BMJ Open Socioeconomic and health-related inequalities in major depressive symptoms among older adults: A Wagstaff’s decomposition analysis of data from the LASI baseline survey, 2017–2018

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ABSTRACT

Objectives To find out the association between socioeconomic and health status and depression among older adults and explore the contributing factors in the socioeconomic and health-related inequalities in late-life depression.

Design A cross-sectional study was conducted using large representative survey data.

Setting and participants Data for this study were derived from the baseline wave of the Longitudinal Ageing Study in India conducted during 2017–2018. The effective sample size was 30888 older adults aged 60 years and above.

Primary and secondary outcome measures The outcome variable in this study was depression among older adults. Descriptive statistics along with bivariate analysis was conducted to report the preliminary results. Multivariable binary logistic regression analysis and Wagstaff’s decomposition were used to fulfill the objectives of the study.

Results There was a significant difference for the prevalence of depression (4.3%; p<0.05) among older adults from poor (11.2%) and non-poor categories (6.8%). The value of the Concentration Index was −0.179 which also confirms that the major depression was more concentrated among poor older adults. About 38.4% of the socioeconomic and health-related inequality was explained by the wealth quintile for major depression among older adults. Moreover, about 26.6% of the inequality in major depression was explained by psychological distress. Self-rated health (SRH), difficulty in activities of daily living (ADL) and instrumental ADL (IADL) contributed 8.7%, 3.3% and 4.8% to the inequality, respectively. Additionally, region explained about 23.1% of inequality followed by life satisfaction (11.2) and working status (9.8%) for major depression among older adults.

Conclusions Findings revealed large socioeconomic and health-related inequalities in depression in older adults which were especially pronounced by poor household economy, widowhood, poor SRH, ADL and IADL difficulty, and psychological distress. In designing prevention programmes, detection and management of older adults with depression should be a high priority, especially for those who are more vulnerable.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The study uses a large nationally representative sample of the older population.
⇒ A comprehensive scale was used to measure the depression among older adults.
⇒ The cross-sectional design is a limitation of the study as it is impossible to establish the observed directions of the relationships.

BACKGROUND

The WHO estimates that the proportion of older adults would double from 12% to 22% and that low-income and middle-income countries will be home to 80% of all older adults by 2050. Similarly in India, it is estimated that the population of older adults will double by the year 2050 and is expected to reach 19% of the total population.

Increasing age reduces both physical and mental wellness. Studies have shown that older adults are highly prone to mental illness because of biological and socioeconomic factors. Mental health conditions affect the quality of life, and could also lead to morbidity and premature mortality. One of the common mental disorders in late life is depression, which has devastating consequences and therefore becomes a serious public health concern. Globally, around 322 million people suffer from depression. In 2010, depression alone accounted for the second global disease burden and it was also projected to be the key cause of years lived with disability in 2020. Numerous studies have been carried out to estimate the overall
A higher rate of depression at 43%. A higher pooled study among the older population in Iran also estimated and widowhood among women. Hence, educational be partly explained through health problems, poverty is higher in women than in men. This high rate could further, social comparisons stemming from income reduce social cohesion and capital, thus increasing stress. The potential mechanisms of economic inequality in mental health can be the insufficient expenditure on healthcare services. Additionally, higher inequality can reduce social cohesion and capital, thus increasing stress. Further, social comparisons stemming from income inequality can cause various psychosocial and physiological issues.

The role of education, occupation and income cannot be used interchangeably in understanding health. Each one of these point to different phenomena and reflect different mechanisms underlying the social inequality in health. With regard to mental health, educational attainment reflects and relates to cognitive ability, self-efficacy, values that shape mental health related behaviour, coping strategy and the use of mental health services. Similarly, occupation can affect mental health in various ways. It can expose one to psychosocial stress due to lack of work, job strain, lack of balance between work-related effort and reward, low occupational social prestige, and so on. Furthermore, the prevalence of depression is higher in women than in men. This high rate could be partly explained through health problems, poverty and widowhood among women. Hence, educational status, gender/ethnic group, functional limitations, hearing difficulty, physical disability, perceived income inadequacy and living arrangement were significant correlates of depression and psychological distress among the young population and older adults. Studies in low-income and middle-income countries revealed that female older adults, those living in urban areas, those with lower educational attainment and lower household wealth, and those who have never worked in the past were found to have higher prevalence of depression. The same study has also found that increasing education was found to be significant in lowering the odds of depression in India.

Furthermore, findings from a previous study has revealed that older women living without a spouse in a nuclear family and living alone were more strongly associated with depressive symptoms. A Vietnamese study revealed that the distribution of depression (slight, moderate and major) varied among older adults according to the age group, alcohol use, physical activity, medicine intake, quality of life and some components of social connectedness. Thus, due to increasing availability of cross-country data sets, previous evidence suggests that social inequality and health are bound to specific country contexts and the policy environment and they can influence health through various channels. Although depression is a major health problem among older adults, it is yet to be recognised as a public health issue. Often, depression among older adults remains hidden and untreated, which ultimately leads to declined quality of life. Studies have firmly established that illnesses in the middle and later life are shaped by the development processes experienced in the different stages of life. Furthermore, literature has also supported the fact that older people who have experienced differential socioeconomic status might experience large inequality in depression. In addition, studies on the association between socioeconomic and health status and inequality are scarce. Therefore, insights from studies oriented in this direction can help in developing intervention tools and determining the inter-relationships that can help plan better policies and service delivery mechanisms, thus improving the quality of life of older adults.

