

# Depression and Loneliness Among the Elderly Poor<sup>1</sup>

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## Abstract

The mental health of the elderly in low- and middle-income countries (LMICs) is a largely neglected subject, both by policy and research. We combine data from the health and retirement family of surveys in seven LMICs (plus the US) to document that depressive symptoms among those aged 55 and above are more prevalent in those countries and increase sharply with age. Depressive symptoms in one survey wave are associated with a greater decline in functional abilities and higher probability of death in the next wave. Using data from a panel survey we conducted in Tamil Nadu with a focus on elderly living alone, we document that social isolation, poverty, and health challenges are three of the leading correlates of depression. We discuss potential policy interventions in these three domains, including some results from our randomized control trials in the Tamil Nadu sample.

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Mental health is currently at the forefront of policy discussion in rich countries, but it remains underemphasized in low- and middle-income countries (LMICs), both as a matter of policy and an object of study. High-income countries allocate about 5.4% of their total government health expenditure to mental health, compared to 1.7% in LMICs — and only 0.02% in the nine low-income countries covered by the WHO mental health Atlas (WHO 2020; Mental Health Atlas 2021). This lack of spending results in very limited availability of trained staff: there are 1.4 mental health workers per 100,000 population in poor countries, compared to 62 in rich countries, resulting in 80 to 90% of cases going untreated in many settings (Thorncroft et al. 2017).

Moreover, given that populations in lower-income countries generally skew younger — 8% of the population of LMICs are above 65, compared to 19% for high-income countries — there is generally much less policy focus on health issues faced by the older populations in those countries than in richer countries (United Nations 2019). Even in the United States, mental health of the elderly is relatively underserved. For example, as of 2010, there were approximately 2.6 to 4 million Americans 65 years of age or older with a mental health or substance use disorder, yet under 1,300 practicing geriatric psychiatrists to serve them (Eden et al. 2012). In total, mental health expenditures account for only 1% of Medicare expenditure.

Given this, it is perhaps not surprising that there is little research on the issue of mental health of the aging populations in poor countries. Most existing research on the consequences of depression comes from rich countries (Brandão et al. 2018), and there is little direct measurement of the prevalence of depression in most countries (Bromet et al. 2011). Less than 2.7% of published research on public health in poor countries focuses on mental health, compared to 8% in richer countries (WHO 2020 Mental Health Atlas 2021). At the policy level, geriatric mental health is an almost non-existent field, in part because the very limited available data severely hampers evidence-based policymaking. Of the 528 studies that the 2019 Global Burden of Disease uses as inputs for calculating the global burden of depression, only 17 were designed specifically to study the elderly in low- and middle-income countries, and they cover a total of 6 countries, most of which are middle-income (China, Brazil, India, Nigeria, South Africa, and Nepal). The state of treatment is even more dire. For example, as of 2012, Madras Medical College was the only medical school in all of India that offered a course on geriatric mental health (Prakash and Kukreti 2013).

This is notwithstanding the fact that the elderly population is growing rapidly in poor countries. While still relatively small, the share of the population above 65 grew from 5% in 2000 to 8% in 2019. The number of elderly in LMICs is projected to grow from about

500 million in 2019 to over 1.2 billion in 2050 (United Nations World Population Ageing 2019).

Furthermore, the elderly in low- and middle-income countries appear to be particularly vulnerable to poor mental health. In Figure 1, we use data from several LMICs and the US to calculate the share of the population that is likely depressed, based on how many symptoms are reported on a standard depression screening questionnaire and cutoffs taken from existing literature. We assembled these estimates from surveys of the elderly modeled on the (US) Health and Retirement Study.<sup>3</sup> In our data, the incidence of depressive symptoms among the elderly is much higher in poorer countries than it is in the US, and it is alarmingly high indeed. In India, for example, 30% of men and 38% of women aged 61 to 70 test positive for symptoms indicative of possible depression, compared to 11% of men and 14% of women aged 61 to 70 in the US.

Far from being a rich country's problem or one that should be addressed only once more urgent concerns have been handled, elderly mental health in poor countries is a pressing issue, on which this paper seeks to shed light. To make this case, we first construct and present comparable international data on mental health. Then we focus on data from a panel survey on the elderly we conducted in Tamil Nadu, India. Finally, discuss priorities for future research and policy action on the topic.

## **1. Elderly mental health in low- and middle-income countries**

### **1.1 Creating internationally comparable measures**

It is already hard to find internationally comparable data to study mental health in the general population, and this becomes even more challenging for the elderly population. For example, it was not until 2020 that the Gallup World Poll included a mental health module as part of their "Wellcome Global Monitor," which covered a total of 113 countries. The questionnaire included one item on self-reported mental health: "Have you ever been so anxious or depressed that you could not continue your regular daily activities as you normally would for two weeks or longer?" (Wellcome 2021). In this data, close to one in five adults (19%) answered yes to this question. The rates in Africa and South Asia were similar to the global average but were significantly higher in Latin America.

While broad in its coverage, the Gallup World Poll has several limitations. First, the interviews were all done on the phone, with a single question that has the risk of being

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<sup>3</sup> In the online appendix, we provide detailed information on how the data is constructed to ensure comparability of the measures in the different datasets.

understood and answered differently in different countries. Second, the question asks about lifetime incidence of mental health problems using a single cross-section, which limits inference about the evolution of mental distress over a lifetime. Moreover, it was only asked at a potentially very tense time (during the pandemic).

Another dataset with an overview of global mental health comes from the Institute for Health Metrics and Evaluation (IHME), which produces the results on the Global Burden of Disease (GBD). The most recent edition from 2019 estimates that mental disorders (e.g., major depressive disorder, generalized anxiety disorder, bipolar disease, etc.) account for 3.13% of disability-adjusted life years in low-income countries and 4.92% of DALYs overall (IHME 2019b).

However, the GBD data also has two shortcomings that limit its usefulness for poor countries. The first is limited coverage. Of 134 LMICs in the world, the GBD only has data on depression for 46 of them (34%), compared to 35 of 59 HICs (59%). Further, the sample sizes of depression studies conducted in LMICs are much smaller: we calculate that the GBD estimates for depression for HICs were constructed using nearly ten times as many observations per capita than for LMICs — and more than 50 times as many as for LICs (IHME 2019a). The second is the differential quality of the underlying data for rich and poor countries. In rich countries, many of the studies included in the GBD database rely on clinical diagnoses from psychiatrists using lengthy structured or semi-structured interviews like the Structured Clinical Interview for the DSM (SCID). However, collecting clinical diagnoses for a representative sample is especially challenging in LMICs, where psychiatrists are in short supply.<sup>4</sup> Instead, many of the depression measurements in the GBD input data for LMICs come from short screening instruments such as the WHO World Health Survey from 2002–4; unfortunately, we could not find any validation for its six-question depression module.

To construct more robust and comparable data on elderly mental health, we assess depression prevalence with validated scales for a smaller sample of LMICs. In our analysis we combine data from surveys of six countries (Brazil, China, Costa Rica, India, Mexico, and South Africa) that were modeled after the Health and Retirement Study (HRS). The HRS is an ongoing decades-long longitudinal study conducted in the US and has become the model for a growing network of longitudinal aging studies around the world. We include data from the 2016 wave of the United States HRS study as a comparison for these six HRS-style surveys. We also included data from one other survey that followed a similar template and included detailed questionnaires pertaining to mental health: the Malawi Longitudinal Study of Families and Health (MLSFH).

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<sup>4</sup> Much of the GBD input data in rich countries uses the WHO Composite International Diagnostic Interview (CIDI), which can be administered by laypeople with some training. It is too lengthy to be useful for large surveys, and its accuracy is contested (Wittchen 1994; Kurdyak and Gnam 2005).

Finally, we present data from a new panel dataset that we collected in Tamil Nadu, which we analyze in more detail in Section 2.

To measure mental health, the HRS-style surveys use a questionnaire that falls between the long, structured interviews like the CIDI and very short questionnaires like the WHO survey. The surveys include a relatively short screening instrument based on about 10 questions about recent experience of depression symptoms. Most panel surveys of the elderly use some variation of the Center for Epidemiological Studies Depression Scale (CES-D), which has proven accurate in validations across many contexts, including among the elderly (see Vilagut et al. 2016, for a meta-analysis).<sup>5</sup> Other panel surveys of the elderly instead use versions of the Geriatric Depression Scale (GDS), which has the advantage of having been specifically designed to screen for depression in the elderly (Yesavage et al. 1983).

To the best of our knowledge, this paper is the first to combine and analyze data from HRS-style panel surveys across multiple countries with the goal of analyzing elderly mental health.<sup>6</sup> To compare depression prevalence across countries, for each country we selected a cutoff score for the number of depression symptoms reported, above which an individual is assessed to likely be depressed. To determine a cutoff score for “likely depressed” at the population level, we rely on existing validation studies that chose the optimal cutoff point to balance the sensitivity (the rate of false negatives) and the specificity (the rate of false positives) of different cutoff points. However, a remaining challenge is that validations find different optimal cutoff points in different settings, making it difficult to compare depression levels across countries, even for those that use the same test. Moreover, mental health questions are by nature sensitive to issues of translation, interpretation, and cultural norms.

Despite the validation studies, it is important to highlight that, compared to clinical diagnosis or even the CIDI survey, these surveys are prone to measurement errors and may lead to an overestimate of clinical depression — which, by Bayes’ rule, is the case when using any less-than-perfect screening test for a condition that has low prevalence

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<sup>5</sup> This is different from the most well-known depression screening instrument, the PHQ-9, which has been validated across many contexts (Moriarty et al. 2015). However, the PHQ-9 is generally avoided in surveys of the elderly, perhaps due to its reliance on the existence of somatic symptoms (i.e., symptoms having to do with the body), which can lead to conflating depression and old age (Balsamo et al. 2018). Take, for example, the questions about “feeling tired” or “having trouble sleeping” — these symptoms would be unusual in the young except in the case of depression, but are a natural result of the aging process and are common in the elderly.

<sup>6</sup> A few existing studies attempt to describe cross-country depression rates (Weissman et al. 1996; Simon et al. 2002; Andrade et al. 2003; Bromet et al. 2011), including some that focus on the elderly (Kessler et al. 2010; Guerra et al. 2016), but they only use surveys that use the same (short) depression questionnaire (such as the WHO survey) and sidestep the issue of comparability.

in the population and therefore produces many more chances to produce false positives than false negatives (Maxim, Nebo, and Utell 2014) — but they are the only procedures that are feasible on sample size like those of the HRS. Moreover, regardless of whether individuals tagged as “depressed” are literally clinically depressed or not, there is no doubt that they exhibit depression *symptoms* that are clearly associated with low well-being. The binary concept of “depression” does not fully capture the continuous aspect of mental health, which should be considered as a spectrum (Patel 2019).

Notwithstanding these challenges, we selected cutoffs from the existing literature toward the aim of making these cross-country comparisons as meaningful as possible (see details in Appendix Table A2).

## **1.2 Incidence of depression among the elderly**

Our first key finding is the very high rate of symptoms indicative of depression among the elderly in poor countries relative to the US (Figure 1). In the US, around 10% of men and 15% of women aged 55 and above are found to likely be depressed. These rates are consistently higher in the poor countries in our sample, often by a large margin. In the 61-70 age bracket, for example, men and women in LMICs test positive on depression screening questionnaires at rates of 25% and 35% respectively – more than double the rates in the US. Among the LMICs, China and Mexico tend to have the highest prevalence of depressive symptoms, and Costa Rica and South Africa have the lowest. India is in the middle (both in the nationally representative HRS-style survey and in our own Tamil Nadu survey).

Two other patterns in Figure 1 deserve note. First, for almost every combination of country and age category, depression rates are higher for women than for men, which is consistent with higher prevalence rates of anxiety and depression among women that have been documented in many other contexts (Salk, Hyde, and Abramson 2017). Second, rates of depression steeply increase with age in most poor countries, while they are more or less flat across age groups in the US.

Our data also suggests that depression remains largely undiagnosed and untreated in many of these populations, consistent with enormous treatment gaps for depression that have been documented in low-income settings (Thorncroft et al. 2017). In China, for example, among those who are predicted to be depressed (approx. 35% of respondents), only 2% of individuals have ever been diagnosed by a doctor with any psychological condition, 1% are taking any medication for psychological conditions, and 0.3% are receiving any other type of treatment. We find similarly large treatment gaps in our Tamil Nadu data (Table A3).

### 1.3 Depression, functional abilities, and death

Existing evidence has shown that depression is strongly correlated with a substantially worse quality of life. First and foremost, depression is a key predictor and aspect of well-being and life satisfaction (Kahneman et al. 2004; Kahneman and Krueger 2006). Even beyond any direct effects on well-being, depression is also associated with a host of other adverse outcomes that may in turn impact well-being. In our discussion, we focus on the relationship between depression and functional impairment, since a defining feature of aging is a slow deterioration in the ability to carry out basic activities of daily living (ADLs) such as eating, taking a bath, getting dressed, or taking a bus.

In the HRS data, the depression indicator based on the screening questionnaire is indeed associated with strong impairments in ADLs (Figure 2 Panel A). In all countries, the share of those reporting ADL limitations is at least double among those who show symptoms of depression, even after controlling for gender and age,<sup>7</sup> which are themselves strong predictors of both depression and functional impairment (Appendix Figure A1). For example, in China, the average depressed respondent has difficulties with 12% of ADLs, compared to only 3% for the average non-depressed respondent. Interestingly, the difference is largest in the US. This evidence builds on an expansive literature documenting the correlation between depression and functional disability: studies have identified the same trend in the US (Lyness et al. 1993), China (Tang, Jiang, and Futatsuka 2002), and Ethiopia (Mogga et al. 2006), among other countries. This correlation almost surely reflects a two-way causal relationship: restrictions in ADLs likely cause depression, while at the same time, depression may lower the ability and will to perform these activities.

Perhaps even more striking, depression symptoms are also a strong predictor of future death, controlling for age and gender. Figure 2 Panel B uses the panel dimension of the data to demonstrate this fact. Across both developing countries and the US, elders with depression symptoms in the first panel wave were more likely to have died by the second panel wave, two years later. That is, controlling for age, gender, and country, depressed elders die sooner than non-depressed elders. For example, in Mexico, the two-year mortality rate for those not depressed at baseline was 3%, while the mortality

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<sup>7</sup> We use linear regression to construct group averages for those who are predicted to be depressed versus those who are not (where an individual is predicted to be depressed if their score on the depression questionnaire surpasses the specified threshold). For the group that is not predicted to be depressed, we take the weighted average of the outcome (a measure of functional impairment) among all respondents who were not predicted to be depressed. For the group that is predicted to be depressed, we add to this average the coefficient on an indicator for predicted depression from a regression of the outcome on predicted depression, age bins, and gender. This is the same methodology we use to control for age and gender when making other comparisons between subgroups in subsequent analysis.

rate for the depressed increases to 5%. The excess mortality among people with depression appears to be even larger in the US. These findings echo a literature on excess mortality among those with depressive symptoms, both among the elderly in rich countries (Penninx et al. 1999; Adamson et al. 2005) and the elderly in LMICs (Brandão et al. 2018). Once again, a number of factors could explain this relationship. Depression could be caused by poor health, which itself causes mortality. Another possibility is that depression accelerates death by leading to withdrawal from day-to-day activities that promote mobility and longevity in old age or even suicide (World Health Organization, 2018).

#### **1.4 Loneliness and depression in old age**

What causes depression in old age? Besides health concerns, a leading explanation in wealthier countries is loneliness and a loss of social purpose (Cacioppo and Patrick 2009). We find that the relationship between loneliness and depression seems to hold in poorer countries as well. In Panel A of Figure 3, we plot rates of predicted depression by self-reported loneliness in all countries. Across all countries and age groups, rates of depression are higher among elderly who feel lonely than among elderly who do not. These differences are large. For example, rates of predicted depression among the lonely in the median poor country are around 75% versus 25% for the non-lonely.

