were conducted in different cultural and geographic contexts (Tan and Haining 2016; Wu et al. 2019; Holliday et al. 2021; Kovess-Masfety et al. 2021). Furthermore, using a nationally representative sample ensures that different Mexican minorities (e.g., ethnic) are present in our data and that our findings are generalizable to the country level. This is of particular importance given the concern expressed by violence researchers that study samples be sufficiently diverse to allow for cross-cultural generalization (Bent-Goodley 2021). On the other hand, our study did not include some variables relevant to both diversity and the phenomena under study (e.g., sexual orientation).

Conclusion

In Mexico, the prevalence of depressive symptoms among victims of violence was twice that of non-victims. Likewise, the prevalence of suicide attempts was triple that of the rest of the population. In both cases, the impact of violence on mental health was similar in men and women. These results emphasize the need to intervene, from different approaches and disciplines, on a problem as complex as violence in the Mexican population.

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Authors' contributions PDV and ARG conceived the research idea. PDV conducted the statistical analysis and interpretation of the data. All authors participated in the literature review, data curation, drafting of the manuscript, and all participated in the review and approval of the final manuscript.

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Data availability The ENSANUT 2021 data are freely available in the following link: https://ensanut.insp.mx/encuestas/ensanutcontinua2021/descargas.php

Code availability The R script of the present study can be obtained from the corresponding author upon reasonable request.

Declarations

Ethics approval The primary data collection of this study were collected after approval from the Ethics, Research, and Biosafety Commissions of the National Institute of Public Health.

Consent to participate For primary data collection, written informed consent was obtained from all participants.

Consent for publication The ENSANUT data set is in the public domain, so any person can use these data for research and publication purposes.

Conflicts of interest The authors declare that they have no conflicts of interest.

Ethical Statement The primary data collection of this study was conducted after approval from the Ethics, Research, and Biosafety Commissions of the National Institute of Public Health (CI-450-2021). Written informed consent was obtained from all participants.

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