Figure 1 represents the theoretical framework for the study. In this study, we aim to bridge the gap in the literature with the objective of finding the association between socioeconomic and health status and depression among older adults and explore the contributing factors in the inequalities in late-life depression. Moreover, this study has also employed Wagstaff’s decomposition analysis, a widely used method for studying income inequality determinants for understanding late-life mental health inequality in India.

**METHODS**

**Data**

This study makes use of data from India’s first nationally representative longitudinal ageing survey (Longitudinal Ageing Study in India (LASI), 2017–2018), which looks into the health, economic, and social determinants and repercussions of population ageing in the country. Except for Sikkim, the sample includes 72,250 people aged 45 years and up, as well as their spouses, from all Indian states and union territories. To choose the final units of observation, the LASI uses a multistage stratified area probability cluster sampling design. The last unit of observation was households with at least one member aged 45 years or older. This survey offers empirical
evidence on demographics, household economic status, chronic health issues, symptom-based health conditions, functional and mental health, biomarkers, healthcare utilisation, work and employment, and more. It was created to analyse the impact of altering policies and behavioural outcomes in India, and it allows for cross-state and cross-national evaluations of ageing, health, economic status and social behaviours. The LASI Wave 1 report contains detailed information about the sampling frame. Older persons, aged 60 years and up, were simply included for the purpose of analysis. After removing 576 missing cases, the study’s effective sample size was 30,888 older individuals.43

**Variable description**

**Outcome variable**

The outcome variable for the study was depression which was coded as 0 for ‘not diagnosed with depression’ and 1 for ‘diagnosed with depression’.43 Major depression among older adults with symptoms of dysphoria was calculated using the Composite International Diagnostic Interview - Short Form (CIDI-SF) on a scale of 0–10. This scale estimates a probable psychiatric diagnosis of major depression and has been validated in field settings and widely used in population-based health surveys.44,45 It has 10 questions and respondents with positive answers to 3 or more symptoms are considered ‘depressed’. The scale was validated for older adults.

The questions which were used to assess depression are as follow:

1. During the last 12 months, was there ever a time when you felt sad, blue or depressed for 2 weeks or more in a row?
2. Please think of the 2-week period during the last 12 months when these feelings were worst. During that time did the feelings of being sad, blue or depressed usually last all day long, most of the day, about half the day or less than half the day?
3. During those 2 weeks, did you feel this way every day, almost every day or less often than that?
4. Did you lose interest in most things?
5. Did you ever feel more tired out or low in energy than is usual for you?
6. Did you lose your appetite?
7. During the same 2-week period did you have a lot more trouble concentrating than usual?
8. People sometimes feel down on themselves, and no
good or worthless. During that 2-week period, did
you feel this way?
9. Did you think a lot about death—either your own,
someone else’s or death in general—during those
2 weeks?
10. Did you have more trouble falling asleep than you
usually do during those 2 weeks?

Equity stratifier

Wealth Index was calculated using variables related to
household assets, amenities and housing quality. For
constructing the Wealth Index in LASI, we have used
a similar approach that is being used in Demographic
Health Surveys.46 To construct the Wealth Index, we have
used a set of 46 variables that cover the broad domains
of the household’s wealth and amenities and access to
financial institutions. We have used principal component
analysis to construct the composite Wealth Index. We
observed that the first principal component with an eigen-
value of 7.2 has explained around 16% of the variance.47

The factor scores of the variables were used as the weight
in constructing the overall composite index. The five
wealth quintiles were derived from the overall composite
score: poorest, poorer, middle, richer and richest. These
quintiles were based on the household’s distribution, and
population weight is adjusted for the household size in
generating the composite Wealth Index. The reliability of
the estimates has been carried out by 

KMO of

=0.82 indicates the reliability of the Wealth Index.
Moreover, the Kaiser-Meyer-Olkin (KMO) test was used
to measure sampling adequacy of the factor extracted. A
KMO of >0.6 confirms sampling adequacy.50 The descrip-
tion of the variables included in calculating the Wealth
Index is as follows:

Housing quality: number of rooms, separate kitchen,
the monetary value of the house.
Household amenity: water and toilet facilities in the
household, availability of the electricity and cooking
fuel.
Consumer durables: cars, scooters, motorcycles, bicy-
cles, mopeds, refrigerators, computers, washing ma-
chines, laptops, stereo systems, cameras, camcorders,
fans, coolers, air conditioners, mobile phones, musical
instruments, jewellery, precious metals (gold, silver)
and ornaments, antiques, valuable paintings, televi-
sions, sewing machines, radios/transistors, water puri-
fiers, juicer and mixtures, microwave oven.
Others: saving accounts, postal accounts, certificate of
deposits or other depository products, stocks, mutual
funds or shares in companies, and bonds.
Finally, the wealth quintile was categorised as poor
which includes poorest and poorer category and non-
poor which includes middle, richer and richest.