This evidence contributes to the growing literature on loneliness as a cause of depression. For example, other longitudinal studies have demonstrated that loneliness predicts the onset of depression with a several-year lag (Cacioppo, Hawkley, and Thisted 2010).<sup>8</sup> Loneliness also predicts mobility reduction and symptoms of dementia (Luo et al. 2012; Tilvis et al. 2004), both of which are thought to be causes of depression (Bennett and Thomas 2014; Ormel et al. 2002). And, not surprisingly, loneliness tends to increase with age in the elderly (Cacioppo et al. 2006); as one ages, one's social network also ages, and deaths and disease among friends, siblings, or spouses could cause loneliness and depression.

One might assume that the elderly in poor countries are at a lower risk of feeling lonely than those in rich countries, because they are often assumed to live with extended families. It is indeed more common for the elderly to live alone in wealthy regions of the world than in poor ones. In the US and Europe, an estimated 27% and 28% of individuals 60 and older live alone, versus 11%, 9%, and 12% in the Asia-Pacific, Sub-Saharan Africa, and Latin America-Caribbean regions (Pew Research Center 2019). However, the number of elderly living alone in developing regions is rising as

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<sup>8</sup> Results from Luo et al. (2012) support this finding as well as a reciprocal relationship: depression also predicts loneliness.

fertility drops and in rural to urban migration increases with higher household income — increasing between 1990 and 2010 from 6% to 7% in Asia, 8% to 10% in Africa, and 9% to 13% in Latin America and the Caribbean (United Nations 2017).

Furthermore, we find that feeling lonely is far from being just a rich-country problem (Figure 3 Panel B). The data underlying this figure come from a ‘direct measure’ of loneliness (Pinquart and Sorensen 2001), i.e., the answer to a single question of the form, “During the past week, did you feel lonely the majority of the time?”, which is used in most of the HRS-inspired panel surveys.<sup>9</sup> Notably, the elderly in the US are only in the middle of the pack, as far as loneliness is concerned. The elderly report the highest rates of loneliness in Mexico, where 35% of people aged 61-70 reported feeling lonely a majority of the time. In most countries, loneliness is increasing with age and hovers between 10% to 15% for people 50–54, and 15% to 20% for those 80 or older (except for Tamil Nadu, which we discuss below in more detail).

While people can be lonely when living with others, elderly living alone are likely to be particularly susceptible to loneliness, and hence to depression. However, even the HRS-style surveys are not particularly suitable to study the elderly living alone. While the demographic transition has increased the number of elderly living alone, the rate is still relatively low among the countries in our sample: for example, the share of 61–70 year olds living alone ranges from 2% to 15% of respondents for both men and women, while nearly 25% of men and 50% of women in this age group are living alone in the US (Figure A2). To get a glimpse of what the next decades may reveal for elderly mental and physical health, as the demographic transition increases the rate of elderly living entirely on their own, our Tamil Nadu survey focused explicitly on this very group of people.

## **2. The Tamil Nadu Aging Panel: A focus on elderly living alone**

The Tamil Nadu Aging panel is the result of a cooperation between J-PAL and the Government of Tamil Nadu, co-funded by the National Institute of Health and the Government of Tamil Nadu. The interviews are conducted by government surveyors, and the survey instruments were provided by the J-PAL team of researchers.

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<sup>9</sup> A downside of this measure is that it may be vulnerable to social desirability bias (due to stigma around the word “lonely”). However the validity of alternative measures, such as the UCLA Loneliness Scale (Russell, Peplau, and Ferguson 1978) is still subject to debate in the psychiatry literature (Mund et al. 2022), and there is a dearth of validation studies in poorer countries. Questions such as “How often do you feel ‘in tune’ with the people around you?” may be interpreted very differently in different contexts. Furthermore, the question on loneliness is a part of the depression screening questionnaire. To ensure that our measures of depression and loneliness are not mechanically correlated, for this analysis we recalculate and rescale the depression score after removing the loneliness question. More details are in the description of Figure 3.

To obtain a sample frame for the Tamil Nadu Aging panel, we first conducted a census of all households in each enumeration area (typically, a village). One of the key findings of the census was that 7% of those above 50 (and nearly 15% of the elderly aged 60 years and above) lived entirely alone (Appendix Figure A3). Unsurprisingly, most of the elderly living alone (ELA) have been widowed (Appendix Figure A4). They tend to be older than those living with others, and most of them are female (Appendix Figure A3). This may be the case for two reasons: first, women tend to be younger than their spouse, and they enjoy a longer life expectancy, leading to a much higher fraction of females who are widows compared to the fraction among males. In our sample, for example, 54% of women above age 60 are widows compared to only 9% of men, consistent with a previous finding in Tamil Nadu (Sathyanarayana et al. 2014). Second, conditional on having lost their spouse, women are more likely to live alone. In our sample, controlling for age and widowhood, women are 21% more likely to live alone, perhaps because women are less likely to remarry compared to men (Cleveland and Gianturco 1976).

Why do widows not move in with their children? We investigated this question in a survey within our Elderly Living Alone (ELA) sample. Most of them (88%) had at least one child. The most common reason for not living with a child, cited by 33.6% of those surveyed, was that the elder could not live with their son-in-law — traditionally, in Indian culture, elders live with their sons and daughters-in-law rather than with their daughters and sons-in-law. Having difficulties with their daughter-in-law was the second most common reason (22.2%). The third most common reason (20.3%), was not wanting to leave home. A 2011 survey in Tamil Nadu found that approximately half of the elderly report a preference for living independently (i.e., alone or with their spouse) over living with their children or other relatives (Sathyanarayana et al. 2014). This shift in preferred living arrangement is proceeding rapidly in the developing world: the proportion of elders living independently in India increased from 9% to 19% in just over a decade (Jadhav et al. 2013).

The relatively high fraction of ELA came as a surprise to our government partners: as most policy makers, they assumed that most elderly widows would be taken in by their relatives. Indeed, the eligibility rule for a social pension, which states that the person has to be “destitute” explicitly rules out people who have an able-bodied son, assuming that such son should be in charge of their relative. Perhaps as a result of this lack of awareness of this phenomenon, very few government services are geared to this population. But given the rapid demographic changes in Tamil Nadu (the fertility rate in Tamil Nadu is now 1.8), it is very likely that this demographic group will grow, and will need some specific policies. In consultation with the government, we therefore decided

to oversample the population of ELA for our study – in order to better understand the implications of living alone on health and mental health, as well as to develop and test interventions that could be helpful to them.

## **2.1 Elderly living alone, isolation, and mental health**

Figure 1 shows that the elderly in Tamil Nadu are, like in the other surveys in the HRS, quite likely to be depressed. Among women, the share of elderly likely to be depressed increases from 30% for those 55-60 years of age to 40% for those over 80.

It is perhaps unsurprising that the elderly living alone are more likely to report feeling lonely, yet the magnitude of this difference is striking. Figure 4 shows the percent of elders with various living arrangements who report often feeling lonely, controlling for age and gender. The share that report feeling lonely are lowest for elders whose household members include their spouses, hovering around 20-30%. The share that report feeling lonely among elders who do not live with their spouses but do live with others is higher, around 30-40%. Strikingly, the rate jumps to over 60% for the ELA.

The elderly living alone are also more likely to feel depressed. For every age and gender, we see significantly higher rates of depression amongst the ELA than the non-ELA (Figure 5). The ELA are also worse off on a number of other dimensions other than their isolation. In addition to being older, they are also poorer, with lower daily per-capita household expenditure than the non-ELA (Appendix Figure A5), lower self-rated financial health (Appendix Figure A5), lower asset ownership (Appendix Figure A6), and, in many respects, lower food and financial security (Appendix Figure A6). Are these factors responsible for their poor mental health, or is there something especially harmful about social isolation for those living alone?

The ELA are also worse off in terms of functional and cognitive impairment. A greater percentage of ELA than non-ELA reported severe difficulty completing each of 22 activities of daily living our panel survey measured (Appendix Figure A7). Likewise, the ELA are more likely to be cognitively impaired within every gender-age bin, with the exception of males aged 55-60 (Appendix Figure A8).

These findings are reminiscent of Chen and Dreze (1992), who thirty years ago examined the marginalization, poor health, and low well-being of widows in North India, and made the point that this was an overlooked population. More recent analysis of the elderly in India also finds the importance of living arrangement and companionship for well-being: Srivastata et al (2021) also find that living alone and widowhood are two highly significant predictors of poor mental health in the LASI data set in India.

To investigate the potential role of living arrangements in affecting depression, we use our data to study dozens of potential predictors of depression. Figure 6 presents results from a regression of depression on several variables from our panel data. Candidate predictors were selected using double Lasso (Urminsky et al. 2016). Our measure of depression is the total score on the Geriatric Depression Scale—Short Form questionnaire (GDS-SF), ranging between 0 and 15, where each symptom that is reported by a respondent adds one to the total score so that higher scores correspond to more severe levels of depression.

While this regression does not establish causality, it provides a picture of the kind of factors that are most strongly associated with depression. Three features seem to strongly predict depression more than others: physical health (as measured by ADL limitations and falls), economic hardship (proxied by missed meals), and social isolation (living alone). Interestingly, living alone appears to be a strong predictor, but being a widow is not (the two are correlated, but not collinear).

Taken together, our results suggest living alone is a predictor of poor elderly mental health and well-being. It is closely related to loneliness and depression, as well as to poverty and physical impairment. This suggests that this population, whose very existence seems to have been forgotten by researchers and policy makers, should be given a key priority in research and policymaking.

### **3. What should be done about elderly mental health?**

We are only beginning to understand the economic and psychological lives of the elderly poor. The Tamil Nadu panel dataset has given us a unique window into the issues faced by the elderly in a low-income context. This evidence shows high levels of psychological distress that warrants urgent attention from policymakers and researchers. Given the largely descriptive and correlational evidence, it is too early to make strong policy prescriptions based on it. Rather, our evidence generates ideas and hypotheses for different policies to help improve the psychological well-being among the elderly. This section outlines some of these ideas, emphasizing the need to explore and evaluate policies to better address the economic and psychological needs of the elderly poor.

Poverty alleviation has been the key objective of many policy and research efforts in developing countries. Thus, a natural focus has been on labor market outcomes, human capital investments, and other ways to increase current or future earnings. In contrast, for the elderly, these types of policies are less central since labor-market earnings are

often low, as are returns to human capital investments. Instead, thinking more expansively about and improving well-being directly is the key objective in and of itself. This goal might be achieved by policies that directly target mental distress, such as therapies for depression or psychosocial interventions to reduce loneliness. However, our correlational evidence also suggests that policies to lower poverty and financial strain might go a long way toward reducing depression and improving psychological well-being more broadly (for example, via pensions).

### **3.1 Cash transfers and old age pensions**

One insight from our descriptive analysis is that economic hardship among the elderly is highly predictive of depression (Figure 6). This echoes a literature on the relationship between poverty and psychological well-being, which shows that poverty lowers psychological well-being and that the poor are disproportionately affected by depression, anxiety, and loneliness (Haushofer and Fehr 2014; Fokkema, De Jong Gierveld, and Dykstra 2012). One-time or more regular cash transfers have been found to improve mental health in many settings with working-age adults (Ridley et al. 2020). This suggests that alleviating financial hardship could also improve mental health among elderly adults. One promising avenue to improve mental well-being for this group would be non-contributory old-age pensions, which are becoming increasingly popular across the world.

Alzua et al. (2020) conducted a randomized evaluation of a sustained cash transfer for the elderly in Ethiopia. For twelve months, people above 65 who had no other means of support received a monthly unconditional cash transfer. During the first six months, the study found moderate improvements in the presence of depressive symptoms, and this effect vanished within six months. They hypothesized that the anticipation of soon losing the transfer is what might have led to the decline. This suggests cash transfers can help, but that the permanence of pensions may be an important factor for producing sustained improvements in elderly well-being.

Fortunately there is also growing evidence on the impacts of sustained old-age pensions on mental well-being in developing countries. Combining age eligibility and geographic eligibility for the pension, Salinas-Rodríguez et al. (2014) find that Mexico's "70 y más" program (a non-conditional cash transfer of \$40 USD monthly to all older adults aged 70 and over living in rural areas) led to a reduction in depressive symptoms as measured by the GDS. Non-contributory pensions have also been found to lead to a reduction in elders' depression symptoms in Mexico, Peru, and Paraguay (Galiani, Gertler, and Bando 2016; Bando, Galiani, and Gertler 2020, 2021). In China, Chen, Wang, and Busch (2019) exploit the staggered roll out of the largest social pension

program in the world, China's New Rural Pension Scheme (NRPS) to evaluate its impact on mental health and find a reduction in the incidence of depressive symptoms among the elderly.

While this evidence is promising, more high-quality evidence on the impact of pensions on mental health from other settings is needed. Although experiments can be difficult to conduct and require long-term commitment only affordable by a government, the evidence to date argues strongly in favor of extending non-contributory cash transfer programs.

The designs of these programs raise issues similar to those of general cash transfers and, in particular, the issue of targeting (Hanna and Olken 2018). Should they be reserved for the extremely poor (as they are for example in Tamil Nadu, where the existing Old Age Pension program is in principle targeted only to the "destitute"), universal to all age-eligible individuals, or open to nearly everyone (such as the program in South Africa, which is open to anyone who does not already get a private pension)? Well-targeted programs should be both sufficiently generous to recipients and fiscally sustainable for governments.

However, one challenge with targeting is that ordeals introduced by screening can lead to exclusion errors. Complicated screening rules are challenging for the poorest and lead to exclusion errors even at best (Banerjee and Duflo 2019, Chapter 9). Importantly, they may be particularly onerous for the elderly, especially those living alone, whose limited information access, mobility, and ability to deal with paperwork is especially limited. In Tamil Nadu for example, a non-contributory pension of Rs. 1,000 per month (\$43 dollars at PPP) is currently allocated based on being "destitute", or in high need. Data from our census (which identified the elderly for our panel sample) suggest that over half of those likely eligible for the pension were not receiving it. Notably, those likely eligible but not receiving the pension looked much poorer in terms of asset ownership than those who were receiving it. Several factors are likely to explain this disparity. First, many of the elderly do not know how to apply or need help to apply. Second, the definition of need is complex and somewhat open to interpretation, as it is based on asset ownership, ability to work, and family structure.. In practice, neediness is determined by local officials who often apply the criteria in a very stringent way, and maybe somewhat arbitrarily. When we submitted a list of likely eligible individuals based on the data collected by the Department of Economics and Statistics (one branch of the government) to the pension administration (another branch of the government) for vetting, almost no one was approved, suggesting that interventions are needed not only to streamline the application process but also to reform the screening process.

Given the heightened risk of perverse effects of targeting, there is a strong case for universality or very narrow exclusion rules (e.g., if the person receives private pension). Fiscal impact could be moderated by making the pension very small. The support should require individuals to apply only once via an easy process but to recertify once in a while. This would induce some self screening of those who don't need the transfer without excluding truly needy people if they are supported throughout the application process. Notably, based on findings from this project, this is the policy proposed by the Tamil Nadu Welfare department as part of the draft of the general Senior Citizen Policy.

### **3.2 Psychosocial interventions to reduce depression and loneliness**

**Treating and preventing depression.** Considerable progress has been made in our ability to treat symptoms of depression via psychotherapy and pharmacotherapy. Cognitive behavioral therapy (CBT) and other forms of therapy effectively reduce symptoms of depression in many settings, including for the elderly (Cuijpers et al. 2016; Orgeta, Brede, and Livingston 2017). Similarly, pharmacotherapy has been shown to effectively treat depression among the elderly in high-income settings (Reynolds et al. 2006; Prucker and Holthoff-Detto 2017). However, staff shortages in low-income contexts mean that widespread therapy by trained psychiatrists and adequate treatment with medication are not currently feasible. This challenge has sparked the recent development of simplified forms of therapy administered by laypeople, which was found to be effective across several low-income settings, often at a low cost (Singla et al. 2017). For instance, a non-specialist treatment involving 6 to 8 therapy sessions lead to sizable reductions in depression symptoms for up to five years among adults in India (Patel et al. 2017; Bhat et al. 2022).

