

Original Article

Mediating effect of loneliness in association between smartphone use and depression among older adults in West Bengal, India: An analytical cross-sectional study

Sembagamuthu Sembiah¹, Sunom M. Lepcha^{2*}, Md AK. Gazi¹, Loknath Agasti¹, Madhu S. Nayak¹, Jagyabalya Sahu¹, Jishnu Dhali¹, Himanshu Choudhary¹, Koushik Mondal¹ and Khushi Singhanian¹

¹Department of Community Medicine and Family Medicine, All India Institute of Medical Sciences, Kalyani, India;

²Department of Community Medicine, North Bengal Medical College, Siliguri, India

*Corresponding author: smelep8@gmail.com

Abstract

Smartphone use among older adults is increasing and may influence mental well-being by improving social connection and reducing loneliness. This community-based analytical cross-sectional study assessed the association between smartphone use and depression among older adults and examined whether loneliness mediated this relationship. The study included adults aged 60 years and above from an urban community in Nadia district, West Bengal, India. Data on sociodemographic characteristics and smartphone use were collected using a pretested, semi-structured questionnaire. Depression was assessed using the Center for Epidemiologic Studies Depression Scale Revised-10 item version, while loneliness was assessed using the 8-item UCLA Loneliness Scale. Linear regression and mediation analyses were performed to evaluate the associations among smartphone use, loneliness, and depression. Overall, 153 participants (62.7%) used smartphones. Smartphone users had lower mean depression scores than non-users (14.15 ± 4.96 vs 16.61 ± 5.24) and lower mean loneliness scores (15.77 ± 5.18 vs 17.90 ± 5.23). Depression was observed in 83.7% of smartphone users and 92.3% of non-users, while loneliness was observed in 45.8% and 63.7%, respectively. Smartphone use was significantly associated with lower depression scores ($B = -2.30$; $p < 0.001$) and lower loneliness scores ($B = -2.12$; $p = 0.002$). Mediation analysis showed that loneliness partially mediated the association between smartphone use and depression, accounting for 60.7% of the total effect. These findings suggest that smartphone use may be associated with lower depressive symptoms among older adults, partly through reduced loneliness. Digital inclusion strategies that promote meaningful social connection may have potential value for public mental health interventions targeting elderly populations.

Keywords: Smartphone, elderly, mental health, loneliness, mediating effect

Introduction

The global population is aging rapidly. The number of people aged 60 years or older is projected to increase from 1 billion in 2020 to 1.4 billion by 2030 [1]. In India, the 2011 Census reported that 8.6% of the population was aged 60 years or older, and this proportion is expected to increase to 19% by 2050 [2]. Alongside this demographic transition, mental health problems among older adults have become an important public health concern. The World Health Organization estimates that approximately 14% of people aged 60 years and above have a mental illness [3].



Evidence from the Longitudinal Ageing Study in India (LASI) Wave-1 (2017–2018) showed that 13.4% of older adults reported frequent loneliness [4]. Loneliness has been associated with cognitive decline, reduced resistance to infections, and increased susceptibility to depression and dementia [5]. A systematic review among the elderly population in India reported a pooled prevalence of depression of 34.4% [2]. The COVID-19 pandemic has further increased the global burden of depression and has also accelerated the use of smartphones [6,7].

Mental health in later life is influenced by several interrelated factors. Older adults often experience challenges related to physical aging, reduced social interaction, financial dependency, loneliness, and illness-related disability, all of which may contribute to depression [8,9]. In India, rapid urbanization may further weaken family connections and traditional social support systems, thereby affecting the social and mental well-being of older adults [10]. In this context, modern technologies such as smartphones may play an increasingly important role in the lives of elderly populations.

Smartphones and advances in wireless technology have enabled on-demand access to healthcare services through health-tracking applications and online search platforms [11]. Smartphone use may also enhance social connections, strengthen relationships with family and friends, and help reduce feelings of loneliness, isolation, and depression [12,13]. However, smartphone use may also have adverse effects when excessive or problematic, with previous studies linking it to poorer sleep quality, depression, and anxiety [14–16]. Among older adults, the reported prevalence of smartphone use varies widely, ranging from 26.4% to 80.9% across studies [11,16,17].