Explanatory variables

Individual factors

1. Age was categorised as young-old (60–69 years), old-
old (70–79 years) and oldest-old (80+ years).51
2. Sex was categorised as male and female.
3. Educational status was categorised as no education/
primary not completed, primary, secondary and high-
er.
4. Living arrangement was categorised as living alone,
living with spouse, living with children and living with
others.
5. Marital status was coded as currently married, widowed
and others. Others included respondents who separat-
ed/divorced/never married.52
6. Working status was categorised as currently working,
ever worked but currently not working and not work-
ing. Ever worked and currently not working category
also included the older adults who were retired.
7. Social participation was categorised as no and yes.
Social participation was measured though the question
‘Are you a member of any of the organisations, reli-
gious groups, clubs, or societies?’. The response was
categorised as no and yes.51

Health indicators

1. Life satisfaction among older adults was assessed using
the questions: (a) In most ways my life is close to ideal;
(b) The conditions of my life are excellent; (c) I am
satisfied with my life; (d) So far, I have got the import-
ant things I want in life; (e) If I could live my life again,
I would change almost nothing. The responses were
categorised as strongly disagree, somewhat disagree,
slightly disagree, neither agree nor disagree, slightly
agree, somewhat agree and strongly agree. Using the
responses to the five statements regarding life satis-
faction, a scale was constructed. The categories of
the scale are ‘low satisfaction’ (score of 5–20), ‘medium
satisfaction’ (score of 21–25) and ‘high satisfaction’
(score of 26–35) (Cronbach’s \( \alpha \): 0.84).43 53

2. Self-rated health (SRH) was coded as good which in-
cludes excellent, very good and good whereas poor in-
cludes fair and poor.26

3. Difficulty in activities of daily living (ADL) was coded as
no and yes. ADL is a term used to refer to normal daily
self-care activities (such as movement in bed, chang-
ing position from sitting to standing, feeding, bathing,
dressing, grooming, personal hygiene, etc). The ability
or inability to perform ADLs is used to measure a per-
son’s functional status, especially in the case of people
with disabilities and the older adults.54

4. Difficulty in IADL (instrumental ADL) was coded as
no and yes. This refers to ADLs that are not necessarily
related to fundamental functioning of a person, but
allow an individual to live independently in a commu-
nity. The set of questions asked were necessary for old-
er adults’ independent functioning in the community.
Respondents were asked if they were having any diffi-
culties that were expected to last more than 3 months,
such as preparing a hot meal, shopping for groceries, making a telephone call, taking medications, doing work around the house or garden, managing money (such as paying bills and keeping track of expenses), and getting around or finding an address in unfamiliar places.54

5. Psychological distress was coded as low, medium and high. Psychological distress was measured using the following questions: (a) How often did you have trouble concentrating? (b) How often did you feel depressed? (c) How often did you feel tired or low in energy? (d) How often were you afraid of something? (e) How often did you feel you were overall satisfied? (f) How often did you feel alone? (g) How often were you bothered by things that don’t usually bother you? (h) How often did you feel that everything you did was an effort? (i) How often did you feel hopeful about the fu-

| Background characteristics | Poor | Non-poor |
|-----------------------------|------|---------|
| Age                         |      |         |
| Young-old                   | 6833 | 11311   |
| Old-old                     | 3503 | 5762    |
| Oldest-old                  | 1345 | 2134    |
| Sex                         |      |         |
| Male                        | 5415 | 9336    |
| Female                      | 6266 | 9871    |
| Education                   |      |         |
| No education/primary not completed | 10021 | 10439 |
| Primary completed           | 888  | 2725    |
| Secondary completed         | 655  | 3751    |
| Higher and above            | 118  | 2292    |
| Living arrangements         |      |         |
| Alone                       | 1186 | 440     |
| With spouse                 | 3049 | 2990    |
| With children               | 6653 | 14835   |
| Others                      | 792  | 942     |
| Marital status              |      |         |
| Currently married           | 7008 | 12207   |
| Widowed                     | 4383 | 6620    |
| Others                      | 291  | 379     |
| Working status              |      |         |
| Working                     | 4426 | 4957    |
| Ever worked but currently not working | 4927 | 8297 |
| Not working                 | 2328 | 5953    |
| Social participation        |      |         |
| No                          | 11308| 18134   |
| Yes                         | 373  | 1073    |
| Health indicators           |      |         |
| Life satisfaction*          |      |         |
| Low                         | 4529 | 4827    |
| Medium                      | 2805 | 3775    |
| High                        | 3934 | 10006   |
| Self-rated health*          |      |         |
| Good                        | 5327 | 10489   |
| Poor                        | 6088 | 8353    |
| Difficulty in ADL*          |      |         |
| No                          | 8573 | 14991   |
| Yes                         | 3108 | 4216    |
| Difficulty in IADL*         |      |         |
| No                          | 5441 | 10712   |
| Yes                         | 6240 | 8495    |
| Psychological distress      |      |         |
| Low                         | 3567 | 8592    |

Continued
ture? (j) How often did you feel happy? The response was coded as: (1) Rarely or never; (2) Sometimes; (3) Often; and (4) Most or all of the times. The response was coded as per the question in binary form 0 ‘Rarely or never/ Sometimes’ and 1 ‘Often/ Most or all of the time’ (Cronbach’s α: 0.70). A score of 0–10 was thus calculated using the *egen* command in STATA and a variable consisting of three quintiles (low, medium and high) was made using the *xtile* command in STATA.