Recent work evaluated a similar form of therapy among the elderly. In a small-scale study in Goa, India, a six-session CBT intervention amongst elders with mild depression symptoms lowered depression and improved some measures of physical health 12 months post baseline (Dias et al. 2019).

However, even relatively cheap therapy may still be less cost effective than cash, unless it could be made even cheaper by mainstreaming into existing operations or well-targeted to those who stand to benefit the most. Given the relative ease of implementing cash transfers and the importance of understanding cost-effectiveness, cash transfers are a natural benchmark for any other interventions and should be included in experimental evaluations.

Another important question for the cost-effectiveness of therapy is whether it can be designed and implemented in a way to yield sustained effects. In non-elderly populations, some interventions have shown persistent effects for up to seven years

(Baranov et al. 2020; Bhat et al. 2022), but among the elderly, the effects have faded faster. This may be due to additional challenges such as impaired memory among the elderly, suggesting the importances of regular booster sessions as in Dias et al. (2019). In addition, sustained reductions in depression might be difficult to achieve if the underlying cause is loneliness and there is a limited supply of social interactions. One promising avenue of research is testing different approaches to sustain the stimulation coming from therapy, for example by training support persons (the family, neighbors) to provide simple booster sessions, or by integrating therapy and boosters into regular health care checks. For example, the Tamil Nadu government has recently launched a program of monthly home visits to all adults at risk for non-communicable diseases by a village health volunteer, for testing and delivery of medication. To address elder mental health, the government could expand the program to include the elderly and train the village health workers to provide some CBT as part of their visits.

Beyond treating the currently depressed, interventions that help people to prevent future episodes of depression could be valuable. Barker et al. (2022) find that group therapy in Ghana reduced future depression symptoms even for people who were not depressed at baseline but who were likely to become depressed based on baseline information. The idea is that therapy teaches people tools that help them deal with shocks or other triggers better, in part by understanding which activities might help improve their mood so that they can avoid or mitigate the potential onset of future depression episodes. Evidence from HICs shows promise in preventative interventions and suggests that targeting at-risk individuals (e.g., ELA, widows), and encouraging the elderly to engage in social and physical activities might be effective in preventing depression (Hoare et al. 2021; Forsman, Nordmyr, and Wahlbeck 2011; Reynolds III et al. 2012; Park, Han, and Kang 2014).

**Reducing social isolation and loneliness.** The evidence we present suggests that social isolation and loneliness may be key to the mental health of the elderly. In Tamil Nadu, the ELA are about 140% more likely to be lonely and 55% more likely to be depressed, suggesting that this group might warrant particular attention (e.g., by targeting them with interventions). This also points to a potential causal effect of living alone on psychological well-being. Because living alone is itself potentially affected by psychological well-being and its correlates, causal evidence on the issue is highly valuable for informing policy. As of now, little empirical evidence exists on well-powered interventions to tackle social isolation and loneliness among the elderly in any context, and evidence is especially sparse for low-income contexts (Masi et al. 2011).

Loneliness can be self-reinforcing by changing the way people think about and value social interactions and by changing people's mood, perceptions, and behavior toward

others (Cacioppo and Patrick 2009). Even non-lonely individuals tend to routinely underestimate the benefits of social interactions (Epley and Schroeder 2014), but for those who are lonely, this may be an even greater issue because a baseline lack of contact can lower their beliefs about how pleasant and interesting future conversations might be. As a result, their demand for social interactions might be inefficiently low, thus providing scope for interventions that foster social interactions to improve welfare even beyond what an equivalent cash transfer would accomplish.

Many of the elderly have family members or friends with whom they could connect more frequently (even if they do not cohabit with them). Policies to strengthen these connections and to better equip families to support their elderly relatives could help. One key area of concern, though, is that those family providers also need to be supported. In particular, the burden of caring for the elderly often falls on young women. Encouraging the family to take a greater responsibility for the mental and physical well-being of the elderly could end up placing a large mental health tax on those young women or inhibit their labor supply or mobility.

Therefore, other opportunities for connections outside of the family must also be explored. In India, women typically leave their natal villages upon marriage and face restrictions on their physical mobility once they are married. Indeed, research on the social networks of young married women reveals high amounts of isolation (Andrew et al. 2020). Creating opportunities to socialize with others at all ages would lower the risk that women end up without any friends outside of their households as they age. These opportunities to socialize can also be created for the elderly specifically, through senior citizen clubs and activities, which are mostly absent in villages in LMICs. Some evidence from high-income countries suggests that such activities can improve physical and mental health, including RCTs involving activities such as dancing, hiking, or discussion (Pitkala et al. 2009), or qigong and tai chi (Rogers, Larkey, and Keller 2009).

Even relatively light-touch interventions have been shown to improve psychological well-being, such as providing phones (and teaching people how to use them) or phone credit to enable increased communication in Ghana (Annan and Archibong 2021). Similarly, employing laypeople to regularly call the elderly during the pandemic reduced depression among the elderly (Kahlon et al. 2021). This is consistent with our cross section analysis: having a phone and being able to use it appears to be correlated with less depression. Such interventions could be tested on the elderly in low-income contexts. To conduct our therapy RCT in Tamil Nadu, where the training had to happen in a socially distanced way due to COVID-19, we delivered cell phones and trained older people in their use. Despite the fact that many recipients had never had a phone before, the participants used their phones extensively, and continued to do so through

the end of the intervention. This suggests that this could be a promising intervention to scale.

Another important idea in the loneliness literature is that increasing the supply of social interactions on its own might not be enough to improve outcomes since a lonely person might not be in the right mindset to take advantage of these opportunities precisely because they are lonely (Cacioppo and Patrick 2009). This would suggest potential added benefits of simultaneously offering interventions that increase the demand for social interactions, such as cognitive behavioral therapy, and those that increase the supply, compared to the two interventions in isolation.

**Purpose, dignity, and dementia.** An elder who was once a respected member of their community, in charge of raising their children and making decisions in the household, or a breadwinner of their family may feel a loss of purpose or dignity as they retire, their children leave their homes, and their opinions are less respected or listened to. This loss of purpose or dignity may diminish their mental health. Providing opportunities for elders to maintain or rebuild their (perceived) ability to contribute to society could be an important way to strengthen purpose, dignity, and thus mental health. For instance, offering (non-elderly) refugees work has meaningful benefits for their psychosocial well-being including reduced depression beyond the cash value of this work (Hussam et al. 2022). Similar benefits could potentially be achieved for the elderly in low-income contexts through interventions that involve them in child care or provide some suitable work opportunity. Even if the productivity of the elderly were low, there may be significant direct mental health benefits from remaining active and engaged and from feeling a sense of purpose.

Yet another defining feature of aging is the loss of cognitive abilities, which leads to a host of challenges. Dementia, an elderly person's loss of cognitive functioning, may prevent elders from performing roles they used to occupy, exacerbating the impacts of aging on people's sense of purpose and dignity and thus deteriorating their mental health as well. Indeed, dementia is strongly associated with depression, both for the elderly themselves and their caregiver in the family (Korczyn and Halperin 2009; Cuijpers 2005), suggesting potentially large benefits from identifying and supporting families with an elder who experiences dementia (Dias et al. 2008).

### **3.3 Interventions to improve physical health and activity**

Measures of physical well-being among the elderly are strongly negatively correlated with depression (Figure 2 Panel A). The causality runs, at least in part, from mental health to physical health. This is demonstrated by the fact that our CBT experiment in

Tamil Nadu improved functional abilities as well as mental health, as well as by existing work. The literature also suggests that causality also runs the other way: a longitudinal study with elders in North Carolina found that functional disability predicted increased depression symptoms six years later, possibly via worsening self-esteem and sense of control (Yang 2006), so there may be a role for interventions to improve elder mental health via improvements to physical health.

**Reducing physical pain and improving functional abilities.** Significant physical pain is a nearly universal experience for the elderly, including in our Tamil Nadu sample, where 94% of respondents report at least some pain during the past week (Figure A9 Panel A). The experience of physical pain has been found to be strongly associated with poor mental health (Von Korff and Simon 1996; Bair et al. 2003). Indeed, in the Tamil Nadu sample, pain is associated with a higher GDS score (Figure A9 Panel B). However, pain does not need to be an inevitable byproduct of old age, as it often can be addressed, through the treatment of underlying health conditions (such as arthritis or dental decay), or through psychological interventions. In the rich world, CBT for chronic pain has shown some promise (Ehde, Dillworth, and Turner 2014).

Another key link between poor physical health and poor mental health is the deterioration of the ability of carrying out daily activities: Older adults' ability to see, hear and move deteriorates as they age and this affects their ability to carry out all daily tasks. Figure A1 shows a sharp deterioration of ADL with age, which is faster in most developing countries as it is in the US. In Tamil Nadu, ADL limitations is the strongest predictor of poor mental health (and the number of falls, which is closely related, comes third). Hearing, vision, or mobility loss impede people's ability to communicate and socialize. Correlational evidence suggests that this may increase their sense of isolation and deteriorate mental health (Marmamula et al. 2021), highlighting the importance of supporting the elderly in coping with these disabilities. The first step is diagnosis. Figure 7 compares the reported versus measured prevalence of several health conditions. Reported prevalence is measured with self-reported responses during the survey. Measured prevalence is based on objective diagnoses based on blood tests and physical exams conducted on a subset of the sampled population at health camps operated by the Department of Health services. Despite nearly 40% of elders being evaluated as hearing impaired, very few of them report suffering from hearing loss. Similarly, 25% report having vision loss due to cataracts, whereas again over 40% have them.

It should be a priority to provide widespread access to affordable, high-quality devices to mitigate specific functional impairment --- like hearing aids, eyeglasses, and walkers --- for the elderly in low-income settings. Providing eyeglasses has been shown to

increase work productivity for non-elderly populations (Reddy et al. 2018). For the elderly, such benefits could involve being able to leave the homes again on their own, visit their friends, or enjoy beautiful sights, all of which may improve their mental health (Mulrow et al. 1990; Ye et al. 2022).

**Managing chronic conditions.** Underlying chronic diseases form a root cause of many of the limitations in ADL, as well as of pain, and their importance is rising fast in the developing world: between 1990 and 2019, the percentage of disability-adjusted life years attributed to chronic diseases increased from 18% to 31% in low SDI countries, and from 27% to 50% in low-middle SDI countries (IMHE 2019b). For many of these conditions, early detection and regular treatment can improve disease management and survival rates, as well as slow down the progression of the disease to the stage where it will cause physical limitations. However, many chronic health conditions remain undetected: over 44% of the elderly were diagnosed with diabetes, but only 23% of them knew it; over 63% had hypertension, but only around 19% knew it (Figure 7).

This suggests that there could be large potential from regular check-ups. Regular health camps could be organized close to people's homes (in fact, a policy under consideration in Tamil Nadu is that the annual recertification for pension be done at a health camp). For the most immobile of the elderly, another promising avenue is at-home visits from health care workers, which may be particularly valuable for the most impaired and vulnerable among the elderly. Tamil Nadu has recently launched a "health care at your doorstep scheme", wherein frontline health workers would visit everyone in the village to diagnose chronic health conditions, and would then follow up with those diagnosed to ensure adherence. While such schemes are promising, there is little work evaluating their impact on physical and mental health, and none in developing countries.<sup>10</sup> More research could also be undertaken on how to use software on mobile phones and cheap diagnostic tools to improve home health care. Machine learning techniques could be used to map existing measurement of blood pressures to predict possible diagnoses and orient towards future testing.

Once the elderly are diagnosed, it would be possible to put them on treatment plans. However, adherence to a regular regimen of daily medication can be yet another challenge. Adherence is an issue for everyone in developing countries, but it could be worse for the elderly, since individuals become more prone to developing memory issues or other cognitive impairment as they age. Also adhering to new medication schedules may require elders to adjust long-standing routines, which may be difficult. This suggests that there is value in developing technologies to aid, encourage, and

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<sup>10</sup> Liimatta et al. (2019) find positive impacts of home visits for adults above 75 on physical health and depression in Finland.

remind elderly adults in managing their medications, such as daily reminders and specially designed pill bottles that help keep count of medications, but also in more traditional approaches like regular home visits to supply drugs, and so on.

**Encouraging physical activity and improving sleep.** Among policymakers and practitioners, there has been a long-standing hypothesis that engagement in physical activity can be directly protective of mental health. Perhaps surprisingly, we lack conclusive empirical evidence on whether physical activity is an effective treatment for depression in the general population. Part of the challenge in establishing a causal relationship from physical activity to mental health is that the reverse causal link is likely important: people are more likely to begin and maintain regular exercise when their mental health is better. The existing RCT evidence on the impact of encouraging exercise on depression rates is mixed, including promising evidence with elderly samples (Cooney et al. 2013; Nyström et al. 2015; Bigarella et al. 2022).

Regardless of any direct mental health impact, the proven benefits for physical health, such as benefits for diabetes management (Xiao 2020), suggest that finding ways to encourage physical activity among the elderly in developing countries would be helpful. In non-elderly populations, small incentives to walk have been shown to be effective (Dizon-Ross and Zucker 2022), but it is not clear that they would be appropriate in a population with low mobility. Group activities, such as group exercise classes, could both increase socialization and lead to some exercise. These types of activities and their benefits for the elderly in poor countries are highly promising and merit more careful research.

Finally, physical exercise would help with another potential driver of cognitive decline and depression: poor sleep. The ability to sleep soundly declines substantially with age, which has been linked to cognitive decline (Mander, Winer, and Walker 2017). Helping older poor people sleep better may be a way to substantially improve their well-being and mental health.<sup>11</sup>

## **Conclusion**

Cognitive and physical decline are a defining feature of aging. But this decline in physical and mental capacities does not need to entail a decline in well-being and mental health. Indeed, for the world overall, previous work using Gallup and other surveys has documented measures of happiness and well-being increasing in age for people above 50 (Blanchflower 2020, 2021). Yet we find stark increases in depression

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<sup>11</sup> There is very little research on how to do this, especially in LMICs. CBT for insomnia has been shown to be effective in improving sleep quality in high-income non-elderly samples (Trauer et al. 2015). Reducing pain would also likely help.

in several of the low- and middle-income countries for which we have data.<sup>12</sup> As depression is strongly correlated with poverty, living status, and physical health, this suggests that financial means and social environments could play an important role in determining the mental health trajectory as people age. This in turn suggests that policy choices can strongly influence the well-being of the elderly.

The wellbeing of the elderly in poor countries has not been a top policy priority until recently. In the 17 goals and 169 targets of sustainable development goals, the elderly are specifically mentioned only three times, and always as part of a list including many others: “those in vulnerable situations, women, children, persons with disabilities and older persons”. Goal 3 (promote health) does mention non-communicable diseases and mental health but never mentions the issue of aging.

Yet, with a growing share of older people in poor countries, improving the welfare for all people will require paying more attention to this forgotten group. This paper has shown that the mental health of the elderly can not be taken for granted. The elderly in poor countries are, if anything, more likely to be depressed and lonely than those in richer countries. This calls for a strong research and policy agenda for this group.

There is some indication that this may be happening. Noting the serious shortcoming in policies, systems and services targeted towards the elderly, the United Nation has called 2021-2030 the “United Nation decade of Healthy Aging”, during which there should be “concerted global action on healthy aging ensure that older people can fulfill their potential in dignity and equality in a healthy environment”. Researchers have a lot to contribute to make this happen.

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<sup>12</sup> It is worth noting that Blanchflower documents a similar age U-Shaped curve in the answer to general happiness and life satisfaction questions for many developing countries as well. But average happiness could be increasing while more people are depressed. His work documents a decrease in depression in the UK and Europe, but does not have data on depression in poorer countries.