In India, research on digital interventions and smartphone use in relation to mental health among older adults remains limited. Existing international literature suggests that smartphone use may contribute positively to psychological well-being, but the mechanisms underlying this relationship are not fully understood [11,12,13]. In particular, the role of loneliness as a mediator between smartphone use and depression remains underexplored in the Indian context. Therefore, the present study aimed to assess the mediating role of loneliness in the relationship between smartphone use and depression among older adults.

Methods

Study design and setting

This community-based analytical cross-sectional study was conducted in an urban community in Nadia district, West Bengal, India. Data collection was carried out from September to October 2025 through house-to-house visits. The target population comprised community-dwelling older adults aged 60 years and above who resided in the selected urban community during the study period.

Participants and criteria

Participants were eligible if they were aged 60 years or older, resided in the selected community, and were able to comprehend and respond to the interview questions. Bedridden or severely ill individuals, those unable to comprehend the interview, and those with communication difficulties that prevented reliable questionnaire completion were excluded. Individuals who did not provide consent were not enrolled in the study.

Sample size and sampling method

The required sample size was estimated based on a previous study that reported a smartphone use prevalence of 34.9% among older adults [17]. Using a 95% confidence level, 20% relative precision, and an anticipated non-response rate of 10%, the minimum required sample size was 208 participants. To improve precision and account for possible incomplete responses, the final sample size was increased to 244 participants. Participants were recruited using convenience sampling through house-to-house visits in the selected urban community. During each visit, older adults who met the eligibility criteria were invited to participate until the required sample size was achieved.

Study instruments

Data were collected using a pretested, semi-structured questionnaire administered through face-to-face interviews. The questionnaire included sections on sociodemographic characteristics, smartphone use, depressive symptoms, and loneliness. Sociodemographic variables included age, sex, marital status, educational status, monthly income, and socioeconomic status. Smartphone use was assessed using structured questions on current smartphone use, recorded as yes or no, and average daily duration of use among smartphone users.

Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale Revised-10 item version (CESD-R-10), a validated 10-item self-reported instrument [18]. Each item is scored from 0 to 3, giving a total score range of 0–30, with higher scores indicating greater depressive symptoms. A total score of ≥ 10 was considered indicative of depression.

Loneliness was assessed using the 8-item short form of the UCLA Loneliness Scale (ULS-8) [19]. Each item is scored from 1 to 4, giving a total score range of 8–32, with higher scores indicating greater loneliness. Participants with a score of ≥ 16 were classified as lonely, whereas those with a score < 16 were classified as not lonely [20].

The questionnaire was translated from English into Bengali by two independent experts and then back-translated into English by two other experts. The translated version was reviewed for face and content validity to ensure clarity, cultural appropriateness, and semantic equivalence with the original instruments.

Study variables

The primary outcome variable was depressive symptoms, assessed using the CESD-R-10 total score. Depression status was also categorized using a cut-off score of ≥ 10 . The main independent variable was smartphone use, classified as yes or no. Loneliness was evaluated as the mediator variable using the ULS-8 total score, and loneliness status was categorized using a cut-off score of ≥ 16 .

For regression analysis, depression and loneliness scores were treated as continuous dependent variables. Age, sex, education, monthly income, and smartphone use were included as independent variables. For mediation analysis, smartphone use was entered as the independent variable, loneliness score as the mediator, and depression score as the dependent variable.

Data collection

Eligible older adults were identified during household visits according to the predefined eligibility criteria. Written informed consent was obtained before the interview. Face-to-face interviews were conducted in Bengali using the pretested questionnaire, preferably in a private setting to maintain confidentiality and minimize response bias. Each interview lasted approximately 15 minutes.

Data collection was carried out by trained medical students who had received prior instruction on the study protocol, interview procedures, questionnaire administration, ethical considerations, and communication with older adults. At the end of each day, completed questionnaires were reviewed by the investigators for completeness and consistency. The data were coded and anonymized by removing personal identifiers, entered into Microsoft Excel 2013, and checked regularly to minimize data entry errors before statistical analysis.

Statistical analysis

Statistical analysis was performed using Jamovi version 2.7 (The Jamovi Project, Sydney, Australia). Descriptive statistics were used to summarize participant characteristics, smartphone use, depressive symptoms, and loneliness. Continuous variables were presented as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages.

The prevalence of smartphone use, depression, and loneliness was calculated. Mean CESD-R-10 depression scores and ULS-8 loneliness scores were compared between smartphone users and non-users using independent samples t-tests. Differences in categorical depression and loneliness status according to smartphone use were assessed using chi-square test or Fisher's exact test, as appropriate.

