



The association of pain with suicidal ideation and suicide attempts with depressive symptoms among adults aged ≥ 50 years from low- and middle-income countries

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Abstract

Objectives: We aimed to examine the relationship of pain with suicidal ideation and suicide attempts with depressive symptoms among adults aged ≥ 50 years from six low- and middle-income countries (LMICs) (China, Ghana, India, Mexico, Russia, and South Africa).

Methods: Cross-sectional, community-based, nationally representative data from the WHO Study on global AGEing and adult health were analyzed. Self-reported information on past 12-month suicidal ideation and suicide attempts among people with depressive symptoms was collected. Pain was assessed with the question "Overall in the last 30 days, how much of bodily aches or pain did you have?" With answer options: "none", "mild", "moderate", "severe/extreme". Multivariable logistic regression was done to assess associations.

Results: Data on 34,129 adults aged ≥ 50 years (mean [SD] age 62.4 [16.0] years; males 47.9%) were analyzed. Compared to no pain, mild, moderate, and severe/extreme pain were associated with 2.83 (95% CI = 1.51–5.28), 4.01 (95% CI = 2.38–6.76), and 12.26 (95% CI = 6.44–23.36) times higher odds for suicidal ideation. For suicide attempt, only severe/extreme pain was associated with significantly increased odds (OR = 4.68; 95% CI = 1.67–13.08).

Conclusions: In this large sample of older adults from multiple LMICs, pain was strongly associated with suicidal thoughts and suicide attempts with depressive symptoms. Future studies should assess whether addressing pain among older people in LMICs may lead to reduction in suicidal thoughts and behaviors.

KEYWORDS

low- and middle-income countries, older adults, pain, suicidal ideation, suicide attempt

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Key points

- Thirty-four thousand one hundred twenty-nine adults aged ≥ 50 years (mean [SD] age 62.4 [16.0] years; males 47.9%).
- Pain was strongly associated with suicidal thoughts.
- Pain was strongly associated with suicide attempts.
- Future studies should assess whether addressing pain may reduce suicide.

1 | INTRODUCTION

Suicide is defined as death caused by self-directed injurious behavior with intent to die, as a result of the behavior.¹ Approximately 700,000 people die by suicide each year, of which 77% occur in low- and middle-income countries (LMICs). Suicidal ideation (defined as thinking about, considering, or planning suicide)¹ typically precedes a suicide attempt (defined as a non-fatal, self-directed, potentially injurious behavior with intent to die as a result of the behavior),¹ and a prior suicide attempt is the most important risk factor for completed suicides in the general population.² In addition, suicide attempts are associated with a plethora of negative outcomes including injury, hospitalization, and loss of independence, as well as imposing a significant financial burden on society.³ Although suicide attempts are more frequent among adolescents and young adults, older men and women show the highest suicide rate in almost all countries.^{4,5} Moreover, the rate of suicide increases with age among people older than 60 years.⁶ Given this, it is important to develop targeted interventions to prevent suicidal ideation and suicide attempts among older adults, especially in the context of LMICs.

One understudied but potentially important risk factor for suicidality among older people in LMICs is pain. Pain may increase risk for suicidal ideation and suicide attempt by, for example, causing mental defeat, which is a thought process involving a loss of emotional autonomy and a sense of feeling broken.⁷ Importantly, mental defeat has been identified as a key indicator for heightened suicide risk.⁸ Moreover, pain can lead to insomnia and problem-solving deficits,⁹ and these conditions may increase risk for suicidality.^{10,11} Pain may be an important risk factor for suicidality especially in older adults in LMICs as studies have shown a trend toward increasing prevalence of pain with increasing age with the highest prevalence being observed among older adults,¹²⁻¹⁴ while the prevalence of chronic pain has been reported to be particularly high in LMICs.¹⁵