6. Morbidity status was categorised as 0 ‘no morbidity’, 1 ‘any one morbid condition’ and 2+ ‘co-morbidity’.

**Household/community related factors**

1. Religion was coded as Hindu, Muslim, Christian and Others.
2. Caste was recorded as Scheduled Tribe, Scheduled Caste, Other Backward Classes and others. The Scheduled Castes are a group of people who are socially separated and financially/economically disadvantaged as a result of their low caste status in the Hindu traditional hierarchy. The Scheduled Castes and Scheduled Tribes are among India’s most economically disadvantaged groups. The Other Backward Classes refer to those who have been labelled ‘educationally, economically, and socially backward’. In the traditional caste order, they are regarded as the lower castes but now most disadvantaged. The others group refers to mainly higher castes who are thought to have a greater social position.
3. Place of residence was categorised as rural and urban.
4. The region was coded as North, Central, East, North-East, West and South.

**Statistical analysis**

Bivariate analysis was conducted to identify the significant variables that are related to major depression. A two-sample proportion test was used to evaluate if the prevalence of the various socioeconomic and demographic variables obtained according to the wealth status (Poor, Non-poor) were significantly different. In addition, multiple logistic regression was used to examine the association between major depression and various socioeconomic and demographic covariates. The presence of multicollinearity among the independent variables was detected using the variance inflation factor at a cut-off point of 10. In the final model, to check the goodness of fit, an F-adjusted goodness-of-fit test was employed. Due to complex sampling design effects in LASI, we accounted for inverse probability weights by using the *svyset* command in STATA V.15.

Concentration curve (CC) and Concentration Index were used to determine the inequalities in the distribution of major depression by Wealth Index Scores. The CC depicts how a cumulative share of the major depression (y-axis) is accounted for by the cumulative percentage of the individuals ranked by Wealth Scores (x-axis). If every individual has an identical health outcome, regardless of the wealth status, the CC would be a 45° line that runs from the lower-left corner to the upper-right corner, also known as the ‘line of equality’. On the contrary, if the health outcome variable has higher values among poorer people, the CC will lie above the ‘line of equality’ and vice versa. The farther the curve is away from the baseline, represented by the equality line, the more unequal is the distribution of the health outcome variable. The Concentration Index corresponds to twice the area between the CC and the line of equality. In the present paper, the Concentration Index (CI) is computed as twice the covariance of the health outcome variable and a person’s rank in terms of wealth status, divided by the mean of the health variable:

\[ CI = \frac{2}{\mu} \text{cov}(\gamma_j, R_j), \]

where \(\gamma_j\) and \(R_j\) are the health status and fractional rank (in terms of the index of economic status) of the jth individual, respectively; \(\mu\) is the mean of the health outcome variable and cov denotes the covariance.

**Decomposition of the Concentration Index**

The present study used Wagstaff’s Concentration Index decomposition approach to reveal the contribution of each explanatory variable to the measured health inequality (ie, major depression inequality). According to Wagstaff, a linear regression model links health outcome variable (y) to a set of k explanatory variables (\(x_k\)):

\[ y_i = \alpha + \sum_k \beta_k x_{ki} + \epsilon_i, \]

where \(x_{ki}\) is a set of k explanatory variables for the ith individual, \(\beta_k\) signifies the coefficient and \(\epsilon_i\) is an error term. Given the association of \(y_i\) and \(x_{ki}\), in equation (2), the Concentration Index for y, can be written as follows:

\[ C = \sum_k \left( \frac{\beta_k \bar{x}_k}{\mu} \right) C_k + G C, \]

where C denotes the overall Concentration Index, \(\mu\) is the mean of y, \(\bar{x}_k\) is the mean of \(x_k\), \(C_k\) is the normalised Concentration Index for \(x_k\) (defined exactly like Concentration Index), \(\frac{\beta_k \bar{x}_k}{\mu}\) is the elasticity of health variable with the explanatory variables and \(G C\) is the generalised Concentration Index for \(\epsilon_i\) (residual component). Equation (3) suggests that the Concentration Index consists of explained and residual (unexplained) components. In most cases, health outcome variables are rarely continuous. We have approximated decomposition analysis by using marginal effects on the logit model. A linear approximation of the non-linear estimation can be represented as:

\[ y_i = \alpha^m + \sum_k \beta_k^m x_{ki} + \mu_i, \]

where \(\beta_k^m\) is the marginal effects (\(\frac{dy}{dx}\) of each \(x\) and \(\mu_i\) signifies the error term generated by the linear approximation. The Concentration Index (CI) for the health variable (y) (in our case, major depression) is given as:
Table 2 Percentage of older adults suffering from major depression by their background characteristics