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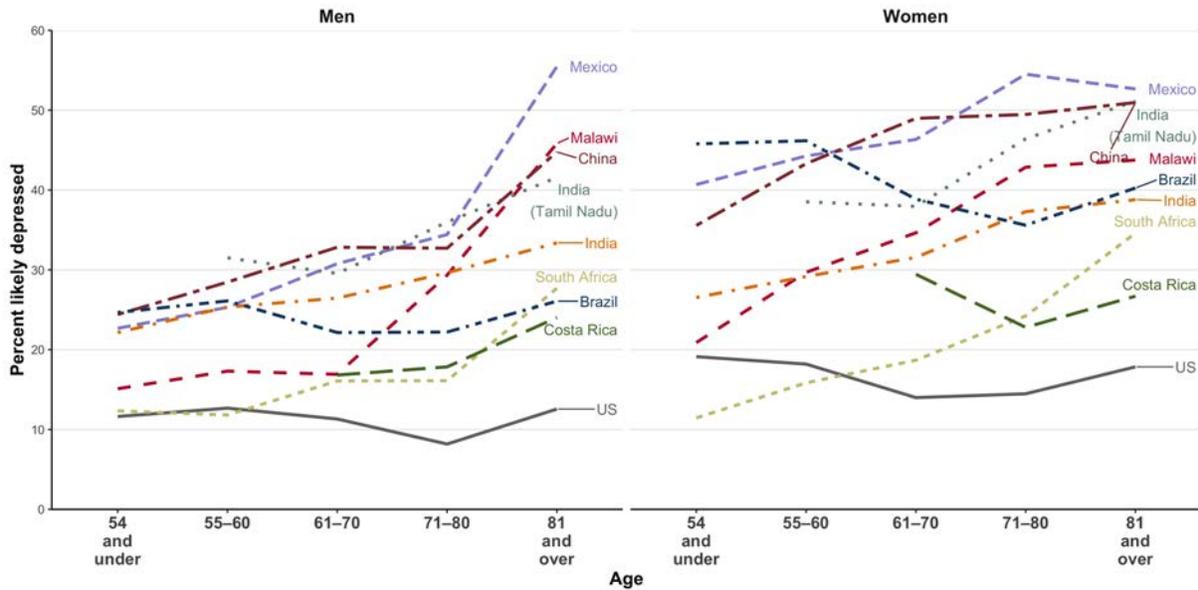
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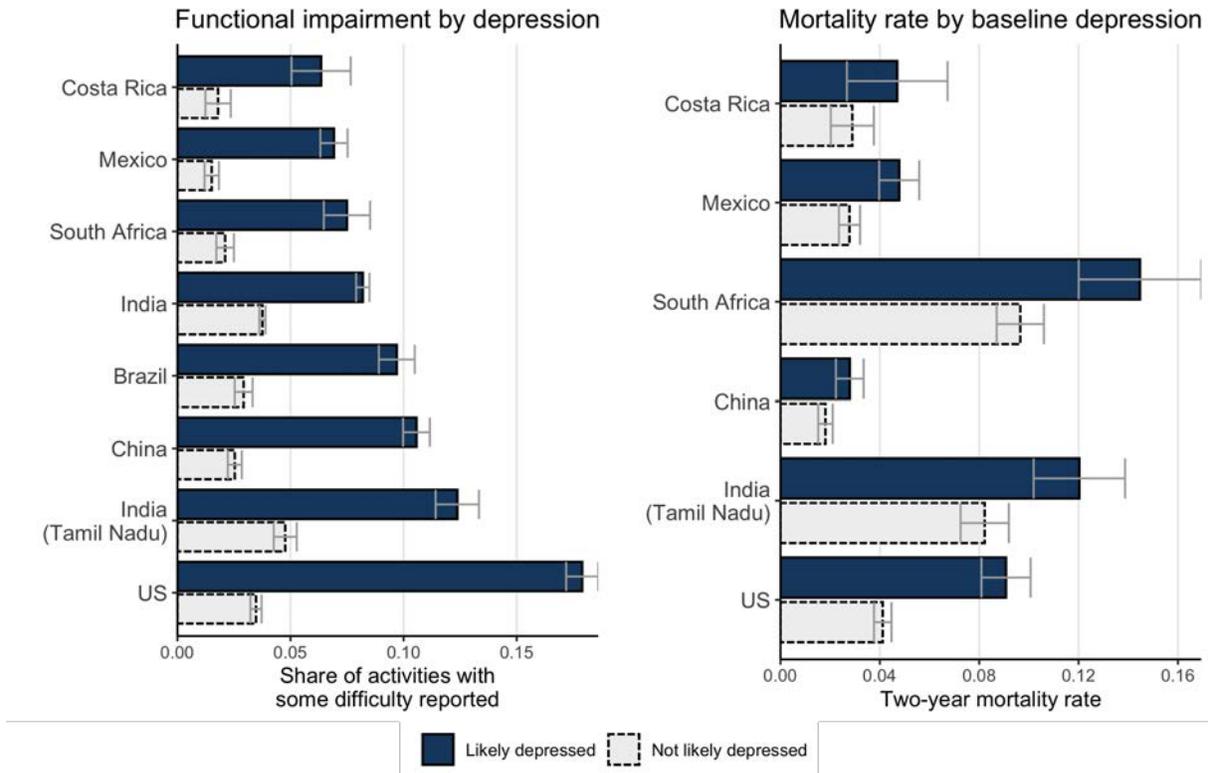
# Main Figures and Tables

Figure 1: Prevalence of depression symptoms by gender, age, and country



*Notes:* This figure shows the share of the population that is likely to be depressed (as determined by whether the depression index scores surpass the specified thresholds) for each age group and gender across the countries in our sample. The data for the US uses sample averages from the Health and Retirement Study (HRS) in 2014. The data for four other countries comes from nationally representative studies modeled after the US HRS (China, Costa Rica, Mexico, India, and South Africa). The data for Malawi comes from another independent study (MLSFH) of the health and well-being of older adults. Data for Tamil Nadu comes from our own study that was conducted in the state of Tamil Nadu. When available, survey weights are used to calculate averages that are nationally representative of older adults in each country or area.

Figure 2: Correlates of depression: Functional impairment and mortality by country

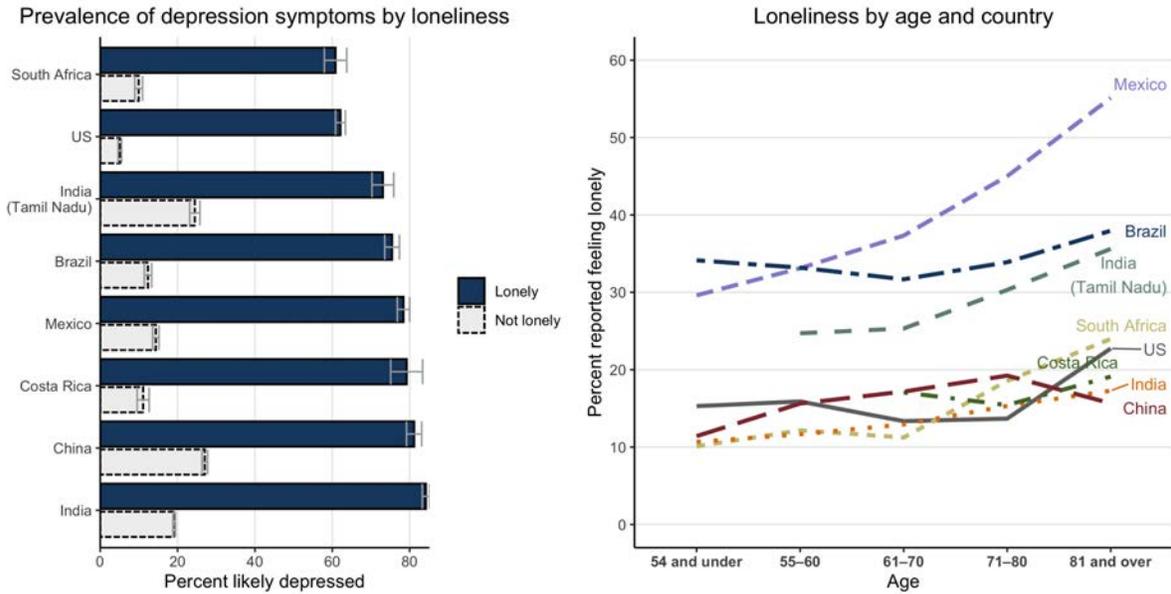


*Notes:* The left panel of the figure shows the average share of Activities of Daily Living (ADLs) for which respondents reported having some difficulty, for those who were likely to be depressed versus those who were not. For all countries, five of the six activities asked about were: dressing, eating, bathing, getting in and out of bed, using the toilet. For all countries except China, the sixth activity was walking across the room. For China, the sixth activity was controlling urination and defecation. Responses with more than two activities missing were dropped from this analysis.

The right panel shows the rate of mortality in the two-year follow-up survey, separately for the group of individuals who were not likely depressed versus those who were likely depressed at baseline. An individual is marked as likely to be depressed if their score on the depression questionnaire surpassed the specified threshold. For all countries, the two waves used for comparison consist of the first (baseline) and second waves of each study, except for the US, which uses data from the 2014 and 2016 waves (the two most recent non-COVID waves with non-missing survey response weights). For all of the countries, the time between the first and second wave was two years. Specific dates of the surveys can be found in Appendix Table A1. When available, survey weights are used to calculate averages that are nationally representative of older adults in each country or area.

In both figures, for each country we control for age and gender by constructing the displayed averages in the following way: for a given country, we first take the weighted average of the outcome for those who are not likely depressed to construct the “Not likely depressed” average. Then, we add to this the regression coefficient on an indicator for whether an individual was likely to be depressed, controlling for each age bin and gender to construct the “Likely depressed” average. These are then the two averages shown for each country, for both outcomes. Displayed are 95% confidence intervals.

Figure 3: Loneliness and depression by country

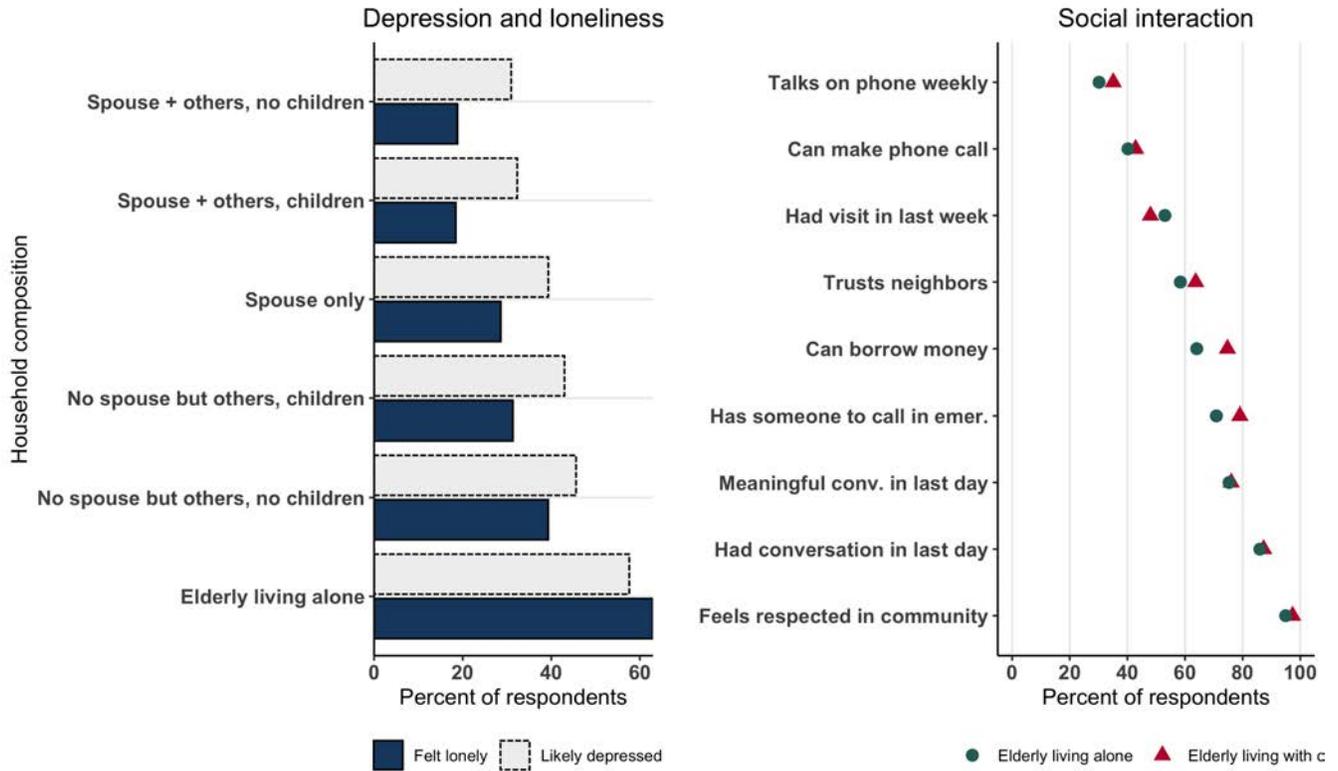


*Notes:* The left panel shows the rate of depression among respondents separately by those who expressed feeling lonely most or all of the time in the past week and for those who did not, controlling for age and gender. For surveys in which self-reported loneliness is part of the depression index calculation (US, China, India, Mexico, South Africa), we re-calculate depression scores excluding the response to the loneliness question and rescale accordingly. When available, survey weights are used to calculate averages that are nationally representative of older adults in each country.

For the left panel figure, for each country we control for age and gender by constructing the displayed averages in the following way: for a given country, we first take the weighted average of the outcome for those who are not likely depressed to construct the “Not likely depressed” average. Then, we add to this the regression coefficient on an indicator for whether an individual was likely depressed, controlling for each age bin and gender to construct the “Likely depressed” average. These are then the two averages shown for each country or area. Displayed are 95% confidence intervals.

The right panel shows the percent of individuals who reported feeling lonely across each age group and several countries where this direct report of loneliness is available. Calculation of depression score excludes question about loneliness and is rescaled accordingly. When applicable, averages are weighted to be nationally representative of older adult population. The measure of loneliness comes from a question that asked respondents either whether they felt lonely for the majority of the past week or how often they felt lonely. Respondents are marked as having felt lonely if they responded yes to the first question or either most or all of the time to the second. For the Tamil Nadu data, the question was worded slightly differently (“Do you often feel lonely?”) but still is made in reference to the previous week.

Figure 4: Social interaction and loneliness for the elderly living alone in Tamil Nadu

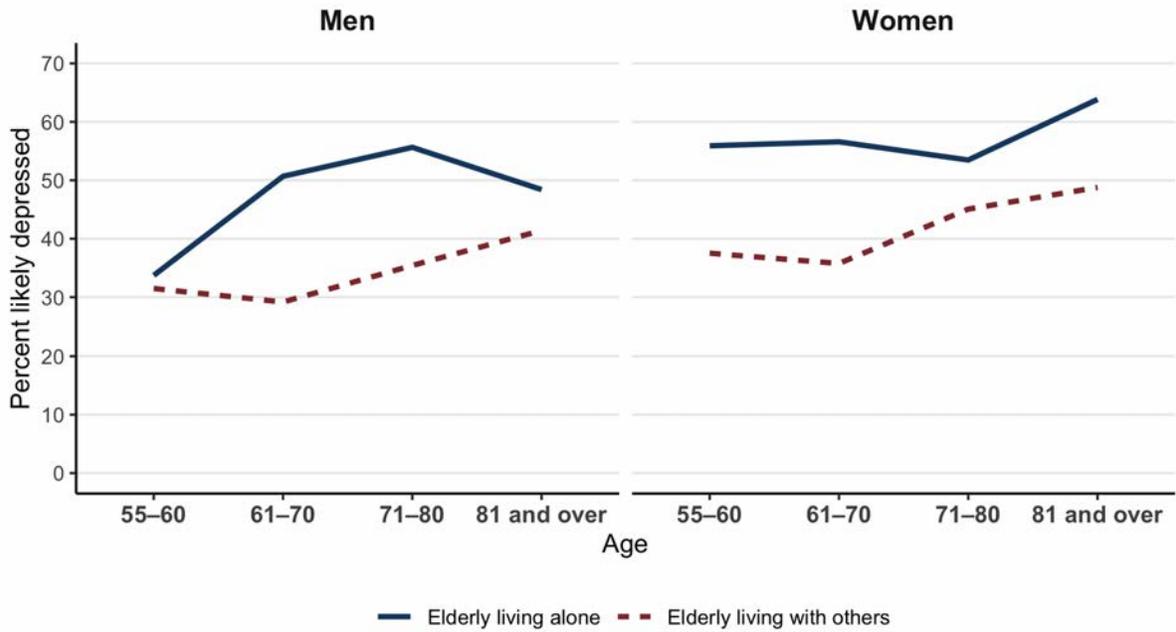


*Notes:* The left panel shows the percent of elderly, by age bracket and household composition, who report often feeling lonely as well as the percent of the elderly who are likely to be depressed (as determined by whether their score on the depression index surpassed the specified threshold for at least mild depression).