Cancer pain, acute pain, and chronic non-cancer pain all contribute to a large burden of pain in LMICs, which is frequently underdiagnosed and undertreated.¹⁶ While there is a scarcity of literature on the prevalence of untreated pain globally, the World Health Organization (WHO) estimates that 5.5 billion people (more than 80% of the global population) do not have access to treatments for moderate to severe pain, and states that most of these people are living in LMICs.¹⁷ Indeed, in many LMICs, the range of analgesic medications is very limited, and the supply of medications may be intermittent or non-existent.¹⁶

One recent systematic review focusing on pain as a risk factor for suicidal behavior in older adults (defined as people aged ≥ 60 years) included 38 original research articles, and suggested the existence of a relationship between pain and suicidal behavior in older adults. However, none of the studies were from LMICs.¹⁸ In fact, there is just one previous study on pain and suicidal thoughts and behavior among older people from LMICs. Specifically, in this study including a sample of 251 Ghanian women aged ≥ 50 years, mild and moderate pain, when compared to severe or extreme pain, was associated with a lower risk of suicidal ideation.¹⁹ It is clear that more research is needed to investigate the association between pain and suicidal thoughts or behavior among older adults from LMICs given that findings from high-income countries may not be applicable to LMICs due to different disease profiles that may lead to pain and the limited availability of treatment for pain in this setting.²⁰ Moreover, multi-country studies are needed as these studies allow for the comparison of standardized estimates across different settings and can thus better inform targeted intervention and policy.

Given this background, the aim of the present study was to examine the relationship between pain with suicidal ideation and suicide attempts among adults aged ≥ 50 years from six LMICs (China, Ghana, India, Mexico, Russia, and South Africa).

2 | METHODS

Data from the Study on Global Ageing and Adult Health (SAGE) were analyzed. This survey was undertaken in China, Ghana, India, Mexico, Russia, and South Africa between 2007 and 2010. Based on the World Bank classification at the time of the survey, Ghana was the only low-income country, and China and India were lower middle-income countries, although China became an upper middle-income country in 2010. The remaining countries were upper middle-income countries. Details of the survey methodology have been published elsewhere.²¹ Briefly, in order to obtain nationally representative samples, a multistage clustered sampling design method was used. The sample consisted of adults aged ≥ 18 years with oversampling of those aged ≥ 50 years. Trained interviewers conducted face-to-face interviews using a standard questionnaire. Standard translation procedures were undertaken to ensure comparability between countries. The survey response rates were: China 93%; Ghana 81%; India 68%; Mexico 53%; Russia 83%; and South Africa 75%. Sampling weights were constructed to adjust for

the population structure as reported by the United Nations Statistical Division. Ethical approval was obtained from the WHO Ethical Review Committee and local ethics research review boards. Written informed consent was obtained from all participants.

2.1 | Suicidal ideation and suicide attempts

Information on suicidal ideation and suicide attempt were assessed in the same way as in previous SAGE publications,^{22–24} using an adapted version of the depression module of the WHO Composite International Diagnostic Interview.²⁵ Those who screened positive in the depression module were further asked about suicidal thoughts and behavior. A positive screen referred to having at least one of the three following conditions for more than 2 weeks in the past 12 months: sadness, loss of interest, or low energy. Suicidal ideation was assessed by the question “Did you think of death, or wish you were dead?” and suicide attempts by the question “During this period, did you ever try to end your life?” with “yes” and “no” answer options.^{22,23}

2.2 | Pain

Pain was assessed with the question “Overall in the last 30 days, how much of bodily aches or pain did you have?” With answer options “none” (unweighted $n = 13,059$), “mild” ($n = 10,729$), “moderate” ($n = 6,579$), “severe” ($n = 3,095$) and “extreme” ($n = 221$). In the analysis, “severe” and “extreme” were collapsed into one category as there were very few people who answered “extreme”. Furthermore, a dichotomized variable of severe/extreme pain (yes/no) was also created and used in some analyses. A follow-up question on difficulty in daily life due to pain (“Overall in the last 30 days, how much difficulty did you have in your daily life because of your pain?”) was asked to those who answered “mild” to “extreme” to the above-mentioned question on pain. Answer options were the same as above and those who answered “severe” and “extreme” were categorized together as very few people answered “extreme”.