Linear regression analysis was performed to identify factors associated with depression and loneliness scores. Age, sex, education, monthly income, and smartphone use were included as independent variables. Results were reported as unstandardized regression coefficients (B), standard errors (SE), standardized β coefficients, 95% confidence intervals (95%CI), and p-values. Regression assumptions, including normality of residuals, linearity, homoscedasticity, independence of errors, and multicollinearity, were assessed before analysis. Multicollinearity was evaluated using variance inflation factor (VIF) values.

Mediation analysis was conducted to assess whether loneliness mediated the association between smartphone use and depression. Smartphone use was entered as the independent variable, loneliness score as the mediator, and depression score as the dependent variable. The indirect effect was estimated using bootstrapping with 5,000 resamples. Total, direct, and indirect effects were reported with SE, 95%CI, Z-values, and p-values. The proportion of the total effect mediated by loneliness was also calculated. A two-tailed $p < 0.050$ was considered statistically significant.

Results

Sociodemographic characteristics and smartphone use

A total of 244 older adults were included in the study and their characteristics are presented in **Table 1**. The mean age of the participants was 62.4 ± 5.9 years, and most participants were aged 60–69 years. The majority of participants were male and married. Based on educational status, graduate-level education was the most common category, followed by illiteracy and secondary education. Most participants belonged to the middle or lower-middle socioeconomic class. More than half of the participants used smartphones. Among smartphone users, the mean duration of smartphone use was 3.4 ± 1.7 hours per day, and most reported using smartphones for at least two hours daily (**Table 1**).

Table 1. Sociodemographic characteristics and smartphone use patterns among older adults included in the study (n=244)

Variables	Frequency (%)
Age (years)	
60–69	185 (75.8)
70–79	54 (22.1)
≥80 years	5 (2.1)
Sex	
Male	184 (75.4)
Female	60 (24.6)
Marital Status	
Married	221 (90.6)
Widow/widower	21 (8.6)
Unmarried	2 (0.8)
Education	
Illiterate	40 (16.4)
Primary	30 (12.3)
Middle	33 (13.5)
Secondary	40 (16.4)
Senior secondary	26 (10.7)
Graduate	53 (21.7)
Postgraduate	22 (9.0)
Socio-economic status (as per modified BG Prasad scale)	
Upper	1 (0.4)
Upper middle	32 (13.1)
Middle	105 (43.1)
Lower middle	106 (43.4)
Smartphone use	
Yes	153 (62.7)
No	91 (37.3)
Duration of smartphone usage (in hours) n=153	
<2	11 (7.2)
≥2	142 (92.8)
Mean duration 3.4 ± 1.7	

Depression and loneliness according to smartphone use

The mean depression score was lower among smartphone users than among non-users and similarly, the mean loneliness score was lower among smartphone users than among non-users (**Table 2**). Independent samples t-test analysis showed that mean CESD-R-10 depression scores differed significantly according to smartphone use. Smartphone users had lower mean depression scores than non-users (14.15 ± 4.96 vs 16.61 ± 5.24 ; $p < 0.001$). A similar pattern was observed for loneliness, where smartphone users had significantly lower mean UCLA loneliness scores than non-users (15.77 ± 5.18 vs 17.90 ± 5.23 ; $p = 0.002$) (**Table 2**).

Table 2. Comparison of CESD-R-10 depression scores and UCLA loneliness scores according to smartphone use among older adults (n=244)

Smartphone use	Total n (%)	CESD score Mean $\pm$ SD	UCLA score Mean $\pm$ SD
Yes	153 (62.7)	14.15 $\pm$ 4.96	15.77 $\pm$ 5.18
No	91 (37.3)	16.61 $\pm$ 5.24	17.90 $\pm$ 5.23
p-value ^a		<0.001*	0.002*

^a Analyzed using independent samples t-test

* Statistically significant at $p < 0.01$

When depression and loneliness were categorized, most participants in both groups were classified as depressed (**Table 3**). However, the proportion of depression was lower among smartphone users than among non-users (83.7% vs 92.3%), although this difference did not reach statistical significance ($p = 0.053$). In contrast, loneliness status differed significantly according to smartphone use. The proportion of participants classified as lonely was lower among smartphone users than among non-users (45.8% vs 63.7%; $p = 0.007$). More than half of smartphone users were classified as non-lonely, compared with only 36.3% of non-users (**Table 3**).