The right panel shows the percent of elderly living with others and elderly living alone who engage in various forms of social interaction with other individuals and their communities. “Has someone to borrow money from” refers to a question in which respondents were asked if they had someone to borrow money from (of around Rs 500 in value) for a day if needed. “Had conversation in last day” can refer to a conversation with any other person. “Community leaders” can refer to official or unofficial community leaders. “Collaborate with neighbors” refers to working with neighbors on any project. “Trusts neighbors considerably” reflects reporting that the respondent either trusted neighbors to “a very great or great extent.” All statistics are weighted by the inverse probability with which the various respondent types were sampled. “ELA” refers to elderly living alone.

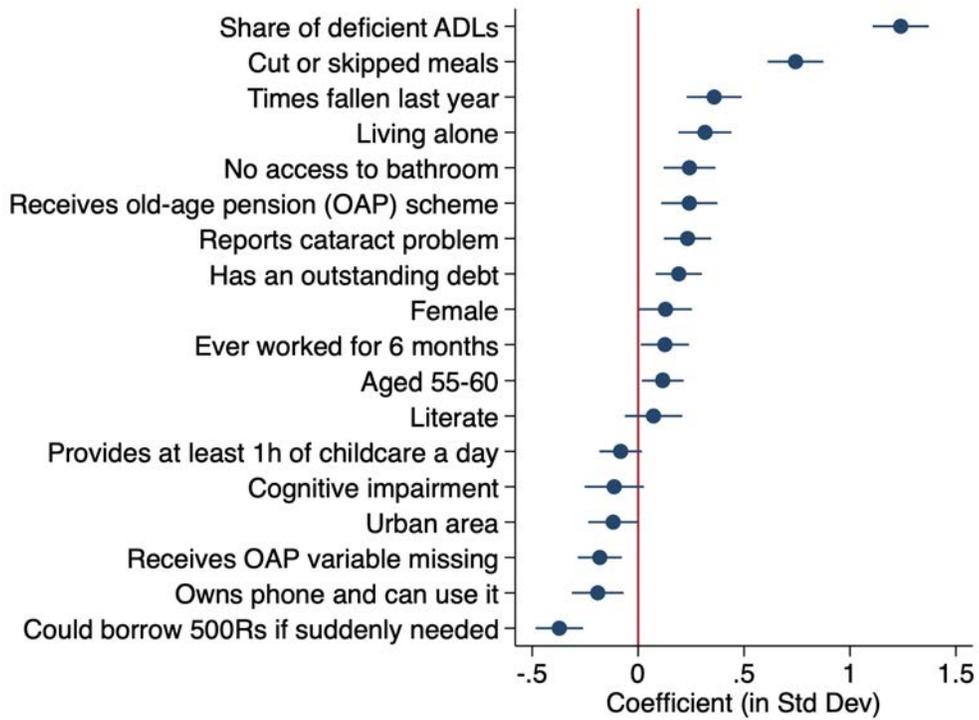
The right panel controls for age and gender, following a similar methodology to the construction for cross-country comparison figures. First, we pick a reference group and calculate the weighted average of the outcome for that group. The reference group used for constructing the predicted averages in this figure is the group that is Elderly Living with Others. Then we obtain the coefficient for the other group (Elderly Living Alone) indicator from a regression of the outcome variable on an indicator for the other group, along with controls for age and gender interacted.

Figure 5: Depression rates among Tamil Nadu elderly



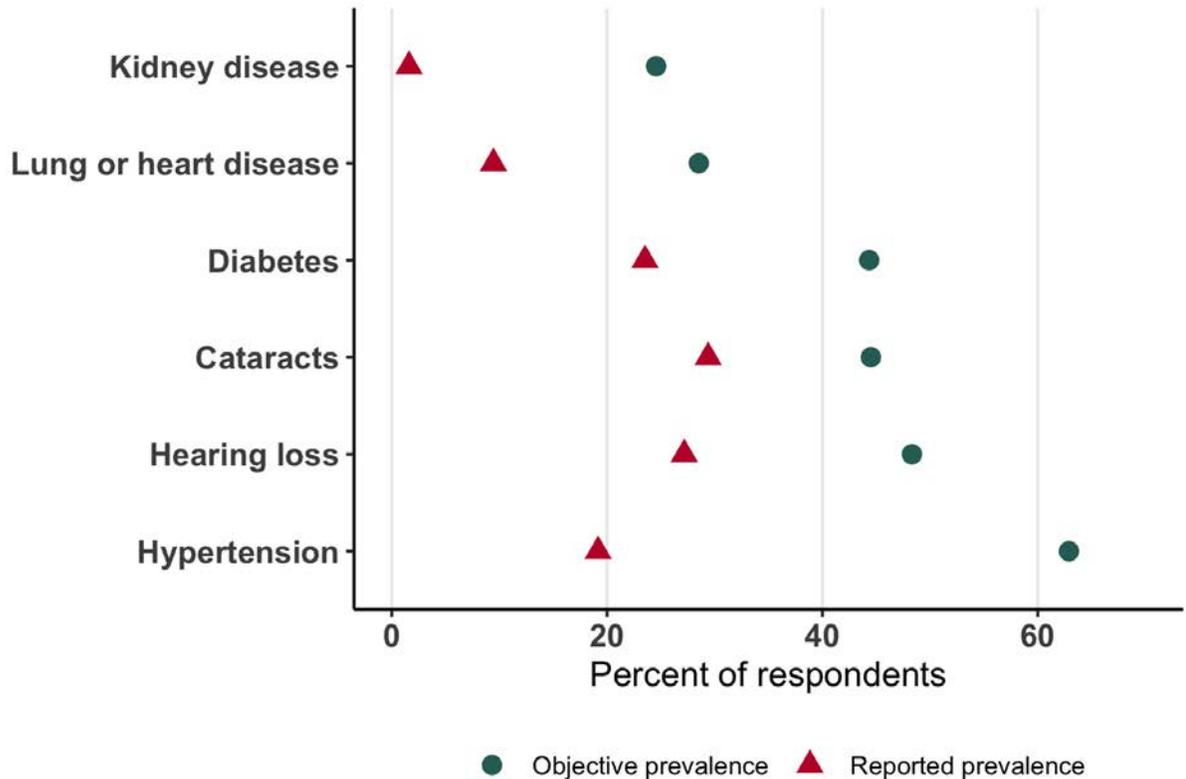
*Notes:* This figure shows the prevalence of depression symptoms among the male and female elderly living alone (male N = 228; female N = 1,297) and elderly living with others (male N = 2,276; female N = 2,463). The Geriatric Depression Score employed is the standard Geriatric Depression Scale - Short Form, a 15-question survey where scores 0-4 are normal and scores  $\geq 5$  are suggestive of depression. ELA refers to “elderly living alone.” Ages are reported in age bins. All statistics are weighted by the inverse sampling probability. Ages are reported in age bins: 55-60, 61-70, 71-80, 81 and above.

Figure 6: Predictors of depression for Tamil Nadu elderly



*Notes:* This figure presents coefficients from a regression of depression on living alone and covariates selected using double Lasso. All covariates are in standard deviation units. The measure of depression is the total score on the Geriatric Depression Scale—Short Form questionnaire (GDS-SF), which ranges between 0 and 15, with higher values corresponding to more severe levels of depression. Bars denote robust, 95% confidence intervals. Both the Lasso selection and the final regression were adjusted for sampling weights.

Figure 7: Discrepancy between health condition prevalence and awareness among the elderly



*Notes:* This graph shows health awareness and treatment-seeking behaviors, and discrepancies between these behaviors and measured disease prevalence.

To construct a measure of objective disease prevalence, we rely on the set of objective health measurements taken for a subset of the study respondents. For arthritis, the c reactive protein level had to be greater than 3g/ml. For lung or heart disease, the measured SPO2 had to be less than 94 or the respiratory rate greater than 18 for those without mobility impairments or greater than 25 for those bedridden or with mobility impairments. For kidney disease, the serum creatinine level had to be greater than 1.2 for women and greater than 1.4 for men. For hearing loss, the medical examiner had to record any one of the following: hearing loss in either ear, failed ear exam in either ear, or failed Rinne or Weber hearing tests. For cataracts, medical examiner had to record cataract presence in either eye during eye exam. For diabetes, the measured level of HbA1c had to be greater than or equal to 6.5. For hypertension, the measured systolic blood pressure exceeded 130 and/or diastolic blood pressure exceeded 80.

To construct a measure of self-reported disease prevalence we relied on questions from the surveys that asked about whether the respondent had ever been diagnosed with a given condition. For arthritis, either respondent or proxy had to report that the respondent was diagnosed with arthritis or a similar joint disease. For lung or heart disease, either respondent or proxy had to report that the respondent was either: diagnosed with a heart problem; diagnosed with chronic lung disease; or diagnosed with tuberculosis. For kidney disease, either respondent or proxy had to report that the respondent was diagnosed with a kidney condition. For hearing loss, either respondent or proxy had to report that the respondent has difficulty hearing or that they have been prescribed a hearing aid. For cataracts, either respondent or proxy had to report that the respondent has been diagnosed with cataracts. For diabetes, either respondent or proxy had to report that the respondent has been diagnosed with diabetes. For hypertension, either respondent or proxy reports that the respondent has been diagnosed with hypertension.

All statistics are weighted by the inverse probability with which the various respondent types were sampled.

## Additional tables and figures

Table A1: Dataset overview by country

Country	Survey	Panel	Dates	Sampling	Sample size	Age req	Depression
United States	HRS	Sixteen waves	1992-2022	Representative panel (plus addtl cohorts)	12,652	51	CESD-10
Brazil	ELSI	One wave	2015	Nationally representative panel of people aged 50+	9,412	50	CESD-8
China	CHARLS	Four waves	2011, 2013, 2015, 2018	Representative panel of people aged 45+ and partners	17,705	45	CESD-10
Costa Rica	CRELES	Three waves for first cohort; Two waves for second cohort	2005, 2007, 2009, 2010, 2012	Representative panel of people aged 60+, with refreshment sample	2,827 (cohort 1); 2,798 (cohort 2)	60 (cohort 1); 55-65 (cohort 2)	GDS-15
India	LASI	One wave	2017	Cohort profile	72,262	45	CIDI-SF and CESD-10
Malawi	MLSFH	Seven waves (only wave 7 has depression measure)	1998, 2001, 2004, 2006, 2008, 2010, 2012	Representative of rural population in Malawi (85% of population) from three districts (Balaka, Mchinji, Rumphu)	1,402 (wave 7)	45	PHQ9 (wave 7)
Mexico	MHAS	Five waves for cohort (plus refreshment samples)	2001, 2003, 2012, 2015, 2018	Representative panel of people aged 50+ and partners living in private dwellings in rural and urban areas	15,402	50	CESD-9, binary indicators
South Africa	HAALSI	Two waves (third wave in progress)	2017, 2019, (2021)	Community members in Agincourt, South Africa	5,059	40	CESD-8, binary indicators for Wave 1; CESD-20, frequency indicators for Wave 2

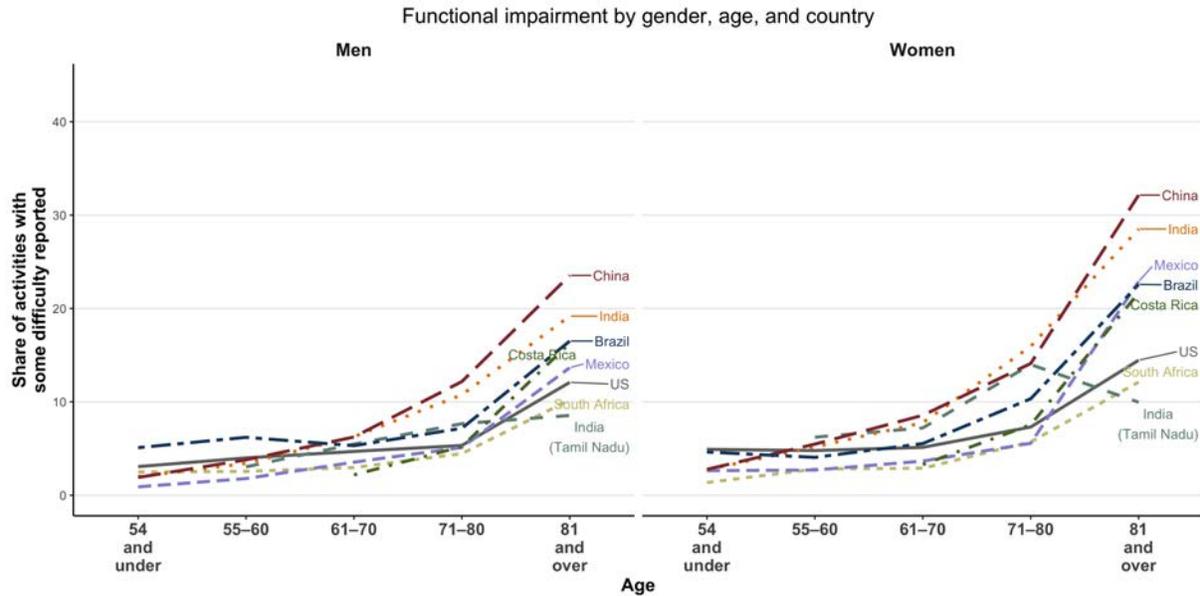
*Notes:* This table summarizes the datasets used in the cross-country comparison analysis in this paper. For each country, the table lists the name of the survey, the panel structure (number of data collection waves), the dates of the data collection rounds, the sampling frame (more detail for each country is available in the Appendix text), the sample size of the original cohort surveyed in the baseline round of data collection, the minimum age requirement to be in the study, as well as the questionnaire used to calculate depression symptom prevalence.