| Background characteristics | Poor  | Non-poor | Differences | P value |
|-----------------------------|-------|----------|-------------|---------|
| **Individual factors**      |       |          |             |         |
| Age                         |       |          |             |         |
| Young-old                   | 11.0  | 6.5      | 4.5         | 0.001   |
| Old-old                     | 10.5  | 6.8      | 3.7         | 0.001   |
| Oldest-old                  | 13.8  | 8.5      | 5.3         | 0.001   |
| Sex                         |       |          |             |         |
| Male                        | 9.7   | 6.0      | 3.7         | 0.001   |
| Female                      | 12.5  | 7.6      | 4.8         | 0.001   |
| Education                   |       |          |             |         |
| No education/primary not completed | 11.3 | 7.5 | 3.7 | 0.001 |
| Primary completed           | 10.8  | 7.0      | 3.8         | 0.001   |
| Secondary completed         | 11.1  | 5.2      | 5.9         | 0.001   |
| Higher and above            | 6.0   | 6.0      | 0.0         | 0.483   |
| **Living arrangements**     |       |          |             |         |
| Alone                       | 14.5  | 10.0     | 4.5         | 0.205   |
| With spouse                 | 9.9   | 6.7      | 3.2         | 0.001   |
| With children               | 10.8  | 6.7      | 4.2         | 0.001   |
| Others                      | 14.5  | 8.5      | 5.9         | 0.001   |
| Marital status              |       |          |             |         |
| Currently married           | 10.3  | 5.9      | 4.4         | 0.001   |
| Widowed                     | 12.8  | 8.6      | 4.1         | 0.001   |
| Others                      | 8.7   | 5.5      | 3.3         | 0.001   |
| Working status              |       |          |             |         |
| Working                     | 9.9   | 5.4      | 4.5         | 0.001   |
| Ever worked but currently not working | 13.1 | 7.7 | 5.4 | 0.001 |
| Not working                 | 9.6   | 6.7      | 2.8         | 0.772   |
| Social participation        |       |          |             |         |
| No                          | 11.2  | 7.0      | 4.2         | 0.001   |
| Yes                         | 10.9  | 4.5      | 6.4         | 0.198   |
| **Health indicators**       |       |          |             |         |
| Life satisfaction           |       |          |             |         |
| Low                         | 15.5  | 10.4     | 5.1         | 0.001   |
| Medium                      | 8.6   | 7.1      | 1.5         | 0.082   |
| High                        | 7.9   | 5.1      | 2.9         | 0.001   |
| Self-rated health           |       |          |             |         |
| Good                        | 6.5   | 3.6      | 2.9         | 0.001   |
| Poor                        | 15.3  | 10.9     | 4.4         | 0.001   |
| Difficulty in ADL           |       |          |             |         |
| No                          | 8.7   | 5.3      | 3.4         | 0.001   |
| Yes                         | 18.3  | 12.5     | 5.8         | 0.001   |
| Difficulty in IADL          |       |          |             |         |
| No                          | 8.1   | 4.0      | 4.1         | 0.001   |
| Yes                         | 14.0  | 10.5     | 3.4         | 0.001   |
| Psychological distress      |       |          |             |         |
| Low                         | 5.3   | 3.0      | 2.3         | 0.001   |

Table 2 Continued

| Background characteristics | Poor  | Non-poor | Differences | P value |
|-----------------------------|-------|----------|-------------|---------|
| **Household/community related factors** |       |          |             |         |
| Religion                    |       |          |             |         |
| Hindu                       | 11.0  | 6.9      | 4.1         | 0.001   |
| Muslim                      | 12.7  | 7.3      | 5.4         | 0.001   |
| Christian                   | 9.9   | 4.5      | 5.4         | 0.572   |
| Others                      | 12.7  | 6.7      | 5.9         | 0.016   |
| Caste                       |       |          |             |         |
| Scheduled Caste             | 11.6  | 7.7      | 4.0         | 0.000   |
| Scheduled Tribe             | 5.1   | 4.5      | 0.6         | 0.016   |
| Other backward Class        | 12.4  | 7.2      | 5.2         | 0.001   |
| Others                      | 11.9  | 6.3      | 5.6         | 0.001   |
| Place of residence          |       |          |             |         |
| Rural                       | 11.1  | 7.7      | 3.4         | 0.001   |
| Urban                       | 12.4  | 5.7      | 6.7         | 0.001   |
| Region                      |       |          |             |         |
| North                       | 6.9   | 6.9      | 0.0         | 0.718   |
| Central                     | 16.6  | 12.0     | 4.6         | 0.020   |
| East                        | 9.4   | 6.4      | 3.0         | 0.001   |
| North-East                  | 7.4   | 4.1      | 3.3         | 0.044   |
| West                        | 11.8  | 5.7      | 6.2         | 0.001   |
| South                       | 7.8   | 5.1      | 2.7         | 0.016   |
| Total                       | 11.2  | 6.8      | 4.3         | 0.001   |

P value based on proportion test. ADL, activities of daily living; Differences, Poor – Non-poor; IADL, instrumental activities of daily living.

CI = \sum_k \left( \frac{\beta_k \bar{x}_k}{\mu} \right) C_k + GC_{e/\mu}, \quad (5)

Patient and public involvement
No patient was involved.

RESULTS
Table 1 represents the socioeconomic profile of older adults in India. About 85.8% and 54.4% of older adults were not educated in the poor and non-poor categories, respectively. Nearly, 10.2% and 2.3% of older adults were living alone in the poor and non-poor categories, respectively. Almost 37.9% and 25.8% of older adults were working in the poor and non-poor categories, respectively. Almost 3.2% and 5.6% of older adults socially participated in the poor and non-poor categories, respectively.
A higher proportion of older adults from the poor category reported low life satisfaction (poor: 40.2% and non-poor: 25.9%). Similarly, a higher proportion of older adults who were from the poor category had poor SRH (53.3%) in reference to older adults from the non-poor category (44.3%). A higher proportion of older adults had difficulty in ADL (poor: 26.6% vs non-poor: 22.0%) and IADL (poor: 53.4% vs non-poor: 44.2%) were from the poor category. A higher proportion of older adults from the poor category had high psychological distress (34.8%) compared with older adults from the non-poor category.

