

Beyond the individual: Household activity of daily living limitations, urban-rural residence, and mental health

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ARTICLE INFO

Handling Editor: Dr A C Tsai

ABSTRACT

Activity of daily living (ADL) limitations, such as difficulty walking or dressing, are increasing as populations age and experience more chronic conditions. To understand the scope of ADLs and make interventions more effective, it is important to examine ADLs beyond the individual to other levels and contexts, such as the household. Thus, using household and individual level survey data in India, we assess how household ADLs relate to the mental health of others in the household. We find that around 40 % of households have at least one resident with an ADL limitation, with ADL limitations more likely in households that are in rural areas, have older residents, and are socioeconomically disadvantaged. Household ADL limitations are associated with increased symptoms of depression and anxiety with the relation varying by the number of household members with an ADL limitation. For adults, having any household member with an ADL limitation is associated with increased mental health symptomatology, whereas for young adults, this association only appears for those with multiple household members with an ADL limitation. Further, we find that the relation between household ADL limitations and mental health is stronger for those living in rural areas compared to urban areas. That is, when comparing individuals with the same number of household members with ADL limitations, predicted mental health symptomatology is higher for those living in rural areas than for those in urban areas. These findings suggest the need for household centered accommodations and supports that consider the social and environmental context.

1. Introduction

Disability affects 16 % of the world's population, with this number growing as the population ages and experiences more chronic conditions (World Health Organization, 2011). Limitations to activities of daily living (ADLs), which is an indicator of disability, are linked to other aspects of health and well-being such as pre-mature mortality and lower quality of life (Sharma et al., 2021; Thompson et al., 2012). However, much of the ADL literature centers on the individual with the limitations or the dyadic relationship of caregiving, neglecting the significance of broader contextual aspects. Drawing on the socio-ecological model, disability can be understood as the result of interactions across multiple levels of influence—from individual health to interpersonal

relationships, household resources, community environments, and broader social and policy structures (Bronfenbrenner, 1977). Whether an impairment is disabling depends on these intersecting contexts, underscoring the need to examine ADLs beyond the individual level (Amilon et al., 2025; Braveman and Gottlieb, 2014; Verbrugge and Jette, 1994). The household context is especially significant to investigate, as individuals are in this environment daily, and households serve as a crucial setting for social roles, relationships, and health behaviors (Hughes and Waite, 2002). However, gaps remain in our understanding of how ADL limitations are distributed across households, how ADL limitations are related to the health of others in the household, and how relations between ADL limitations and household members' health can vary by other contextual factors such as urban-rural residence. This

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<https://doi.org/10.1016/j.ssmmh.2025.100547>

Received 8 July 2025; Received in revised form 10 October 2025; Accepted 14 October 2025

Available online 15 October 2025

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research could help provide insights to better tailor recommendations for accommodations that focus on the household and not just the individual(s) with the ADL limitations.

As the prevalence of ADL limitations increases, more households are likely to have residents with ADL limitations (Zajacova and Montez, 2018). Although prior literature has established the prevalence of ADL limitations across individuals, far less information is available about the prevalence of ADL limitations across households. Research in this area finds that disability clusters within families, that is those with a disability are more likely to live with someone else who has a disability due to a variety of factors including shared environmental exposures, social disadvantage, and intergenerational health risks (Amilon et al., 2024; Shandra et al., 2012). However, this literature focuses on the correlation of disability within the household rather than examining the prevalence of ADL limitations across households. Estimating the prevalence of ADL limitations across households can provide further insights into the scope of ADL limitations, and their impacts on the entire household.

Importantly, given the shared environments and interconnected ties between household members, life course theory suggests that individuals' health are linked within households (Elder et al., 2003). From this perspective, ADL limitations may be related to the mental health, such as symptoms of depression and anxiety, of others in the household through mechanisms such as caregiving stress or worry about the ability to meet the disabled persons' needs (Bobinac et al., 2010; Brinda et al., 2014; Smith et al., 2022). Complementing this, the socio-ecological model underscores that these associations are shaped not only by interpersonal dynamics but also by broader contextual factors, such as low household income and limited access to resources within the community (Amilon et al., 2024; Bronfenbrenner, 1977). Examining the relationship between household ADL limitations and symptoms of depression and anxiety among household members can provide insights into how to improve well-being at the population level, not just those with their own ADL limitations.