Table 3. Distribution of depression and loneliness status according to smartphone use among older adults (n=244)

Smartphone use	Depression status, n (%)		p-value	Loneliness status, n (%)		p-value
	Depressed	Non-depressed		Lonely	Non-lonely	
Yes	128 (83.7)	25 (16.3)	0.053	70 (45.8)	83 (54.2)	0.007*
No	84 (92.3)	7 (7.7)		58 (63.7)	33 (36.3)	

* Statistically significant at $p < 0.01$

Predictors of depression and loneliness

In the linear regression analysis, female sex ($B = -1.10$; 95%CI: -2.08 to -0.12; $p = 0.020$), higher education level ($B = -0.20$; 95%CI: -0.34 to -0.06; $p < 0.01$), higher monthly income ($B = -0.0005$; 95%CI: -0.0009 to -0.0001; $p = 0.010$), and smartphone use ($B = -2.30$; 95%CI: -3.20 to -1.40; $p < 0.001$) were significantly associated with lower depression scores. Age was not significantly associated with depression ($B = 0.110$; 95%CI: -0.015 to 0.235; $p = 0.080$) (**Table 4**).

For loneliness, older age was significantly associated with higher loneliness scores ($B = 0.10$; 95%CI: 0.02 to 0.18; $p = 0.010$). In contrast, higher education level ($B = -0.25$; 95%CI: -0.37 to -0.13; $p < 0.001$), higher monthly income ($B = -0.0004$; 95%CI: -0.0007 to -0.0001; $p = 0.012$), and smartphone use ($B = -2.12$; 95%CI: -3.48 to -0.77; $p = 0.002$) were significantly associated with lower loneliness scores. Sex was not significantly associated with loneliness ($B = 1.06$; 95%CI: -0.49 to 2.61; $p = 0.180$) (**Table 4**).

Mediating role of loneliness in the association between smartphone use and depression

Mediation analysis was performed to determine whether loneliness mediated the association between smartphone use and depression among older adults. The total effect of smartphone use on depression was significant ($B = -2.459$; SE=0.691; 95%CI: -3.790 to -1.072; $p < 0.001$), indicating that smartphone users had lower depression scores than non-users before accounting for loneliness. After loneliness was included in the model, the direct effect of smartphone use on depression remained statistically significant, although the effect size was reduced ($B = -0.966$; SE=0.490; 95%CI: -1.941 to -0.039; $p = 0.049$).

Table 4. Linear regression analysis showing predictors of depression and loneliness among older adults (n=244)

Predictor	Depression				Loneliness			
	B (SE)	95%CI	Standardized β	p-value	B (SE)	95%CI	Standardized β	p-value
Intercept	7.812 (4.23)	-0.53 to 16.15	—	0.060	16.31 (0.39)	15.54 to 17.08	—	<0.001**
Age (in years)	0.110 (0.064)	-0.015 to 0.235	0.110	0.080	0.10 (0.04)	0.02 to 0.18	0.22	0.010*
Female (vs male)	-1.10 (0.50)	-2.08 to -0.12	-0.21	0.020*	1.06 (0.79)	-0.49 to 2.61	0.086	0.180
Education (years)	-0.20 (0.07)	-0.34 to -0.06	-0.25	<0.001**	-0.25 (0.06)	-0.37 to -0.13	-0.30	<0.001**
Monthly income (₹)	-0.0005 (0.0002)	-0.0009 to -0.0001	-0.19	0.010**	-0.0004 (0.0001)	-0.0007 to -0.0001	-0.17	0.012*
Smartphone use (Yes)	-2.30 (0.45)	-3.20 to -1.40	-0.35	<0.001**	-2.12 (0.69)	-3.48 to -0.77	-0.40	0.002**

* Statistically significant at $p < 0.05$ ** Statistically significant at $p < 0.01$

The indirect effect through loneliness was also significant ($B = -1.492$; $SE = 0.488$; 95%CI: -2.440 to -0.503 ; $p = 0.002$), accounting for 60.7% of the total effect. These findings indicate that loneliness partially mediated the relationship between smartphone use and depression, suggesting that the association between smartphone use and lower depression scores was partly explained by lower loneliness among smartphone users (**Table 5**).