### Table 3 Logistic regression estimates for major depression among older adults

| Background characteristics | AOR     | 95% CI    |
|----------------------------|---------|----------|
| Individual factors         |         |          |
| Age                        |         |          |
| Young-old                  | Ref.    |          |
| Old-old                    | 0.79*(0.7 to 0.88) |      |
| Oldest-old                 | 0.71*(0.6 to 0.83) |      |
| Sex                        |         |          |
| Male                       | Ref.    |          |
| Female                     | 1.07 (0.95 to 1.21) |      |
| Education                  |         |          |
| No education/primary not completed | 0.76*(0.61 to 0.96) |      |
| Primary completed          | 0.88 (0.69 to 1.12) |      |
| Secondary completed        | 0.84 (0.67 to 1.07) |      |
| Higher and above           | Ref.    |          |
| Living arrangements        |         |          |
| Alone                      | 0.91 (0.71 to 1.18) |      |
| With spouse                | 0.81 (0.63 to 1.03) |      |
| With children              | 0.82*(0.67 to 0.99) |      |
| Others                     | Ref.    |          |
| Marital status             |         |          |
| Currently married          | Ref.    |          |
| Widowed                    | 1.24*(1.09 to 1.4) |      |
| Others                     | 0.85 (0.61 to 1.18) |      |
| Working status             |         |          |
| Working                    | Ref.    |          |
| Ever worked but currently not working | 0.96 (0.85 to 1.08) |      |
| Not working                | 0.79*(0.68 to 0.92) |      |
| Social participation       |         |          |
| No                         | Ref.    |          |
| Yes                        | 0.87 (0.7 to 1.08) |      |
| Health indicators          |         |          |
| Life satisfaction          |         |          |
| Low                        | 1.62*(1.45 to 1.82) |      |
| Medium                     | 1.11 (0.98 to 1.26) |      |
| High                       | Ref.    |          |
| Self-rated health          |         |          |
| Good                       | Ref.    |          |
| Poor                       | 1.96*(1.76 to 2.18) |      |
| Difficulty in ADL          |         |          |
| No                         | Ref.    |          |
| Yes                        | 1.51*(1.35 to 1.68) |      |
| Difficulty in IADL         |         |          |
| No                         | Ref.    |          |
| Yes                        | 1.47*(1.31 to 1.64) |      |
| Psychological distress     |         |          |
| Low                        | Ref.    |          |

### Table 3 Continued

| Background characteristics | AOR     | 95% CI    |
|----------------------------|---------|----------|
| Morbidity status           |         |          |
| 0                          |         |          |
| 1                          | 1.24*(1.1 to 1.39) |      |
| 2+                         | 1.59*(1.41 to 1.8) |      |
| Household/community related factors | | |
| Wealth quintile            |         |          |
| Poorest                    | 1.39*(1.15 to 1.68) |      |
| Poorer                     | 1.25*(1.04 to 1.5) |      |
| Middle                     | 1.19*(1.1 to 1.41) |      |
| Richer                     | 1.19*(1.01 to 1.4) |      |
| Richest                    | Ref.    |          |
| Religion                   |         |          |
| Hindu                      | Ref.    |          |
| Muslim                     | 1.09 (0.94 to 1.27) |      |
| Christian                  | 1.01 (0.8 to 1.28) |      |
| Others                     | 1.36*(1.09 to 1.7) |      |
| Caste                      |         |          |
| Scheduled Caste            | 1.02 (0.88 to 1.18) |      |
| Scheduled Tribe            | 0.57*(0.46 to 0.69) |      |
| Other backward Class       | 1.16*(1.03 to 1.31) |      |
| Others                     | Ref.    |          |
| Place of residence         |         |          |
| Rural                      | 1.18*(1.05 to 1.33) |      |
| Urban                      | Ref.    |          |
| Region                     |         |          |
| North                      | Ref.    |          |
| Central                    | 1.8*(1.53 to 2.11) |      |
| East                       | 0.86 (0.73 to 1.01) |      |
| North-East                 | 0.67*(0.52 to 0.85) |      |
| West                       | 1.28*(1.08 to 1.53) |      |
| South                      | 0.6*(0.51 to 0.71) |      |
*If p<0.05.

ADL, activities of daily living; AOR, adjusted OR; IADL, instrumental activities of daily living; Ref, references.
category (24.8%). A higher proportion of older adults from the non-poor category (30.1%) had more than two morbidity conditions in comparison to older adults from the poor category (15.7%).

Table 2 represents the percentage of older adults suffering from major depression by their background characteristics in India. It was found that the prevalence of major depression was higher among older adults from the poor category (11.2%) than the non-poor category (6.8%). The difference in prevalence was also statistically significant (4.3%; p<0.05).

Table 3 reveals logistic regression estimates for major depression among older adults by their background characteristics in India. The estimates presented are adjusted estimates in the table. It was found that wealth quintile was significantly associated with major depression among older adults. That is, older adults from the poorest wealth quintile had 39% significantly higher likelihood of suffering from major depression than older adults from the richest wealth quintile [adjusted OR: 1.39; CI 1.15 to 1.68]. Additionally, age, education, living arrangement, marital status and working status were the significant predictors of major depression. Moreover, life satisfaction, SRH, difficulty in ADL and IADL, psychological distress and morbidity status were also significantly associated with major depression among older adults.

Figure 2 reveals that major depression was concentrated among older adults from the socioeconomically poor strata. The value of the concentration quintile was −0.179 which also confirms that the major depression was more concentrated among poor older adults.