2.3 | Control variables

The control variables were selected based on past literature,²⁶ and included age, sex, education (under secondary, secondary or higher), wealth quintiles based on income, alcohol consumption in the past 30 days, and chronic physical conditions. Information on 10 chronic physical diseases (angina, arthritis, asthma, chronic lung disease, diabetes, edentulism, hearing problem, hypertension, stroke, visual impairment) were obtained. The details on the diagnosis of these conditions are provided in Table S1 (Appendix A). The number of chronic conditions were summed and categorized as 0, 1, and ≥ 2 .

2.4 | Statistical analysis

The statistical analysis was conducted with Stata 14.2 (Stata Corp LP). The analysis was restricted to people aged ≥ 50 years. The difference in sample characteristics by severe/extreme pain was tested by Chi-squared tests and Student's t -tests for categorical and continuous variables, respectively. Multivariable logistic regression analysis was conducted to examine the association between severity of pain or difficulty in daily life due to pain (four-category variable with values “none”, “mild”, “moderate”, “severe/extreme”; exposures) and suicidal ideation or suicide attempt (outcomes). The analysis on difficulty in daily life excluded those who did not report pain. We also conducted test of trend to assess whether increasing severity of pain was dose-dependently associated with higher odds for suicidal ideation or suicide attempt. This was done by including the variables on severity of pain or difficulty in daily life due to pain as a continuous variable rather than a categorical variable in the model. The analysis on severity of pain was also stratified by age group (50–64 years [middle-aged adults] and ≥ 65 years [older adults]) and sex. Furthermore, to examine the between country-heterogeneity in the association between severe/extreme pain and suicidal ideation, we conducted country-wise analysis and calculated the Higgin's I^2 , which represents the degree of heterogeneity that is not explained by sampling error with values of 25%, 50%, and 75% often being considered as low, moderate, and high levels of heterogeneity.²⁷ Overall estimates were obtained based on country-wise estimates by meta-analysis with random effects. Country-wise analysis with suicide attempts as the outcome could not be conducted because stable estimates were unobtainable due to the small number of suicide attempts in each country.

All regression analyses were adjusted for age, sex, education, wealth, alcohol consumption, number of chronic conditions, and country, except for the sex- and country-stratified analyses which were not adjusted for sex and country, respectively. Adjustment for country was done by including dummy variables for each country in the model as in previous SAGE publications.^{28,29} Under 2.2% of the data were missing for all the variables used in the analysis, except for the number of chronic conditions (4.4%). Complete case analysis was done. The sample weighting and the complex study design were taken into account in all analyses. Results from the regression analyses are presented as odds ratios (ORs) with 95% confidence intervals (CIs). The level of statistical significance was set at $p < 0.05$.

3 | RESULTS

Data on 34,129 adults aged ≥ 50 years (mean [SD] age 62.4 [16.0] years; males 47.9%) were analyzed. The sample sizes by country were: China $n = 13,175$; Ghana $n = 4,305$; India $n = 6,560$; Mexico $n = 2,313$; Russia $n = 3,938$; South Africa $n = 3,838$. The prevalence of different severities of pain were: mild 32.1%, moderate 18.2%, and severe/extreme 11.1%. Among those who reported at least mild pain,