Table A2: Depression measures overview by country

Country	Measure	Response	Scale	Cutoff	Source	Reasoning
United States	CESD-8	Binary	0-8	4	Steffick (2000)	Approximated based on guidelines in Steffick (2000)
Brazil	CESD-8	Binary	0-8	4	Steffick (2000)	Based on guidelines in Steffick (2000)
China	CESD-10	4-point scale	0-30	10	Chen and Fang (2020); Andresen et al (1994)	Based on guidelines in Andresen et al (1994)
Costa Rica	GDS-15	Binary	0-15	5	Yesavage and Sheikh (1986)	GDS standard
India	CESD-10	Binary	0-10	4	Steffick (2000); Hossain et al (2022)	Approximated based on guidelines in Steffick (2000)
Malawi	W7: PHQ9	4-point scale	0-27	5	Koehler et al (2017)	PHQ9 standard
Mexico	CESD-9	Binary	0-9	5	Torres and Wong (2013); Aguilar-Navarro et al. (2007)	Validated in clinical sample of older Mexican adults in Aguilar-Navarro et al (2007)
South Africa	W1: CESD-8; W2: CESD-20	W1: Binary; W2: 4-point scale	W1: 0-8; W2: 0-60	W1: 3; W2: 16	Turvey et al (1999)	Based on guidelines in Turvey et al (1999)

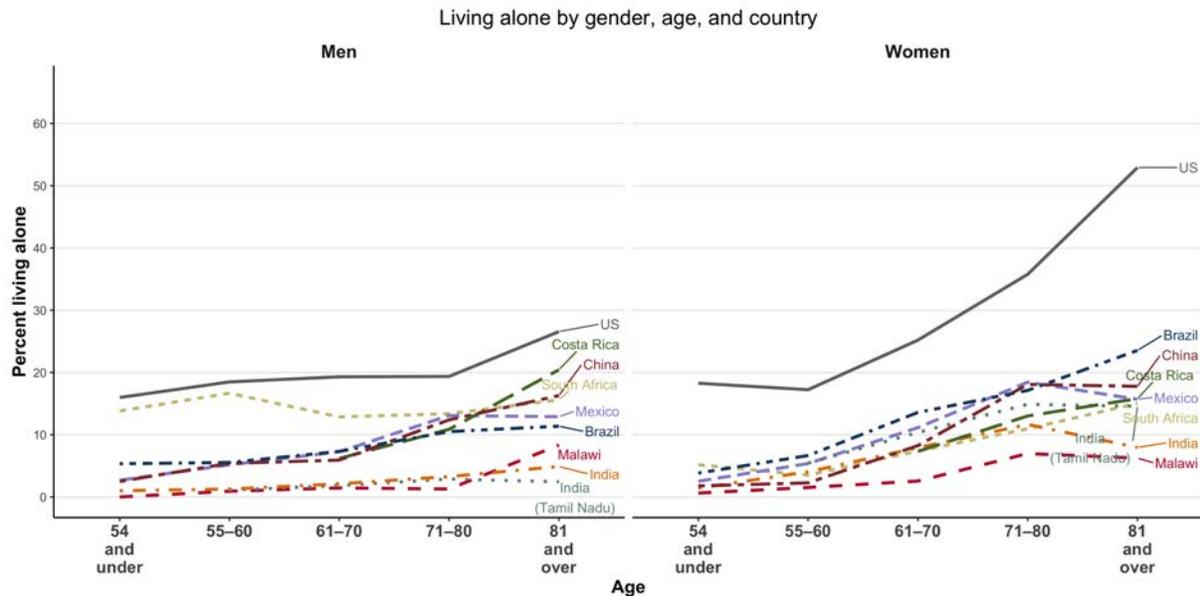
*Notes:* This table summarizes the methodology used to calculate predicted depression rates for each country. For each of the depression scales used, a depression index score is assigned to each respondent based on the number of depression symptoms reported in the questionnaire. For each survey, a cutoff score is chosen as the threshold above which an individual is predicted to be depressed. The table lists the name of the survey, the questionnaire used to calculate depression symptom prevalence, the response format (e.g. what answers the respondent could have given in response to each question), the total range of the depression scale, the cut-off score used to determine predicted depression, the reference from the literature that was used to determine the cut-off, as well as an additional detail on the reasoning for the cut-off score chosen.

Figure A1: Average functional impairment summary measure by gender, age, and country



Notes: This figure shows the average share of Activities of Daily Living (ADLs) for which respondents reported having some difficulty for each age group and gender. For India (Tamil Nadu) data, the y-axis corresponds to the share of activities for which the respondent reported having severe or extreme difficulty, whereas for the other countries we report the share of activities for which the respondent reported having some difficulty (often asked as a binary yes or no response question).

Figure A2: Share of elders living alone by age, gender, and country



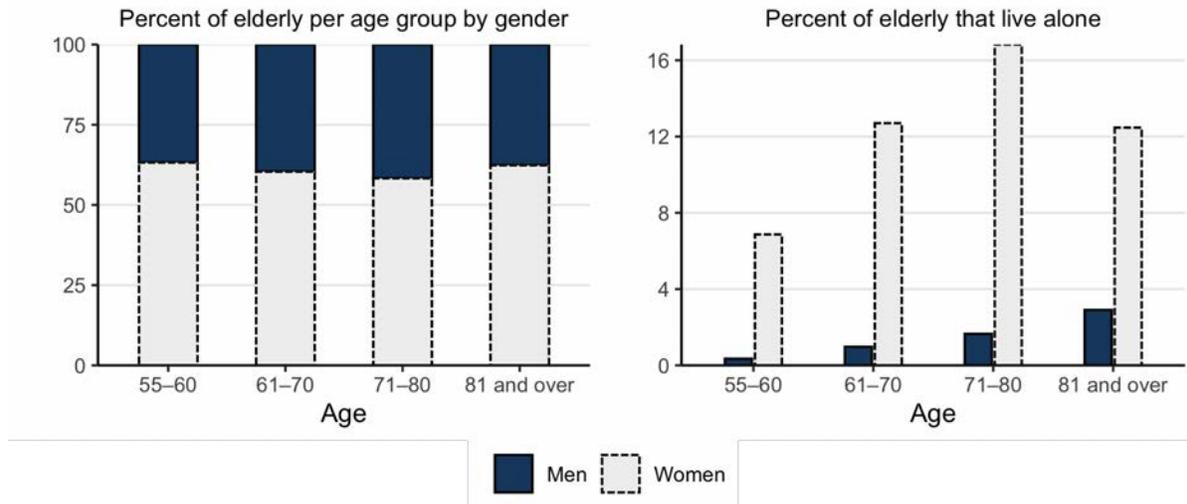
Notes: This figure shows the share of elders who are living alone for each age group, gender, and country. When available, survey weights are used to calculate averages that are nationally representative of older adults in each country.

Table A3: Rate of predicted depression, diagnosis, and treatment

Country	Depression	Pct of sample	Pct ever diagnosed	Pct medication	Pct other treatment
China	Not predicted	56.78	0.63	0.31	0.11
China	Predicted	32.29	2.09	1.02	0.29
India (Tamil Nadu)	Not predicted	56.4	1.4	0.2	—
India (Tamil Nadu)	Predicted	35.8	3.3	0.8	—

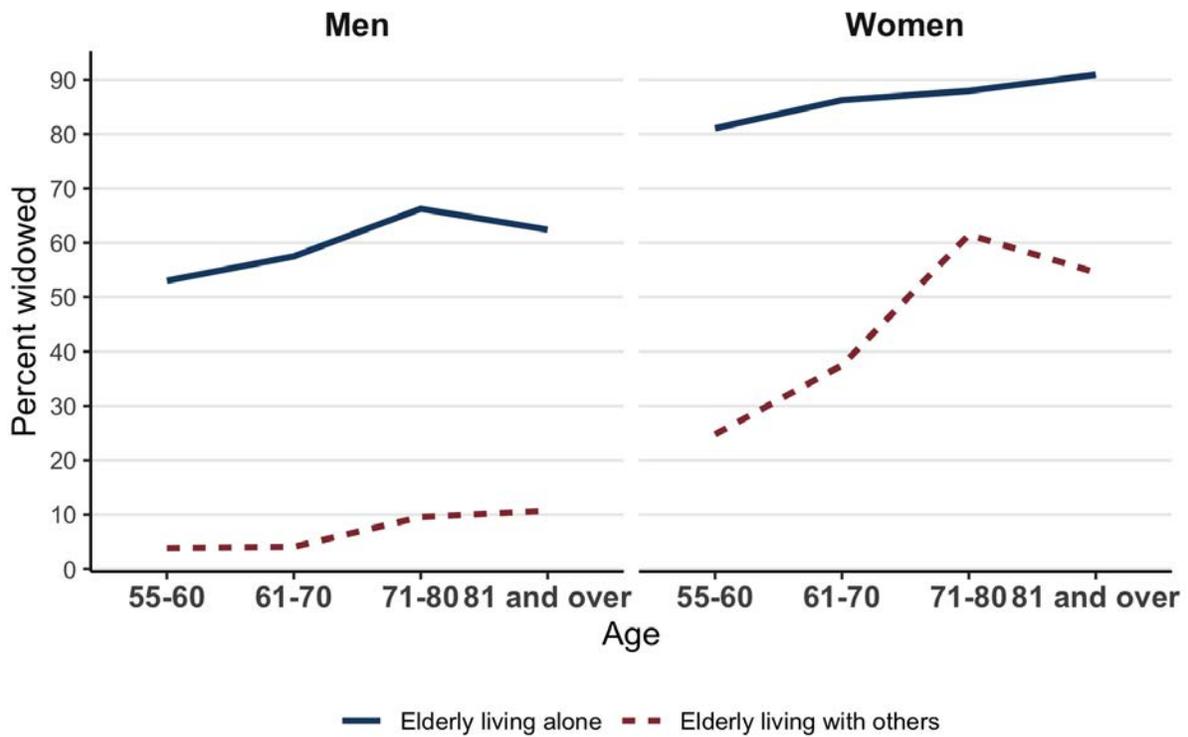
*Notes:* This table compares the proportion of the population that is predicted to be depressed using the depression questionnaires in the studies to the proportion of the population that has ever been diagnosed with any “emotional, nervous, psychiatric problems” (including depression and anxiety, among other conditions). For the CHARLS study of adults in China, there were also questions about whether the respondent is currently taking medication for psychiatric conditions or receiving any psychological treatment. For the Tamil Nadu study in India, respondents are only asked about whether they are taking medication for any “emotional, nervous, mental health, or psychiatric problems.” Note that only those who respond yes to having ever been diagnosed with a mental health problem are asked about whether they take medication for the problem.

Figure A3: Sample demographics of living arrangements and gender



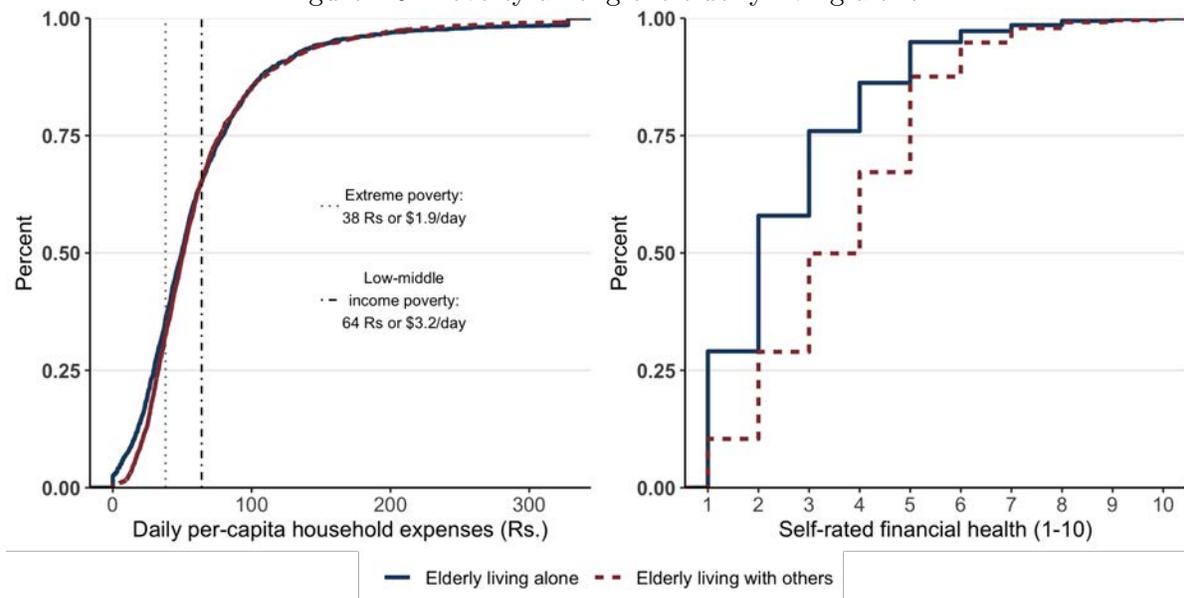
*Notes:* This figure shows the fraction of elderly living alone for each age category as a share of the total population of elderly surveyed in the census exercise (N = 43,540). The elderly population surveyed is representative of all elderly in the state of Tamil Nadu. That is, these 43,540 were selected from a census exercise that surveyed 61,954 households across five districts in Tamil Nadu. These districts were, in turn, selected from a randomized selection process which ensured balance by geographic location and inhabitant demographics. Within these five districts, 80 Primary Sampling Units (PSUs - villages in rural areas and blocks in urban areas) were randomly drawn. All households in each of these 80 PSUs, in each district, comprise the 61,954-household respondent sample for the census exercise. Elderly living alone are those elderly who are the sole resident of their household. ELA stands for “elderly living alone.”

Figure A4: Widowhood among the elderly living alone



*Notes:* This figure shows the percent of male and female elderly living alone (male N = 228; female N = 1,297) versus elderly living with others (male N = 2,276; female N = 2,463) who are widowed at the time of the baseline survey. Respondents are marked as widowed based on their response to a question about their marital status. All statistics are weighted by the inverse probability with which the various respondent types were sampled. Ages are reported in age bins: 55-59, 61-70, 71-80, 81 and above.

Figure A5: Poverty among the elderly living alone

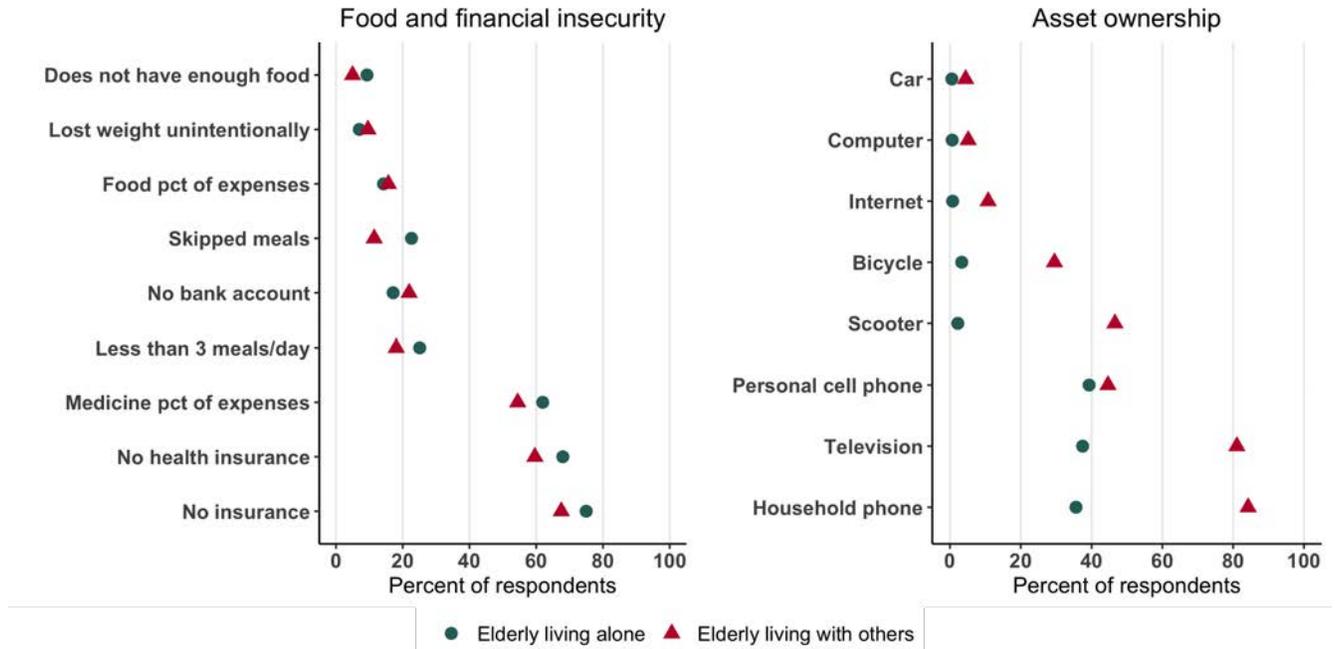


*Notes:* This figure shows daily per-capita household expenditure and self-rated financial health, on a 1-10 scale, for the elderly living with others ( $N = 4,759$ ) and elderly living alone ( $N = 1,534$ ). Daily per-capita household expenditure is found by dividing monthly per-capita household expenditure (monthly household expenditure divided by household size) by thirty. The extreme and low-middle income poverty lines are the World Bank’s poverty lines; conversions are in purchasing power parity (PPP) terms. A higher value reflects greater financial comfort: a “1” corresponds to “extremely difficult financial situation” while a “10” corresponds to “extremely comfortable financial situation.”