Table 4 represents the decomposition estimates for major depression among older adults in India. It was found that about 38.4% of the socioeconomic and health-related inequality was explained by the wealth quintile for major severe depression among older adults. Moreover, about 26.6% of the inequality in major depression was explained by psychological distress. Additionally, region explained about 23.1% of inequality followed by life satisfaction (11.2%) and working status (9.8%) for major depression among older adults.

| Background characteristics | Elasticity | CCI | Absolute contribution | Percentage contribution |
|---------------------------|-----------|-----|-----------------------|------------------------|
| Individual factors        |           |     |                       |                        |
| Age                       |           |     |                       |                        |
| Young-old                 |           |     |                       |                        |
| Old-old                   | −0.005    | −0.006 | 0.000                   | −0.2                   |
| Oldest-old                | −0.001    | 0.005 | 0.000                   | 0.0                    |
| Sex                       |           |     |                       |                        |
| Male                      | 0.9       |     |                       |                        |
| Female                    | 0.012     | −0.011 | 0.000                   | 0.9                    |
| Education                 |           |     |                       |                        |
| No education/primary not completed | −11.0 |     |                       |                        |
| Primary completed          | 0.002     | 0.160 | 0.000                   | −1.9                   |
| Secondary completed       | 0.002     | 0.369 | 0.001                   | −3.8                   |
| Higher and above           | 0.001     | 0.601 | 0.001                   | −5.3                   |
| Living arrangements       |           |     |                       |                        |
| Alone                     | 3.4       |     |                       |                        |
| With spouse               | −0.002    | −0.166 | 0.000                   | −2.0                   |
| With children              | −0.008    | 0.098 | −0.001                   | 5.2                    |
| Others                    | 0.000     | −0.091 | 0.000                   | 0.2                    |
| Marital status            |           |     |                       |                        |
| Currently married          |           |     |                       |                        |
| Widowed                   | 0.003     | −0.022 | 0.000                   | 0.4                    |
| Others                    | −0.001    | −0.072 | 0.000                   | −0.3                   |
| Working status            |           |     |                       |                        |
| Working                   | 9.8       |     |                       |                        |
| Ever worked but currently not working | −0.002 | 0.010 | 0.000                   | 0.1                    |
| Not working               | −0.009    | 0.158 | −0.001                   | 9.7                    |
| Social participation      |           |     |                       |                        |
| No                        |           |     |                       |                        |
| Yes                       | 0.000     | 0.171 | 0.000                   | 0.1                    |
| Health indicators         |           |     |                       |                        |
| Life satisfaction         |           |     |                       |                        |
| Low                       |           |     |                       |                        |
| Medium                    | −0.009    | −0.057 | 0.001                   | −3.7                   |
| High                      | −0.016    | 0.137 | −0.002                   | 14.9                   |
| Self-rated health         |           |     |                       |                        |
| Good                      |           |     |                       |                        |
| Poor                      | 0.022     | −0.059 | −0.001                   | 8.7                    |
| Difficulty in ADL         |           |     |                       |                        |
| No                        |           |     |                       |                        |
| Yes                       | 0.010     | −0.051 | 0.000                   | 3.3                    |
| Difficulty in IADL        |           |     |                       |                        |
| No                        |           |     |                       |                        |
| Yes                       | 0.014     | −0.052 | −0.001                   | 4.8                    |
| Psychological distress    |           |     |                       |                        |

Table 4: Decomposition estimates for major depression among older adults.
and IADL explained 8.7%, 3.3% and 4.8%, respectively, and place of residence explained 5.6% of the observed inequalities in major depression among older adults.

**DISCUSSION**

The current study was an attempt to understand the socioeconomic and health-related inequalities in major depression among the older population in India, using nationally representative data. The overall prevalence was comparable and in parallel with other studies which showed that the prevalence of depression ranged from 17% to 34.4%. On the other hand, the study found greater inequality with 11.2% of the poor older adults suffering from major depression in comparison to nearly 7% of non-poor older adults. A substantial contribution of household wealth status (with a more than 38%) to the inequality in prevalence of depressive symptoms among older individuals was observed in the present study.

The study validates that age, education, living arrangement, marital status and working status were significantly associated with major depression in the older population. Previous studies have examined the association between age and depression and the results have been mixed. Some studies found that the likelihood of developing depression increases with age, and in case of older adults living alone in particular, while several other studies had contradicting results, suggesting that with increasing age, individuals tend to have higher adaptation towards stressful events. The present study found that the chances of suffering from major depression decreases with age confirming the later studies. Depressive disorders were found to be higher in women than in men. Similar bivariate estimates of this study found that the prevalence of depression in older women was higher compared with men. The possible explanation for this could be that older women were exposed to various health problems and adverse life events including widowhood and limited resource availability.

Our study findings are contrary to the evidence regarding the role of lack of education as a major factor associated with depression. There is high level of inequality in the distribution of depression with significantly increased rates of depression among higher educational groups. Previous research investigated inequalities in depression by gender, educational attainment and wealth in isolation. On the other hand, with regard to the household economic status, our findings are consistent with previous studies in India and other developing countries showing a greater prevalence of depression in the population and in older adults in particular from the economically poor background. Therefore, in developing countries like India, the benefits of depression treatment in primary-care units may more than offset its associated costs among older individuals from poor households in particular.