47.6%, 27.9%, and 14.7% reported mild, moderate, and severe/extreme difficulty in daily life due to pain. The prevalence of suicidal ideation and suicide attempt were 3.4% and 0.6%, respectively. The sample characteristics are provided in Table 1. Those with severe/extreme pain were more likely to be older, be females, have lower levels of education and wealth, and were less likely to consume alcohol, while they had more chronic conditions. Country-wise sample characteristics are provided in Table S2 of the Appendix A. The prevalence of females and \geq secondary education was particularly high in Russia. The prevalence of suicidal ideation and suicide attempt increased linearly with increasing severity of pain (Figure 1). For example, the prevalence of suicidal ideation was only 0.6% among those without pain but this increased to 14.8% among those with severe/extreme pain. In the overall sample, after adjustment for potential confounders, compared to no pain, mild, moderate, and severe/extreme pain were associated with 2.83 (95% CI = 1.51–5.28), 4.01 (95% CI = 2.38–6.76), and 12.26 (95% CI = 6.44–23.36) times higher odds for suicidal ideation (Table 2). Results were similar for middle-aged and older adults. For suicide attempt, only severe/extreme pain was associated with significantly increased odds (OR = 4.68; 95% CI = 1.67–13.08). Among those who had pain,

increasing severity of difficulty in daily life due to pain was dose-dependently associated with higher odds for suicidal ideation and suicide attempt (Table 3). For example, severe/extreme difficulty in daily life due to pain (vs. no difficulty) was associated with 7.50 (95% CI = 2.98–18.88) and 24.63 (95% CI = 6.52–93.00) times higher odds for suicidal ideation and suicide attempt, respectively. Test for trend was significant for all analyses on severity of pain or difficulty in daily life due to pain, suggesting dose-dependent associations. Finally, country-wise analysis showed that severe/extreme pain was significantly associated with suicidal ideation in all countries, except Mexico, with a moderate level of between-country heterogeneity ($I^2 = 60.2\%$) (Figure 2).

4 | DISCUSSION

4.1 | Main findings

In the present large sample of older adults from six LMICs, it was observed that increasing severity of pain is dose-dependently associated with higher odds for suicidal ideation and suicide attempts. For

TABLE 1 Sample characteristics (overall and by severe/extreme pain).

Characteristic		Overall		Severe/extreme pain			p-value ^a	
		n/N	% or mean (SD)	No n/N	% or mean (SD)	Yes n/N		% or mean (SD)
Age (years)			62.4 (16.0)		62.0 (15.7)		65.2 (16.9)	<0.001
Sex	Female	18,456/34,122	52.1	16,084/30,363	50.5	2120/3313	64.4	<0.001
	Male	15,666/34,122	47.9	14,279/30,363	49.5	1193/3313	35.6	
Education	<Secondary	21,264/33,396	57.4	18,623/29,870	55.5	2398/3244	71.7	<0.001
	\geq Secondary	12,132/33,396	42.6	11,247/29,870	44.5	846/3244	28.3	
Wealth	Poorest	6496/33,997	17.1	5644/30,244	16.4	748/3308	23.1	<0.001
	Poorer	6697/33,997	19.0	5888/30,244	18.6	721/3308	21.7	
	Middle	6648/33,997	19.5	5866/30,244	19.3	698/3308	21.2	
	Richer	7009/33,997	21.3	6314/30,244	21.8	611/3308	17.6	
	Richest	7147/33,997	23.1	6532/30,244	23.9	530/3308	16.4	
Alcohol consumption	No	27,028/33,552	81.3	24,173/30,212	80.3	2820/3301	89.6	<0.001
	Yes	6524/33,552	18.7	6039/30,212	19.7	481/3301	10.4	
No. of chronic conditions	0	7812/32,780	26.0	7355/29,533	27.5	452/3229	14.0	<0.001
	1	12,600/32,780	36.0	11,672/29,533	37.3	922/3229	25.9	
	≥ 2	12,368/32,780	38.0	10,506/29,533	35.2	1855/3229	60.1	

Abbreviation: SD, standard deviation.

^ap-value was based on Chi-squared tests and Student's t-test for categorical and continuous variables, respectively. Data are unweighted n/N and weighted % or mean (SD).

FIGURE 1 Prevalence of suicidal ideation and suicide attempts by severity of pain. Sample size is $N = 33,345$.