This comparison controls for age and gender by constructing the displayed averages in the following way: for a given activity, we first take the weighted share of individuals with severe difficulty for those who are Elderly Living with Others. This is then the displayed group average for Elderly Living with Others. Then, we add to this the regression coefficient on an indicator for whether an individual was an Elderly Living Alone, controlling for each age bin, gender, and interactions to construct the average for Elderly Living Alone.

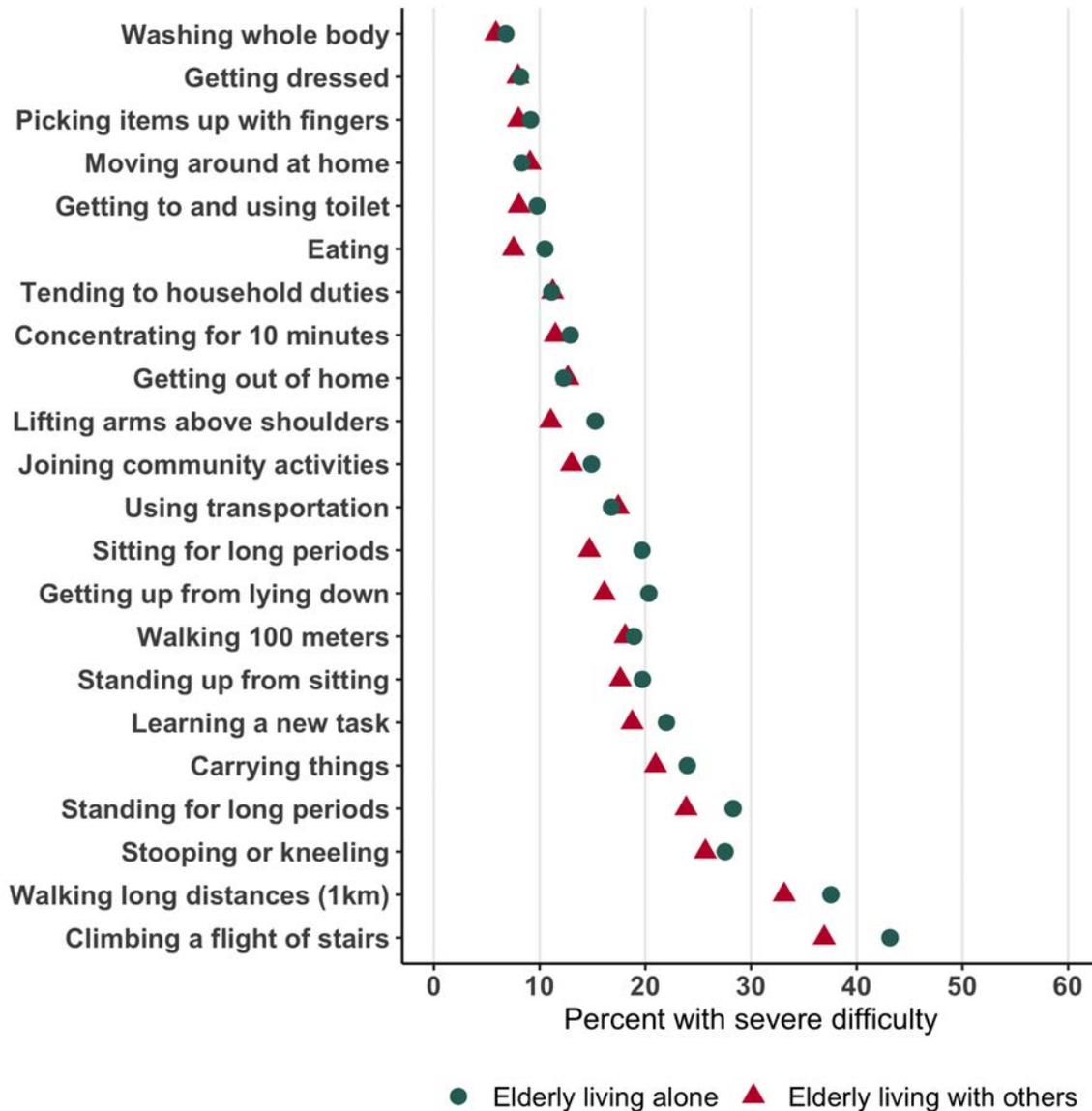
All statistics are weighted by the inverse probability with which the various respondent types were sampled.

Figure A6: Financial well-being among the elderly living alone



*Notes:* This figure shows, separately for the elderly living alone and elderly living with others, the fraction of respondents in each group who answered affirmatively to each question asked about various indicators of financial insecurity and about ownership of various assets. All statistics are weighted by the inverse probability with which the various respondent types were sampled.

Figure A7: Functional impairment among the elderly living alone

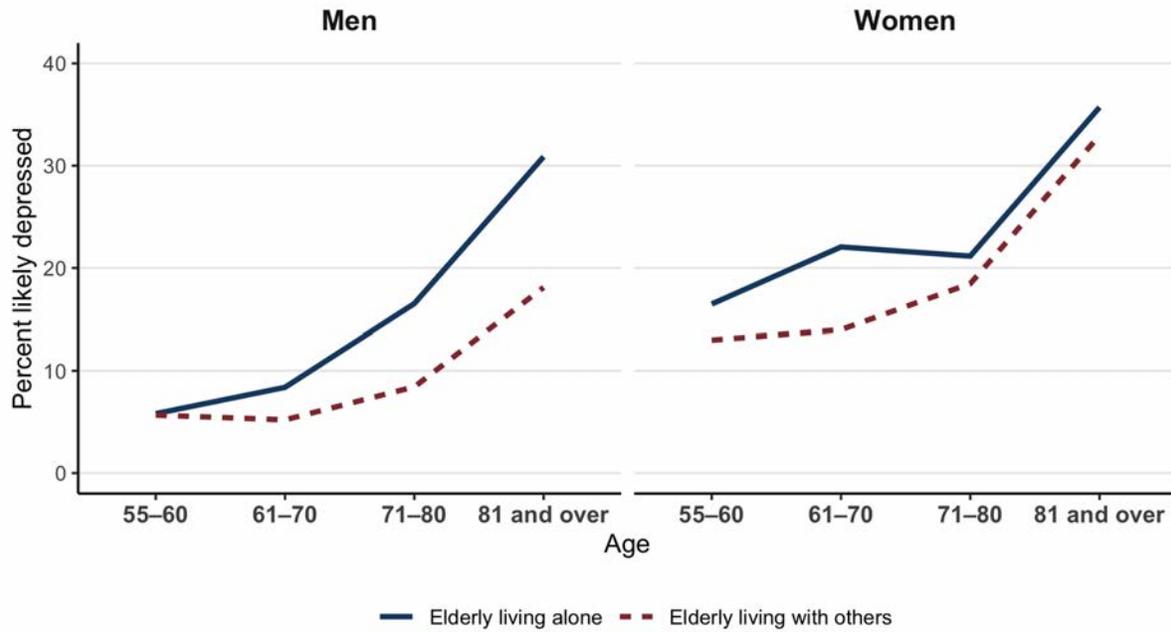


*Notes:* This figure shows the percent of elderly living alone (N = 1,453) and elderly living with others (N = 4,424) who report having severe or extreme difficulty carrying out the specified tasks independently. The 22 listed tasks are based on the World Health Organization’s standard Activities of Daily Living (ADLs) and Instrumental ADLs. Elderly living alone are those elderly who are the sole resident of their household.

This comparison controls for age and gender by constructing the displayed averages in the following way: for a given activity, we first take the weighted share of individuals with severe difficulty for those who are Elderly Living with Others. This is then the displayed group average for Elderly Living with Others. Then, we add to this the regression coefficient on an indicator for whether an individual was an Elderly Living Alone, controlling for each age bin, gender, and interactions to construct the average for Elderly Living Alone.

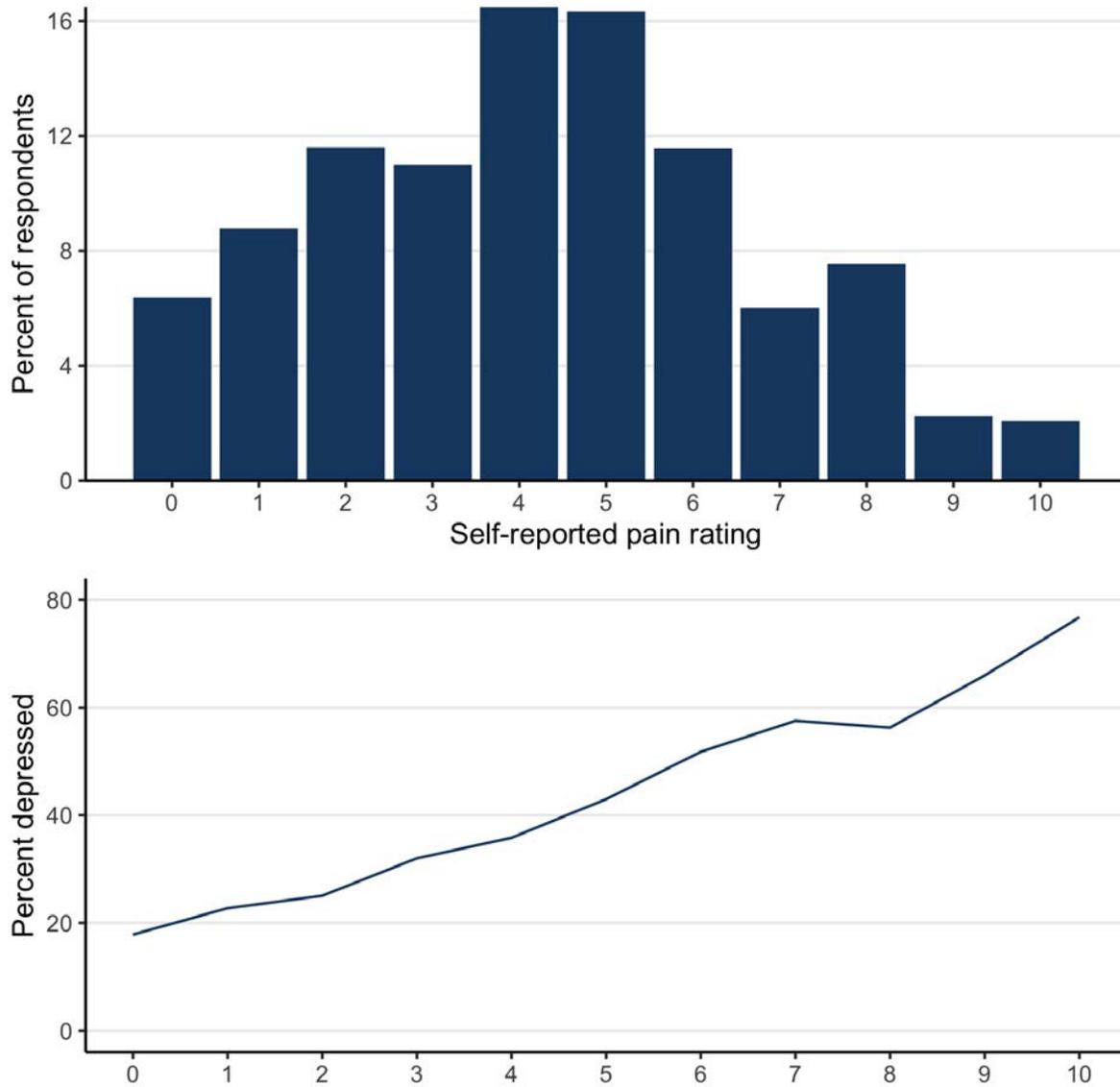
All statistics are weighted by the inverse probability with which the various respondent types were sampled.

Figure A8: Cognitive impairment among the elderly living alone



*Notes:* This figure shows the percent of male and female elderly living alone (male N = 228; female N = 1,297) versus elderly living with others (male N = 2,276; female N = 2,463) who demonstrate severe or mild/severe cognitive impairment by age group. Cognitive impairment is determined by responses to the Mini-Mental State Examination (MMSE), a standard 30-item test of cognition. Cognitive impairment corresponds to 10 or more incorrect items on the 30-item assessment. All statistics are weighted by the inverse probability with which the various respondent types were sampled. Ages are reported in age bins: 55-59, 61-70, 71-80, 81 and above.

Figure A9: Depression rates by self-rated pain



*Notes:*

This figure uses data from the follow-up wave in 2022 for the Tamil Nadu study, since respondents were not asked to self-assess their experience of pain in the baseline survey. The question asked: In the last week, how much physical pain would you say you have been in on a scale of 0-10, with 0 being “No Pain” and 10 being “Worst Pain possible”. For this question, about 20 All statistics are weighted by the inverse probability with which the various respondent types were sampled.

# Data Construction Appendix

## Variable construction for Tamil Nadu survey

### Depression (GDS)

A measure of depression as measured by the GDS is the sum of 15 binary indicators for whether the respondent felt a particular depression symptom over the last week. Note that responses to questions asking about positive feelings (for example: whether the respondent felt happy) are reversed before being summed, so that higher scores always indicate higher severity of depression.

Individuals are categorized into different predicted levels of depression based on the cut-off points:

- 0-4 considered not depressed
- 5-8 indicate mild depression
- 9-11 indicate moderate depression
- 12-15 indicate severe

This measure is only available for the main respondents who were not proxy respondents, since the proxy module didn't include these questions. This measure is also coded as missing for those who missed more than 5 questions. For those who missed 0-5 questions, rescale the raw score proportionally so that it is interpretable as a value out of 15, in line with the guidelines from Yesavage et al (1986).

### Functional Impairment (as measured by Activities of Daily Living)

Respondents were asked to assess their difficulty in completing several Activities of Daily Living (ADLs) on a scale from 1 to 5, in which scores correspond to No difficulty, Mild difficulty, Moderate difficulty, Severe difficulty, and Extreme difficulty respectively. Activities for which the respondent reported Severe or Extreme difficulty are classified as a deficient activity for that respondent. For each respondent, we calculate a summary measure of functional impairment by calculating the share of deficient activities out of the total set of activities considered.

While we are able to construct this measure for both main respondents and proxy respondents, the set of activities asked about are not identical. The source of inconsistency comes from the fact that the proxy module does not include the same set of questions as the main respondent's one. In most of our analysis specific to Tamil Nadu, we code proxy responses as missing for comparability. In analysis for cross-country comparisons, we focus on the six ADLs asked about in the HRS-style surveys (see Details on Other Datasets section for more detail).

This measure is also coded as missing for those who missed more than two questions. For those with two or fewer missing questions, we calculate the share of deficient activities only over the set of activities for which the respondent gave an answer.

## Cognition Score (MMSE)

For a measure of cognitive impairment, we use an inverted transformation of the MMSE score, which is usually scored from 0 to 30 where higher values correspond to higher cognitive functioning. Instead, we construct a measure of cognitive impairment by subtracting the raw MMSE score from the total possible points out of 30, so that higher values correspond to more severe cognitive impairment and any respondent with a score above a certain threshold is classified as having "At least mild cognitive impairment". In our data, we present the share of respondents with at least mild cognitive impairment.