Table 5. Total, direct, and indirect effects of smartphone use on depression through loneliness among older adults

Effect type	Effect size	SE	95%CI	Z	p-value	% of total effect
Total Effect	-2.459	0.691	-3.790 to -1.072	-3.56	<0.001**	100.0
Direct Effect	-0.966	0.490	-1.941 to -0.039	-1.97	0.049*	39.3
Indirect Effect	-1.492	0.488	-2.440 to -0.503	-3.06	0.002**	60.7

SE: standard error; CI: confidence interval; Z: z-score

* Statistically significant at $p < 0.05$

** Statistically significant at $p < 0.01$

The path estimates further supported this mediation model. Smartphone use was significantly associated with lower loneliness scores ($B = -2.123$; $SE = 0.691$; 95%CI: -3.441 to -0.716 ; $p = 0.002$), while loneliness was significantly associated with higher depression scores ($B = 0.703$; $SE = 0.047$; 95%CI: 0.604 to 0.790 ; $p < 0.001$). The direct pathway from smartphone use to depression also remained significant ($B = -0.966$; $SE = 0.490$; 95%CI: -1.941 to -0.039 ; $p = 0.049$), confirming partial rather than full mediation. Overall, these results suggest that smartphone use may be associated with lower depressive symptoms both directly and indirectly through reduced loneliness (**Table 6**).

Table 6. Path estimates for the mediation model examining loneliness as a mediator between smartphone use and depression

Path	Estimate	SE	95%CI	Z	p-value
Smartphone use → loneliness	-2.123	0.691	-3.441 to -0.716	-3.07	0.002**
Loneliness → depression	0.703	0.047	0.604 to 0.790	14.82	<0.001**
Smartphone use → depression	-0.966	0.490	-1.941 to -0.039	-1.97	0.049*

Mediation analysis was conducted using the product of coefficients method with bootstrapping to estimate indirect effects. All variables were entered simultaneously with loneliness as the mediator between smartphone use and depression. All paths were statistically significant, indicating partial mediation.

SE: standard error; CI: confidence interval; Z: z-score

* Statistically significant at $p < 0.05$

** Statistically significant at $p < 0.01$

Discussion

This study found that more than half of the older adults used smartphones (62.7%), indicating relatively high smartphone use in the selected urban community of West Bengal. Previous studies have reported varying levels of smartphone use among older adults, ranging from 26.4% to 80.9% [11,16,17]. These differences may be explained by variations in study setting, sampling method, socioeconomic conditions, and access to digital technology. The present study was conducted in an urban community, where smartphone access and digital exposure may be higher than in rural settings. In contrast, studies based on national surveys may include populations with more diverse socioeconomic status, digital access, and urban–rural representation [11,17]. Similarly, higher smartphone use reported in metropolitan settings may reflect better living standards, stronger digital infrastructure, and greater familiarity with technology [16].

Although depression was common among smartphone users, the proportion of depression was lower among smartphone users than among non-users. Smartphone users also had lower mean depression scores, suggesting that smartphone use may be associated with reduced depressive symptoms among older adults. A previous study from Korea reported a lower prevalence of depressive symptoms than the present study [20]. This difference may be related to variations in study design, population characteristics, and depression assessment methods. The Korean study assessed depressive feelings using a single question, whereas the present study used the CESD-R-10 scale, which captures a broader range of depressive symptoms. Therefore,

differences in measurement tools may partly explain the higher prevalence of depression observed in this study.

Loneliness also differed according to smartphone use. In the present study, 45.8% of smartphone users were classified as lonely, while 54.2% were not lonely. This suggests that a substantial proportion of smartphone users did not experience loneliness. A study among older adults in Helsinki reported that approximately 30% experienced loneliness [21]. The higher proportion observed in the present study may reflect differences in cultural setting, family structure, social support, socioeconomic conditions, and measurement tools. In India, changes in family structure, urbanization, migration of younger family members, and reduced social engagement may increase vulnerability to loneliness among older adults.

Several sociodemographic factors were associated with depression and loneliness. Sex, education, monthly income, and smartphone use were significantly associated with depression scores. Higher education and higher socioeconomic status have been linked to lower depression among older adults, possibly through better health literacy, coping resources, financial security, and access to healthcare [22]. Sex differences in depression among older adults have also been reported, and may be influenced by biological, psychosocial, and sociocultural factors, including gender roles, widowhood, economic dependency, and caregiving burden [23,24]. In the present study, age, education, monthly income, and smartphone use were significantly associated with loneliness scores. Older age, lower educational attainment, and lower socioeconomic status may increase loneliness through reduced mobility, fewer social opportunities, financial limitations, and weaker access to supportive networks [25-27].