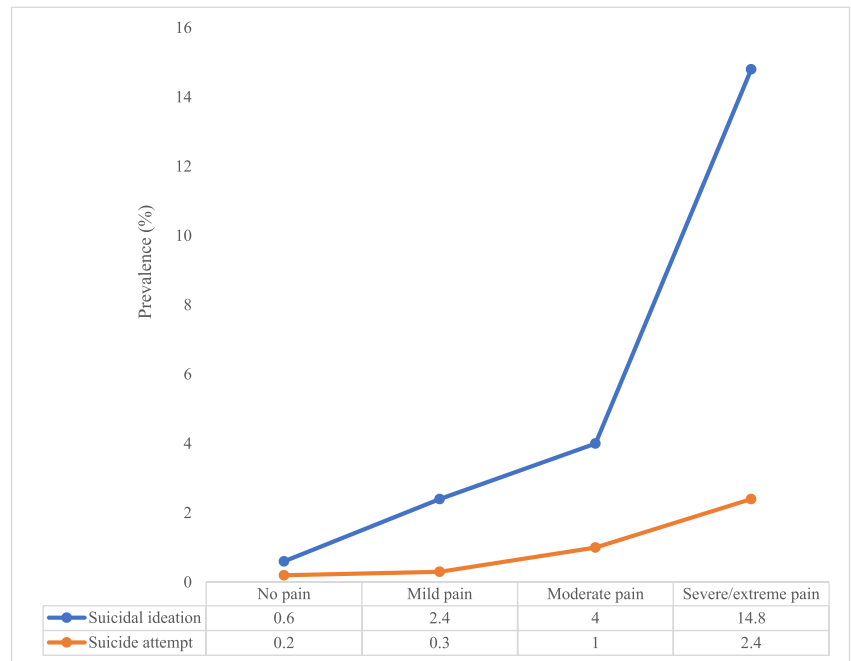


TABLE 2 Association of pain with suicidal ideation and suicide attempt estimated by multivariable logistic regression (overall and by age groups or sex).

Outcome	Pain	Overall OR	N = 31,982 95% CI	Age (years)				Sex			
				50-64 OR	N = 18,342 95% CI	≥65 OR	N = 13,640 95% CI	Male OR	N = 14,643 95% CI	Female OR	N = 17,339 95% CI
Suicidal ideation	None	1.00		1.00		1.00		1.00		1.00	
	Mild	2.83**	(1.51,5.28)	3.12**	(1.53,6.37)	2.15	(0.96,4.81)	1.42	(0.69,2.94)	3.56**	(1.55,8.19)
	Moderate	4.01***	(2.38,6.76)	4.00***	(2.11,7.58)	3.50***	(1.66,7.35)	5.31***	(2.48,11.35)	3.18***	(1.62,6.28)
	Severe/ extreme	12.26***	(6.44,23.36)	13.17***	(5.98,28.99)	10.00***	(4.55,21.94)	10.66***	(4.53,25.09)	12.81***	(5.97,27.47)
Suicide attempt	None	1.00		1.00		1.00		1.00		1.00	
	Mild	1.04	(0.39,2.72)	0.70	(0.20,2.50)	1.65	(0.46,5.96)	1.04	(0.35,3.08)	0.98	(0.27,3.58)
	Moderate	2.53	(0.95,6.70)	3.23	(0.90,11.63)	1.90	(0.48,7.45)	2.97*	(1.15,7.67)	2.06	(0.52,8.06)
	Severe/ extreme	4.68**	(1.67,13.08)	4.52*	(1.20,17.04)	5.02*	(1.16,21.63)	3.16*	(1.01,9.93)	5.09*	(1.31,19.73)

Note: Models are adjusted for age, sex, education, wealth, alcohol consumption, number of chronic physical conditions, and country, except for the sex-stratified analysis which was not adjusted for sex. Significant test for trend for all models ($p < 0.05$).