Literature on the relation between household ADL limitations and symptoms of depression and anxiety of others in the household, often focuses on adults, neglecting young people (Joseph et al., 2020; Schulz et al., 2020). Recently, literature has been growing estimating the prevalence and outcomes for young carers, defined as children or adolescents who are caregiving for family members (Robison et al., 2020; Wepf and Leu, 2022). Although young carers have greater maturity and sense of purpose, they often report worse mental health compared to their peers who are not caregiving due to the stress and time constraints associated with caregiving (Iezzoni et al., 2016; Lacey et al., 2022). In addition to the mental health considerations tied to caregiving responsibilities, household ADL limitations may be related to symptoms of depression and anxiety of young people in the household, even those who are not caregiving, because of the implications these limitations may have on adult household members. For instance, adults may have reduced time or capacity to engage with young people in the household due to their own functional limitations or caregiving obligations toward other household members. Without necessary supports, these adult household members may be constrained in the amount of time they can spend with young people in the household and the developmental engagement they can provide, which may be associated with their mental health (Shandra, 2021; Shandra and Penner, 2017). Additionally, youth experience anxiety or concern about the well-being of the household member(s) with ADL limitations, which could contribute to increased depression and anxiety symptoms (Bobinac et al., 2010; Pacheco Barzallo, 2018; Wittenberg et al., 2013). Given the potential association of ADL limitations to all members of the household, it is important to examine this relationship in both young people and adults, even among those who are not caregiving.

The relation between household ADLs and symptoms of depression and anxiety of others in the household may also vary by the number of household members with an ADL limitation, on which there is limited

research. For example, having multiple household members with an ADL limitation could further compound caregiving duties, stress, and financial strain, and without support can lead to a larger mental health burden for these individuals (Pearlin, 1989; Thoits, 2010). Additionally, with multiple household members with an ADL limitation, young people in the household may be more likely to take on caregiving duties. There may also be a spillover from other adults in the household; compounding caregiving and stress on adults may relate to depression and anxiety in young people. This research would help identify whether special considerations may be needed for households who have multiple members with ADL limitations.

It is important to also explore how this relation varies by other contextual variables, such as urban-rural residence. Geographic region is an environmental extension of the household, which may confer differential access to resources and play a role in the relation between household ADL limitations and the mental health of others in the household. People living in rural regions report higher rates of ADL limitations and higher costs associated with ADL limitations than in urban regions due to a variety of social, economic, and environmental factors (Liao et al., 2022; Sage et al., 2019). Yet findings have been mixed as to whether the number of household members with an ADL limitation is associated with greater depressive symptoms in urban or rural areas (Bigbee et al., 2011; Cohen et al., 2022). Investigating whether the mental health of those living in a household with someone who has an ADL limitation, beyond just caregivers, differs by urban-rural residence can help identify whether contextual factors play a role in this relation. These findings can also help identify areas at greater risk, which could allow for better tailored interventions.

Literature on ADL limitations focuses on high-income countries, with further investigation needed across diverse environments. For example in India, where this study is located, the population aged 60+ is expected to increase from 9 % of the total population in 2011 to 19 % by 2050 (Sharma et al., 2021; United Nations, Department of Economic and Social Affairs, Population Division, 2017). The aging of the population is likely to lead to increases in the prevalence of ADL limitations, as ADL limitations are more likely to occur at older ages (Chauhan et al., 2022; Jagger et al., 2001; Sharma et al., 2021). India provides a particularly important setting to investigate ADL limitations at the household-level because caregiving in India is largely family-based, with limited availability of formal long-term care or institutional support (Chakraborty et al., 2023; Ugargol et al., 2016). Thus, multigenerational and extended households, which comprise of 54 % of all households, are the main sources of caregiving (Kamiya and Hertog, 2020; Pew Research Center, 2019). Moreover, wide rural-urban and socioeconomic disparities in healthcare access, alongside the uneven implementation and coverage of policies such as the National Programme for Health Care of the Elderly (NPHCE; Vaishnav et al., 2022) shape the availability of support for individuals with ADL limitations.

The aims of this study are two-fold: (1) To assess the distribution of ADL limitations across households, including the characteristics of these households, in India; (2) To investigate whether living in a household with someone who has an ADL limitation is associated with symptoms of depression and anxiety in adults and young people living in these households. This includes whether the association with mental health differs by the number of household members with an ADL limitation and by urban-rural residence. This study advances prior research by examining ADL limitations at the household rather than individual level, assessing their associations with the mental health of all household members—including young people—across urban and rural settings in India.