The main finding of this study was that loneliness partially mediated the association between smartphone use and depression. This indicates that smartphone use was associated with lower depression scores both directly and indirectly through lower loneliness. Smartphones may help older adults maintain communication with family members, friends, and community networks, thereby reducing social isolation. They may also provide access to health information, teleconsultation, entertainment, religious content, and learning opportunities, which may support emotional well-being and daily engagement [10]. Similar evidence suggests that digital engagement may reduce depression among older adults by alleviating loneliness [28]. Therefore, digital connectivity may serve as a useful pathway for improving mental health among elderly populations, particularly by enhancing meaningful social interaction and access to support.

Despite these findings, the results should be interpreted with caution. The cross-sectional design does not allow causal inference, and it remains unclear whether smartphone use reduces depression and loneliness or whether older adults with better mental health are more likely to use smartphones. The study was conducted in a single urban locality in Nadia district, West Bengal, and participants were recruited using convenience sampling; therefore, the findings may not be generalizable to all older adults. Selection bias may also have occurred because individuals who were available and willing to participate may differ from those who were not included. In addition, smartphone use was measured only by use status and average daily duration, without assessing the purpose, frequency, quality, or type of smartphone activities. Different patterns of smartphone use, such as social communication, health-related use, passive browsing, or excessive use, may have different effects on loneliness and depression. Other important factors, including financial independence, family relationships, bereavement, social participation, chronic illness, COVID-19-related experiences, and quality of social support, were not assessed. Future longitudinal studies using more detailed measures of smartphone engagement are needed to confirm these findings and clarify the mechanisms linking smartphone use, loneliness, and depression among older adults.

Conclusion

This study found that smartphone use was common among older adults in the selected urban community of West Bengal. Although depression remained highly prevalent, smartphone users had lower depression and loneliness scores than non-users. Mediation analysis showed that loneliness partially mediated the association between smartphone use and depression, accounting for 60.7% of the total effect. These findings suggest that smartphone use may be associated with lower depressive symptoms partly through reduced loneliness. Digital inclusion

strategies for older adults, particularly those that promote meaningful social connection and access to supportive services, may have potential as public mental health interventions. However, further longitudinal studies are needed to confirm the direction and causality of these associations.

Ethics approval

Ethical approval was obtained from the Institutional Ethics Committee of All India Institute of Medical Sciences (Letter No. IEC/AIIMS/Kalyani/certificate/2025/351). Personal identifiers and information of the study participants were kept confidential by the primary investigator.

Acknowledgments

The authors would like to thank all participants in this study, as well as the MBBS batch of 2021 (batch C) of the institute, for their valuable contributions.

Competing interests

All authors declare no conflicts of interest.

Funding

This study received no external funding.

Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

Declaration of artificial intelligence use

This study used an artificial intelligence (AI)-based language model (QuillBot) to refine the language. Authors confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

How to cite

Sembiah S, Lepcha SM, Gazi MAK, *et al.* Mediating effect of loneliness in association between smartphone use and depression among older adults in West Bengal, India: An analytical cross-sectional study. Narra J 2026; 6 (2): e3098 - <http://doi.org/10.52225/narra.v6i2.3098>.

References

1. World Health Organization. Ageing and health. Available from: <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>. Accessed: 21 July 2025.
2. Pilia M, Yadav V, Bairwa M, *et al.* Prevalence of depression among the elderly (60 years and above) population in India, 1997–2016: a systematic review and meta-analysis. BMC Public Health 2019;19:832.
3. World Health Organization. Mental health of older adults. Available from: <https://www.who.int/news-room/fact-sheets/detail/mental-health-of-older-adults>. Accessed: 21 July 2025.
4. Srivastava P, Srivastava M. Prevalence and correlates of loneliness in the later life—insights from Longitudinal Ageing Study in India (LASI) Wave-1. Indian J Psychiatry 2023;65:914–921.
5. Fakoya OA, McCorry NK, Donnelly M. Loneliness and social isolation interventions for older adults: A scoping review of reviews. BMC Public Health 2020;20:129.
6. World Health Organization. COVID-19 pandemic triggers 25% increase in prevalence of anxiety and depression worldwide. Available from: <https://www.who.int/news/item/02-03-2022-covid-19-pandemic-triggers-25-increase-in-prevalence-of-anxiety-and-depression-worldwide>. Accessed: 21 July 2025.
7. Tyagi A, Prasad AK, Bhatia D. Effects of excessive use of mobile phone technology in India on human health during COVID-19 lockdown. Technol Soc 2021;67:101762.