Abbreviations: CI, confidence interval; OR, odds ratio.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.00$.

example, severe/extreme pain (vs. no pain) was associated with 12.26 (95% CI = 6.44–23.36) and 4.68 (95% CI = 1.67–13.08) times higher odds for suicidal ideation and suicide attempts, respectively. Interestingly, among those who had pain, increasing severity of difficulty in daily life due to pain was dose-dependently associated with higher odds for suicidal ideation and suicide attempt, suggesting that the association between pain and suicidality is at least partly mediated by

daily life difficulties related with pain. Furthermore, we found a moderate level of between-country heterogeneity in the association between severe/extreme pain and suicidal ideation. To the best of our knowledge, this is one of the first studies on pain and suicidal thoughts or suicide attempts among older adults from LMICs, and the first multi-country study including large representative samples of older adults.

Outcome	Difficulty in daily life due to pain	OR	95% CI
Suicidal ideation (N = 19,340)	None	1.00	
	Mild	2.32	(0.90,6.00)
	Moderate	3.33*	(1.30,8.54)
	Severe/extreme	7.50***	(2.98,18.88)
Suicide attempt (N = 19,340)	None	1.00	
	Mild	6.63**	(1.77,24.81)
	Moderate	9.14***	(2.50,33.46)
	Severe/extreme	24.63***	(6.52,93.00)

TABLE 3 Association of difficulty in daily life due to pain with suicidal ideation and suicide attempt estimated by multivariable logistic regression.

Note: Those who reported no bodily aches or pains in the last 30 days were excluded. Models are adjusted for age, sex, education, wealth, alcohol consumption, number of chronic physical conditions, and country. Significant test for trend for all models ($p < 0.05$).

Abbreviations: CI, confidence interval; OR, odds ratio.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

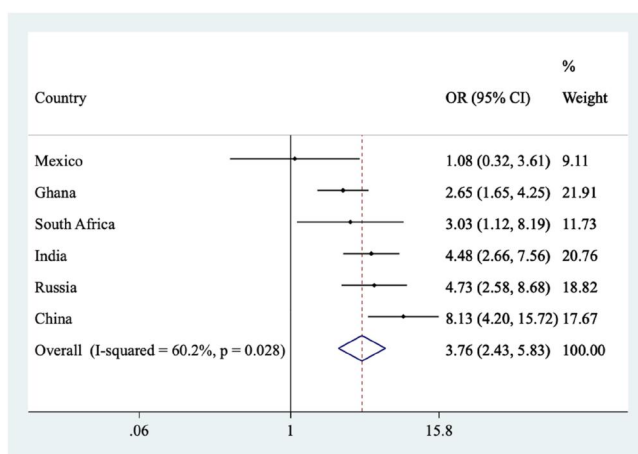


FIGURE 2 Country-wise association between severe/extreme pain and suicidal ideation (outcome) estimated by multivariable logistic regression. Abbreviations: CI, confidence interval; OR, odds ratio. Models are adjusted for age, sex, education, wealth, alcohol consumption, and number of chronic physical conditions. Overall estimate was obtained by meta-analysis with random effects. The sample size of the regression analysis for each country were as follows: China $n = 12,341$; India $n = 6508$; Ghana $n = 4209$; Mexico $n = 2200$; Russia $n = 3819$.

4.2 | Interpretation of findings

Findings from the present study support previous literature that has observed a positive association between pain and suicidality in multiple high-income countries,^{18,30} and pain and suicidal ideation in a sample of Ghanaian women.¹⁹ Our findings add to this literature through confirming that such an association holds in a very large sample of older adults from multiple LMICs.