Another major finding of the study was the lower level of life satisfaction that was positively associated with major depression which is in parallel to previous findings that reported a significant inverse association of life satisfaction with mental distress and depressive symptoms. Importantly, the psychological distress that was assessed using the Center for Epidemiological Studies Depression (CESD-10) scale was positively associated with major depression (measured using the GIDI-SF scale) in our study. This is in line with previous studies showing that multiple domains of depressive symptoms are directly

### Table 4 Continued

| Background characteristics | Elasticity | CCI | Absolute contribution | Percentage contribution |
|---------------------------|-----------|-----|-----------------------|-------------------------|
| Low                       | 0.003     | −0.038 | 0.000                | 0.7                     |
| Medium                    | 0.030     | −0.125 | −0.004               | 25.8                    |
| High                      |           |       |                       |                         |
| Morbidity status          |           |       |                       |                         |
| 0                         |           |       |                       |                         |
| 1                         | 0.004     | 0.039 | 0.000                | −1.1                    |
| 2                         | 0.010     | 0.209 | 0.002               | −13.7                   |
| Household/community related factors |     |       |                       |                         |
| Wealth quintile          |           |       |                       |                         |
| Poorest                   |           |       |                       |                         |
| Poorer                   | −0.003    | −0.282 | 0.001               | −5.0                    |
| Middle                   | −0.003    | 0.084 | 0.000               | 1.8                     |
| Richer                   | −0.003    | 0.441 | −0.001              | 9.0                     |
| Richest                  | −0.006    | 0.796 | −0.005             | 32.6                    |
| Religion                 |           |       |                       |                         |
| Hindu                    |           |       |                       |                         |
| Muslim                   | 0.000     | 0.012 | 0.000               | 0.0                     |
| Christian                | 0.001     | 0.010 | 0.000               | 0.0                     |
| Others                   | 0.001     | 0.211 | 0.000               | −1.0                    |
| Caste                    |           |       |                       |                         |
| Scheduled Caste          |           |       |                       |                         |
| Scheduled Tribe          | −0.003    | −0.351 | 0.001              | −7.7                    |
| Other backward Class     | 0.007     | 0.019 | 0.000               | −0.9                    |
| Others                   | 0.000     | 0.213 | 0.000               | −0.3                    |
| Place of residence       |           |       |                       |                         |
| Rural                    |           |       |                       |                         |
| Urban                    | −0.002    | 0.452 | −0.001              | 5.6                     |
| Region                   |           |       |                       |                         |
| North                    |           |       |                       |                         |
| Central                  | 0.013     | −0.187 | −0.002            | 16.5                    |
| East                     | −0.002    | −0.215 | 0.000              | −3.4                    |
| North-East               | 0.000     | −0.013 | 0.000             | 0.0                     |
| West                     | 0.001     | 0.097 | 0.000              | −0.9                    |
| South                    | −0.009    | 0.175 | −0.002            | 10.8                    |
| Calculated CCI           | −0.015    | 100.0 |                     |                         |
| Total CCI                | −0.179    |       |                     |                         |
| Residual                 | −0.164    |       |                     |                         |

ADL, activities of daily living; CCI, concentration index; IADL, instrumental activities of daily living.
associated with endorsement of clinical depressive disorder.80 Furthermore, significant links have been found between functional disability in ADL and IADL and depression among older adults. Various studies17,52–64 have shown that depressive symptoms were found among older adults with functional limitations.14,27 A higher depressive rate among older adults with functional disability or limitation could be attributed to reduced physical activity and social interactions.81,82 Nonetheless, the association of social participation with depression showed no significance in our study. Furthermore, a positive and significant association between presence of higher number of morbidities and depressive symptoms was also found in our study. The finding is consistent with previous studies suggesting that the older population is more likely to suffer from multiple chronic diseases, which is also associated with escalating mental distress and depressive disorders.83

Findings from the Western countries indicate that strong welfare states may prevent or lower the depressive symptoms by providing a social strata with better healthcare and social service.82 Similarly, studies in developing countries show that the state provisions like welfare schemes and old age pensions can offset the socioeconomic consequences of poor health by reducing the cost of healthcare and improving quality of life, associated with increased healthy life expectancy.84–86 Unlike the well-established healthcare systems and policies in the Western countries for older adults, dedicated geriatric care is a distant dream in India because of the lack of a trained workforce, absence of infrastructure87 and poor implementation of polices. However, it is also worth mentioning that despite the existence of various schemes, the awareness and utilization of these schemes vary from region to region.88,89 Hence, a proper understanding of the morbidity pattern among the older adults and their underlying inequalities is essential to strengthen the geriatric healthcare services to meet the needs of older people.

Our study has certain limitations. First, we classified people as having probable depression on the basis of the CIDI-SF depression screening tool. Thus, the estimates reported in the study are not based on clinical appraisal and should be interpreted with caution. Also, the cross-sectional design of the study does not allow any causal inferences in the observed associations and suggests the possibility of reverse or bidirectional causality in many of the findings. The strength of this study is that it is based on one of the largest, nationally representative data of older adults’ mental health in a resource-poor setting in the developing world. We measured depression using an internationally validated scale of CIDI-SF.

Conclusion

The findings revealed large socioeconomic and health-related inequalities in depression in older adults which were especially pronounced by poor household economy, widowhood, poor SRH, difficulty in ADL and IADL, and psychological distress. Identifying these vulnerable groups can be the starting point for designing and evaluating social, economic and mental health-related interventions to reduce the avoidable inequalities in depression. Further, in order to reduce the burden of older adults’ mental health problems in India, it is vital to strengthen interventions that address determinants such as socioeconomic position, health status and structural supports. The findings also highlight that in designing prevention programmes, detection and management of older adults with depression should be a high priority, especially for those who are more vulnerable.

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