This variable is only available for the main respondents, since the proxy module didn't include this measure. Respondents already diagnosed with dementia are included among those who had proxy responses and thus do not have a cognitive impairment score in our data.

Calculation of the raw (uninverted) MMSE score is such that respondents can score up to 30 possible points (or 26 if they can't see or use at least one hand) by successfully completing a set of tasks outlined below.

The modules that can be answered by all main respondents are:

- Time Module: 5 points
- Location Module: 5 points
- Repeating and remembering 3 objects: 6 points
- Recognize watch and pen (alternative for visually impaired): 2 points
- Mimic facial expression (alternative for visually impaired): 1 point
- Say something about own house: 1 point
- Computation: 5 points

The following modules can only be answered by those who can...

- Use at least one hand: Folding paper (3 points)
- See and use at least one hand: Copy a drawing (1 point)
- Unclear which physical impairment prevents respondents from performing this task but there's a response option for not being physically able to do it: Repeating a sentence (1 point)

The score is a sum of points in all cases but the thresholds for considering that a respondent has at least mild cognitive impairment vary by the level of physical limitation:

- None: 7 or more failed answers (23% of 30) - This was the threshold used for the previous baseline figures.
- For the rest, following the logic: unreachable points + 23% of reachable points.

Except for the case in which questions can't be answered by physically impaired respondents, as agreed by the team, most missing values (refused, don't know, other) are counting as not being able to perform the task.

## Variable construction for International datasets

### Notes for international datasets and figures

#### General notes for figures

For all figures, the surveys and years that the data shown correspond to are the first (baseline) and second waves are as follows (with the exception of the United States and Malawi; reasons in parentheses).

- Brazil: ELSI, 2015 (only one wave)
- China: CHARLS, 2011, 2013
- Costa Rica: CRELES, 2005, 2007
- India: LASI, 2017 (only one wave)
- Malawi: MLSFH, 2012 (only one wave with depression index)
- Mexico: MHAS, 2001, 2003
- South Africa: HAALSI, 2017, 2019
- United States: HRS, 2014, 2016 (most recent two waves before COVID-19 pandemic)

#### Brazil (ELSI)

##### Population and Sampling design

The Brazilian Longitudinal Study of Aging (ELSI) is a nationally representative study designed to examine health conditions and aging process of adults aged 60 and older. In line with other household samples in Brazil, participants were sampled from the geographic operational base of the Brazilian Institute of Geography and Statistics (IBGE). To obtain a nationally representative sample, participants were selected in a multi-stage process. First, municipalities were stratified into four groups depending on population size ( $\leq 26,700$  inhabitants; 26,701–135,000 inhabitants; 135,001–750,000 inhabitants;  $> 750,000$  inhabitants). For the last group of the largest municipalities, first census tracts were selected, and then households were selected. For the first three groups of smaller municipalities, first municipalities were selected, then census tracts, and finally households. For a chosen household, all residents aged 50 years or older were eligible to be interviewed for the study.

##### Timing

##### Measure of mental health

The ELSI survey uses a modified version of the CES-D questionnaire with eight yes/no questions that each pertain to a symptom of depression. In line with the guidelines provided by

Steffick (2000), our analysis uses a cut-off score of 4 to determine whether a respondent is predicted to be depressed.

#### Other notes

We code the aggregate depression score to missing if three or more items of eight` are missing.

## China (CHARLS)

### Population and Sampling design

The China Health and Retirement Longitudinal Study (CHARLS) is a nationally representative panel of people aged 45 and older and their partners, covering 25,586 respondents in total across four waves.

The sample was selected in several stages. First, counties were stratified by region, characteristic of the county (urban or rural), and per-capita gross domestic product (GDP) and selected by probability proportion to size (PPS), except for Tibet. Second, households were selected within each county/PSU using a CHARLS-designed mapping/listing software (CHARLS-GIS) that used Google Earth images to list all dwelling units in all residential buildings. Finally, if the sampled household had occupants older than 40, only one of them was randomly selected. If the selected person was aged 45 or older, they became a respondent. If the selected person was between age 40 and 44, they were reserved as a refreshment sample. The institutionalized elderly are not sampled, except for wave 1 respondents who are later institutionalized (Phillips et al 2021).

### Timing

Four waves were administered in 2011, 2013, 2015, and 2018.

- The initial sample included 17,708 respondents from 10,257 households in 450 villages/urban communities in 150 counties in 28 provinces.
- The second wave was conducted between July 2013 and January 2014. It included a refreshment sample of individuals ages 43-44 years old at Wave 1 and their partners.
- The third wave was conducted between July 2015 and January 2016. It included a refreshment sample of individuals aged ages 41-42 years old at Wave 1 and their partners.
- The fourth wave was conducted between July and November 2018. It included a refreshment sample of individuals who were 40 years old at Wave 1 and their partners.

### Measure of mental health

Individuals were asked a 10 question version of the CES-D. For each question, respondents could give one of four possible responses that characterized the frequency of the depression symptom being asked about in that question. Each question is scored from 0 to 3 from least to most frequent, and the aggregate CESD-10 score ranges from 0 to 30. The threshold for depression is a score greater than or equal to 10, following the methodology of Chen and Fang (2020).

## Other notes

Cross-sectional sample weights are constructed directly from sampling probabilities for households and individuals.

About 10% of observations are missing CES-D values - either due to the main respondent not being present or due to the respondent refusing to answer some questions. We code the aggregate depression score to missing if four or more items of 10 are missing.

## Costa Rica (CRELES)

### Population and Sampling design

The Costa Rican Longevity and Healthy Aging Study (CRELES) consists of a representative panel of older Costa Ricans from two birth cohorts. The first cohort consists of about 3,000 people born in 1945 or before and was surveyed over the course of three waves (Pre-1945 Cohort). The second cohort consists of about 2,800 people and was surveyed over the course of two waves (1945-1955 Retirement Cohort).

The sample design consisted of two selection stages. First, a stratified random selection of 9,600 individuals were chosen from those who were 55 years of age or older in the 2000 Census of Population. Sampling strata were constructed for each 5-year age group, and older adults were over-sampled (e.g. 1% of those born 1941-1945 were chosen while 100% of those born before 1905 were chosen). Second, a sub-sampled selection of 5,000 individuals were chosen from 60 out of 102 "Areas of Health" (covering 59% of Costa Rican territory). The sample consists of all selected individuals who could be located and interviewed (Rosero-Bixby et al 2016).

The dataset includes one entry per individual (and per household, since sampling was done to select at most one individual from any given household). Data collected for the second cohort (1945-1955 Retirement Cohort) in waves 4 and 5 also includes information from a short form questionnaire administered to the original subject's spouse.

### Timing

Five waves were administered across both cohorts: The first cohort (Pre-1945 Cohort) was interviewed in 2005, 2007, and 2009. The second cohort (1945-1955 Retirement Cohort) was interviewed in 2010 and 2012.

### Measures of mental health

Unlike the other HRS-compatible surveys, the survey uses a short-form version of the Geriatric Depression Scale (GDS) with 15 questions instead of a CESD-based questionnaire. Each question asks whether the respondent experienced a symptom for the majority of the time in the previous week. Respondents are marked as having at least mild depression if they exhibit 5 or more symptoms.

The GDS questionnaire was not administered to approximately 25% of respondents who had cognitive impairment and needed a proxy respondent.

#### Other notes

Of the sampling frame, 20% of individuals were not interviewed due to change of residence or not being located. Selection bias from this source of non-randomness can be accounted for using the survey weights.

We code the aggregate depression score to missing if five or more items of 15 are missing.

## India (LASI)

### Population and Sampling design

The Longitudinal Aging Study in India (LASI) consists of a panel of individuals 45 years of age or older as well as their spouses. The dataset includes one entry per individual. Individuals may include spouses of the initially targeted sample, as well as additional members of the household who are also older than 45 years of age.

The sample design consisted of three selection stages in rural areas and four selection stages in urban areas. First, primary sampling units (PSUs) of tehsils or taluks were chosen in each state. Second, villages were selected from rural PSUs and wards selected from urban PSUs. In urban areas, one Census Enumeration Block (CEB) per ward was chosen in the third stage. Last, households were selected among households with at least one member 45 years of age or older. All individuals older than 45 years of age in the eligible household were surveyed, as well as their spouses (regardless of age). In addition to this sample, LASI oversampled individuals 65 years of age and older from all stages and major cities.

### Timing

One wave was administered starting in 2017 and ending in 2019. A second wave is planned and currently in progress.

### Measure of mental health

Respondents were asked a 10 question version of the CES-D. For each question, respondents could give one of four possible responses that characterized the frequency of the depression symptom being asked about in that question. Each question is scored from 0 to 3 from least to most frequent, and the aggregate CESD-10 score ranges from 0 to 30. The responses were also recoded as binary indicators for whether the patient expressed experiencing a symptom for at least a majority of the time in the previous week, so that the alternative CESD-10 score ranges from 0 to 10. The threshold for depression is a score greater than or equal to 4, following the methodology of Hossain et al (2022).

Respondents were also asked about various issues related to stress. For example, they were asked about feeling safe from crime/violence, events categorized as common childhood stressors, as well as experience with everyday discrimination.

## Other notes

We code the aggregate depression score to missing if four or more items of 10 are missing.

## Malawi (MLSFH)

### Population and Sampling design

The Malawi Longitudinal Study of Families and Health (MLSFH) is a panel study that aims to understand the factors and consequences of HIV/AIDS among adults in rural Malawi. Adults were sampled from three districts: Mchinji, Rumphu, and Balaka. The original sample was not selected to be representative of the national rural population in Malawi, but the resulting sample did match closely to the demographics of the rural population in the 1996 Malawi Demographic and Health Survey. This paper focuses on the 2012 round of data collection (seventh wave), in which the PHQ-9 survey was administered to estimate depression prevalence among respondents over the age of 45.

The original 1998 MLSFH target sample consisted of 500 women in each district who had ever been married and were between the ages of 15 and 49, as well as their husbands. In two of the districts (Mchinji and Rumphu), the sample was designed to cover Census Enumeration Areas (CEAs) included in the 1988 Traditional Methods of Child Spacing in Malawi (TMCSM) survey, plus a few neighboring CEAs to reach the targeted 500 women. Sampling fractions were inversely proportional to village population size, such that a higher proportion of eligible women in the smaller villages was sampled. In the other district (Balaka), a random subset of the villages were selected, stratified by treatment status from a prior study. Then, a random 1 in 4 sample of women of reproductive age (15- 49) and their husbands was then drawn from these villages to yield a target sample of 500 women and their husbands (Kohler et al 2015).

### Timing

Data collection rounds occurred in 1998, 2001, 2004, 2006, 2008, 2010, and 2012. The initial sample interviewed in 1998 consisted of more than 1,500 women and nearly 1,100 of their spouses across 120 villages.

In subsequent waves, new spouses of original respondents were also added to the study. Additionally, there were additional samples added in 2004 (a refreshment sample of 998 adolescents) and 2008 (an additional sample of 549 parents of current respondents).

### Measure of mental health

In the seventh wave (2012), the PHQ-9 survey was administered to respondents to obtain a measure of depression severity. The PHQ-9 asks respondents a series of nine questions, each of which pertaining to a symptom of depression consistent with the clinical diagnostic guidelines for depression (Spitzer et al 2001). For each question, there are four possible responses that correspond to the frequency of the symptom experienced in the prior two weeks.

In the fourth through seventh waves (from 2006 onwards), the SF-12 survey was administered to respondents to obtain a measure of general health, which included several questions about the general state of mental health of the respondents. For example, respondents were asked to self-assess their general level of psychological distress and well-being.

#### Other notes

We code the aggregate depression score to missing if four or more items of nine are missing.

#### Mexico (MHAS)

##### Population and Sampling design

The MHAS is a representative panel of 15,186 adults aged 50 years and older and their partners. Individuals were sampled among those living in private dwellings in rural and urban areas.

The initial sample was drawn from the 2000 National Survey of Employment (ENE) among households with at least one resident aged 50 years or older. Households were chosen to from all 32 states of the country, in both urban and rural areas. If the household had more than one age-eligible person, then one of these was selected at random to participate in the study. Any spouses or partners of selected individuals were also interviewed as part of the study. In addition to the nationally representative sample, households in the six states accounting for the largest share of migrants to the United States were over-sampled (these states accounted for 40% of all migrants to the United States) (Michaels-Obregon et al 2022; Wong et al 2017).

##### Timing

Four waves were administered in 2001, 2003, 2012, and 2015.

- The 2001 baseline sample consisted of 15,186 respondents drawn from the 2000 ENE survey.
- The 2003 survey added any new spouses and partners to the study, as well as included next-of-kind interviews for deceased study subjects who were originally part of the baseline wave.
- The 2012 survey added a refreshment sample consisting of a representative sample of the population from the 1952-1962 birth cohort, as well as their spouses and partners (regardless of the spouse or partner's age). This refreshment sample was drawn from the 2012 Mexican National Employment and Occupation Survey (ENOE).

##### Measure of mental health

The primary measures of mental health in the MHAS correspond to a shortened CES-D questionnaire consisting of nine questions. For each of the nine questions, the data records whether participants felt a particular symptom for at least a majority of the time in the previous week: felt depressed, felt everything was an effort, had restless sleep, did not feel happy, felt alone, did not enjoy life, felt sad, felt tired, and did not feel full of energy.

To aggregate these indicators into one measure, the modified CES-D score is a variable that equals the sum of these nine indicators, ranging from 0 to 9.

#### Other notes

The MHAS household weights are based on the sample design and sample selection criteria, and the calibration variables of all community dwelling households with at least one resident 50 years or older, based on the household composition, and the place of residence (urban and rural areas) and geographic areas.

We code the aggregate depression score to missing if four or more items of nine are missing.

#### South Africa (HAALSI)

##### Population and Sampling design

The HAALSI is a study with a goal of understanding the drivers and consequences of non-communicable diseases and HIV among the aging population in Agincourt, South Africa, with a particular focus on longitudinal outcomes (Berkman 2020). The original baseline sample consisted of 5,059 people men and women aged 40 and older living in Agincourt (Gomez-Olive et al 2018).

##### Timing

Data collection occurred in 2015 and 2018.

##### Measure of mental health

In the 2015 baseline wave of the survey, the depression questionnaire used was the CESD-8 with binary responses to each question that indicated whether the respondent experienced a particular symptom for at least a majority of the time in the past week. In the 2018 second wave of the survey, the depression questionnaire used was the full CESD-20 questionnaire, with frequency responses to each question that corresponded to how frequently the respondent experienced a symptom for the past week.

#### Other notes

For analysis of the baseline wave, the estimates are all unweighted, as the survey was not intended to be nationally representative. For analysis of the second wave, the observations were weighted to account for attrition and mortality from the baseline wave, according to the product of two survey weights. First the inverse improbability weight accounts for respondent attrition. Second, the inverse improbability weight accounts for respondent mortality. In each of these respondents were weighted up and down based upon age, sex, and other factors.

## United States (HRS)

### Population and Sampling design

The HRS is a longstanding nationally representative panel of older adults in the United States that has been ongoing since 1992, with data collection rounds occurring every two years. For the analysis in this paper, we focus on data from 2014 and 2016, which are the two most recent rounds of data collection that preceded the COVID-19 pandemic. For all the cross-country comparisons, we compare statistics from the baseline waves of other countries to the 2014 wave of the HRS. The 2014 wave of the HRS consists of over 40,000 individuals in total across a number of refreshment samples, as well as the original study population (Sonnega et al 2014).

### Timing

Data collection rounds occurred every two years since 1992. In this analysis, we focus on data from the 2014 and 2016 waves.

### Measure of mental health

The depression questionnaire used was the CESD-8 with binary responses to each question that indicated whether the respondent experienced a particular symptom for at least a majority of the time in the past week. The total score ranges from 0 to 8, where an affirmative response to each question adds one point to the total score.

### Other notes

We code the aggregate depression score to missing if three or more items of eight are missing.