There are several plausible pathways that likely explain the association between pain and suicidal thoughts and behavior. First, as previously discussed, pain can cause mental defeat, which is a key indicator for heightened suicide risk.⁸ Mental defeat likely heightens

suicide risk via worse functioning, and a breakdown in self-management. Moreover, defeat is aversive and the resultant urge when defeat is perceived is to escape, which thus likely leads to suicidal behaviors.⁸ The relationship between pain and suicidal thoughts and behavior may also be partly explained by depression, which is a key risk factor for suicidality.³¹ For example, depression increases the susceptibility for pain, and non-specific pain may be expressions of late-life depression. Moreover, chronic pain might result in dependence on others, loss of dignity and fear of institutionalization, contributing to depression and subsequently suicidal behaviors.¹⁸ Finally, literature has shown that pain is associated with sleep complications potentially owing to pain-induced alterations in dopamine signaling that may influence the raphe nuclei modulation of sleep and wake.³² Importantly, sleep complications have been associated with suicide behavior³³ potentially due to decreased ability of self-regulation.³⁴

Interestingly, the present study found that increasing severity of difficulty in daily life due to pain was dose-dependently associated with higher odds for suicidal thoughts and behavior. It may be hypothesized that an increase in difficulty in daily life heightens feelings of mental defeat and depression, for example, through loss of independence and feelings of being a burden, subsequently increasing risk of suicidality.

Finally, there was a moderate level of between-country heterogeneity in the association between severe/extreme pain and suicidal ideation, with this association being non-significant in Mexico. Although the reason for this can only be speculated, this may be reflecting differences in availability of treatment for pain across countries, or in the tendency of people to consider death as a way to escape from pain. For example, Mexico may have a better pain management system compared to other countries included in the present study. Specifically, in the 1970s, coordinated efforts were made across Mexico to consolidate pain clinics. These facilities are distributed nationwide and are educational centers for specialists in pain management. These pain clinics have an interdisciplinary staff conformed

by nurses, social workers, psychologists and diverse specialists.³⁵ Alternatively, it is also possible that questions on suicidal ideation and suicide attempts were interpreted differently across different cultures. Clearly, further studies are necessary to understand the reasons for the between-country heterogeneity observed.

4.3 | Implications of findings

Findings from the present study suggest that pain control measures may aid in the prevention of suicidal thoughts and behaviors among older adults residing in LMICs, possibly by directly mitigating pain, or by addressing limitation in daily activities due to pain. This may potentially have a large impact especially in the context of LMICs as more than 80% of the global population lacks access to treatments for moderate to severe pain, and the majority of these individuals live in LMICs.¹⁷ This would clearly require strong governmental and societal commitment to increase availability of pain-control treatment in LMICs. Apart from pharmacological interventions, interventions such as mind-body exercises, which have been shown to relieve pain per se³⁶ and improve activities of daily living,³⁷ may be a cost-effective and feasible intervention especially in the context of LMICs.³⁸

4.4 | Strengths and limitations

The use of a large nationally representative dataset of older adults residing in multiple LMICs is a clear strength of the present study. However, findings must be interpreted in light of the study limitations. First, the study is cross-sectional in nature, and it is thus not known whether pain leads to suicidality or vice versa. For example, it may be hypothesized that injury sustained from a suicide attempt may result in chronic pain. Second, the majority of variables were self-reported, potentially introducing social desirability and recall bias into the findings. Third, the current measure of suicidal ideation was related with wish to die, which has been differentiated from active suicidal ideation. However, a wish to die has been reported to be equally important clinically as the presence of active suicidal ideation.²² Fourth, suicidal ideation and suicide attempts were only examined in people who endorsed depressive symptoms (i.e., sadness, loss of interest or low energy). This may have resulted in an underestimation of suicidal ideation and suicide attempts, but it is worth noting that depressive symptoms are very frequently observed in suicidal thoughts and behavior.³⁹ Furthermore, due to this, it was not possible to assess the role of depression or depression severity in the association between pain and suicidal ideation or suicide attempts.

4.5 | Conclusion

In this large sample of older adults from multiple LMICs, pain was associated with substantially increased odds for suicidal ideation and

suicide attempts, dose-dependently. Future longitudinal or intervention studies that assess the impact of pain management in older adults in LMICs on suicidality are now needed.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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