2. Materials and methods

2.1. Study participants

This study uses data from the Indian Consumer Pyramids Household

Survey (CPHS) combined with data from the Survey of Health Trends (SEHAT), a module of CPHS (Vyas, 2020). CPHS is a survey of household well-being in India collected by the Centre for Monitoring Indian Economy (CMIE). The sample is spread across India's geography and is representative of 98.5 % of the country's population. Each household interview is conducted with a main household respondent designated to answer questions about the household, themselves, and other household members. The sole exception to this was mental health, where household members aged 8 and over who were available reported on their own mental health.

SEHAT was developed as a module of the CPHS and was administered to the subset of households which were scheduled to be interviewed in February 2022 to examine mental health, disability, and COVID-related stressors. The SEHAT sample includes approximately 32,000 households interviewed in the second month of each wave of the CPHS (February, June, and October). Data on ADLs and mental health come from the SEHAT survey. Given the structure of SEHAT, we have ADL limitations on every adult in the household. SEHAT was then combined with the main CPHS to obtain urban-rural residence and covariate data. This study uses data at both the household and individual level from the October 2022 wave, the most recent wave with ADL data. Since we were interested in household ADL limitations and their relation with the mental health of others in the household we excluded households with only one household member, i.e. those living alone. Our descriptive comparisons include data from 26,214 households with non-missing data on household-level variables. Analytic models include members of households for whom we have data on mental health and covariates, resulting in an N of 42,469 adults and 8,062 young people.

2.2. Measures

Mental health was assessed using two self-reported measures (even if the respondent was not the main household respondent) of depression and anxiety symptoms for both adults (ages 20+) and young people (ages 8–19). Although these instruments differ in structure and are age-appropriate for their respective populations, they assess comparable underlying constructs of depression and anxiety symptomology and are validated in our setting (Carroll et al., 2020; Stevanovic et al., 2017).

For adults, depression symptoms were measured using the 9-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) evaluating the frequency of depressive symptoms, such as 'little interest or pleasure in doing things' and 'feeling down, depressed, or hopeless' in the past two weeks. Each item was coded from 0 ('not at all') to 3 ('nearly every day') and summed to create a score of 0–27, with higher scores indicating more depressive symptoms. Anxiety symptoms were measured in adults using the 7-item Generalized Anxiety Disorder scale (GAD-7; Spitzer et al., 2006) which assessed the frequency with which the respondents experienced symptoms such as 'feeling nervous, anxious or on edge' and 'not being able to stop or control worrying' across the past two weeks. Items were similarly coded from 0 to 3 and summed to create a score of 0–21 with higher scores indicating more anxiety symptoms.

For young people aged 8 to 19, the low mood subscale of the Revised Children's Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) and the generalized anxiety subscale of the Spence Children's Anxiety Scale (SCAS; Spence et al., 2003) were used to measure depression and anxiety symptoms. The RCADS asked young people 10 questions related to low mood and depression (e.g., 'you feel sad or empty', 'nothing is fun anymore'), scored from 0 ('never') to 3 ('always'). Scores were summed ranging from 0 to 30 with higher scores indicating greater depressive symptoms. The SCAS used 6 items to evaluate self-reported anxiety in young people including questions about worrying and feeling afraid. The SCAS items were summed, creating a range from 0 to 18 with higher scores indicating more anxiety symptoms.

To assess ADLs, the main household respondent was asked to indicate whether they experienced some difficulty (yes/no) in five indicators: remembering or concentrating, walking 100 m, climbing a set

of stairs, lifting or carrying more than 5 kg, and dressing or putting on shoes. The main household respondent was then asked the same ADL questions for the other adults in the household. We used this information to create multiple variables characterizing ADL limitations at the household and individual level. For the household level measures we created three variables: household ADL limitations grouping, average ADL limitations across all household members, and proportion of adult household members with an ADL limitation. For the household ADL limitations grouping measure, we clustered ADL limitations into three categories: no ADL limitations, some ADL limitations, and all ADL limitations. The 'no ADL limitation households' were households that had no adults with any ADL difficulties. 'some ADL limitation households' have at least one adult in the household (but not all) with at least one ADL limitation. For the 'all ADL limitation households', all adults in the household have at least one ADL limitation.