8. Debnath A, Sandooja C, Kishore J. Depression and associated factors among older adults in a North Indian state: A cross-sectional study. *Cureus* 2023;15(3):e35962.
9. Chandra PS, Shiva L, Nanjundaswamy MH. The impact of urbanization on mental health in India. *Curr Opin Psychiatry* 2018;31:276-281.
10. Bohr A, Memarzadeh K. The rise of artificial intelligence in healthcare applications. In: *Artificial intelligence in healthcare*. 1st ed. Cambridge: Academic Press; 2020.
11. Ji R, Chen WC, Ding MJ. The contribution of the smartphone use to reducing depressive symptoms of Chinese older adults: The mediating effect of social participation. *Front Aging Neurosci* 2023;15:1132871.
12. Yang CC, Li CL, Yeh TF, et al. Assessing Older Adults' Intentions to Use a Smartphone: Using the Meta-Unified Theory of the Acceptance and Use of Technology. *Int J Environ Res Public Health* 2022;19:5403.
13. Khan A, McLeod G, Hidajat T, Edwards EJ. Excessive smartphone use is associated with depression, anxiety, stress, and sleep quality of Australian adults. *J Med Syst* 2023;47(1):109.
14. Busch PA, McCarthy S. Antecedents and consequences of problematic smartphone use: A systematic literature review of an emerging research area. *Comput Human Behav* 2021;114:106414.
15. Tian H, Wang Y. Mobile phone addiction and sleep quality among older people: The mediating roles of depression and loneliness. *Behav Sci* 2023;13:153.
16. Ding L, Li Z, Jiang H, *et al*. Mobile phone problem use and depressive symptoms: The mediating role of social support and attitude to aging among Chinese older adults. *BMC Psychiatry* 2024;24:135.
17. Liang X, Xiong F, Xie F. The effect of smartphones on the self-rated health levels of the elderly. *BMC Public Health* 2022;22:508.
18. Brandeis University. Center for epidemiologic studies depression scale (Revised). 1994. Available from: https://www.brandeis.edu/roybal/docs/CESD-10_website_PDF.pdf. Accessed: 5 June 2025
19. University of California. UCLA Loneliness Scale (ULS8). Available from: https://labs.dgsom.ucla.edu/hays/files/index?folder_id=48891&format=table&orderby=type%2Casc. Accessed: 25 July 2025.
20. Sagong H, Yoon JY. The effects of smartphone use on life satisfaction in older adults: The mediating role of depressive symptoms. *Comput Inform Nurs* 2022;40:523-530.
21. Knuutila M, Jansson A, Rautiainen L, *et al*. Associations of use of smartphone and internet technologies with loneliness. *J Am Geriatr Soc* 2023;71(10):3331-3333.
22. Devagappanavar G, ManojKumar KN. Estimation of prevalence of depression among elderly population in Ron Taluk, Karnataka, South India. *Discov Public Health* 2026;23(1):792.
23. Girgus JS, Yang K, Ferri CV. The gender difference in depression: Are elderly women at greater risk for depression than elderly men? *Geriatrics* 2017;2(4):35.
24. Paul R, Muhammad T, Rashmi R, *et al*. Depression by gender and associated factors among older adults in India: Implications for age-friendly policies. *Sci Rep* 2023;13(1):17651.
25. Damor N, Yogesh M, Makwana N, *et al*. Prevalence and predictors of loneliness and its association with health-seeking behaviors among the elderly population, Gujarat, A community-based cross-sectional study. *J Family Med Prim Care* 2024;13(7):2719-2723.
26. Srivastava P, Srivastava M. Prevalence and correlates of loneliness in the later life—insights from Longitudinal Ageing Study in India (LASI) Wave-1. *Indian J Psychiatry* 2023;65(9):914-921.
27. Mehra A, Agarwal A, Bashar M, *et al*. Prevalence of loneliness in older adults in rural population and its association with depression and caregiver abuse. *Indian J Psychol Med* 2024;46(6):564-569.
28. Liu Z, Li Z. Relationships between digital engagement and the mental health of older adults: Evidence from China. *PLoS One* 2024;19:e0308071.