For the individual ADL limitation measures we created three variables: number of adult household members with an ADL limitation (excluding own ADL limitations), total number of ADL limitations of the respondent (ranging from 0 to 5), and whether the respondent self-reported their ADLs. To create the number of adult household members with an ADL limitation (excluding own ADL limitations) measure, we summed the number of adults within a household who reported at least one ADL limitation and categorized the variable into zero, one, and two or more household members with an ADL limitation. We top-coded this variable at two or more household members with an ADL limitation due to the small number of households with more than two members with an ADL limitation. We then applied this number to every member living in that household and excluded the respondents' own ADL limitations. Thus, this measure reflects ADL limitations of other members of the household. Since ADL limitations were only assessed in adults', respondents' own ADL limitations could not be excluded for young people.

Other household level variables of interest include the average age of members of the household, proportion of household members aged 65 or older, proportion of females in the household, proportion of household members employed, urban or rural residence, whether someone in the household has a chronic condition (history of diabetes, hypertension, heart problems, or paralysis), average number of hours spent on housework, education group of the household, caste, total household size, number of young people in the household, number of adults in the household, and household income (in rupees). Specifically, households were grouped into urban (located in a town) and rural (located in a village) regions based on definitions from the 2011 Census and CMIE. For those aged 19 and older, housework was measured as the average hours spent on work done for the household and its members, such as cooking, cleaning, and taking care of children, elderly, and others in the household. For those aged 8 to 18, housework was measured as the average hours spent doing household work in the last week. We created the household education measure using literacy and education information from all adults in the household ranging from low (no literate or educated adults) to moderate (some literacy and education) to high (includes college graduates) education households, as recommended by CMIE. We categorized caste into four groups: scheduled caste (SC)/scheduled tribes (ST), other backward classes (OBC), intermediate caste, and upper castes (UC). Other individual level variables of interest include age in years, sex, and average hours spent doing housework. For adults, additional variables include whether the respondent was employed and whether the respondent was married.

2.3. Analytic approach

Descriptive analyses were used to explore the distribution of ADL limitations across individuals and households. For the household descriptives we examined the distribution of ADL limitations across the three household ADL limitations groups (no ADL limitation household, some ADL limitation household, all ADL limitation household) and assessed whether various household characteristics differed by

household ADL limitations groups. All descriptives were weighted using country-level weights, provided by CMIE, at either the individual or household level depending on the unit of analysis. Weights also included an adjustment factor for non-response, as provided by CMIE.

For analyses of ADL limitations and mental health, we used data from the adults and young people who reported on their own mental health. We first examined whether the number of adult household members with any ADL limitation was associated with individual mental health outcomes. Mixed effect models, with random effects at the household level, were used to account for unobserved household-level heterogeneity. Models were run separately for each outcome (PHQ-9, GAD-7 for adults; RCADS and SCAS for young people). Diagnostic checks indicate that household-level random effects are evenly distributed.

Models controlled for hours spent doing housework, whether someone in the household has a chronic condition, household education, household income, the number of adults in the household, urban residence, age in years, sex, caste, and the average age of household members. Additionally, the models for adults included controls for their own number of ADL limitations, whether they were employed, married, and whether they self-reported their ADL limitations. Models also included interviewer fixed effects. To examine whether the relation between household ADL limitations and mental health differs by geographic region, we interacted urban residence with the number of adult household members with an ADL limitation. Predictive margins for the interactions are also plotted for ease of interpretation.

3. Results

3.1. Individual ADL and household descriptives

On average, households had 3.7 (SD = 1.3) household members (range: 1–15), with an average of about one (SD = 1.1; range: 0–7) person under the age of 20 in the household (Table 1). About 34 % of households were in urban regions. Roughly 30 % of adults report at least one ADL limitation (see Table 2, mean: 0.7; SD = 1.2). The most common limitations, experienced by about 15 % of adults for each, include difficulties with lifting or carrying more than 5 kgs, remembering or concentrating, and climbing a set of stairs. Table 1 also shows household characteristics according to household ADL limitations grouping: households with no ADL limitations (58.5 % of the sample), households where some members have ADL limitations (20.1 %), and those where all adults are experiencing ADL limitations (21.4 %). The ‘some ADL limitation households’ had an average total of 1.0 (SD = 0.7) ADL limitations and the ‘all ADL limitation households’ had an average total of 2.2 (SD = 1.0) ADL limitations.

Households that had at least one resident with an ADL limitation were older on average, including more residents who were 65 or older (Table 1). Households where everyone had an ADL limitation were also less educated, with lower incomes than households with no or only some members with ADL limitations. Finally, households where all of the residents had an ADL limitation were less likely to be urban. There were minimal differences across the household ADL limitation groups by the proportion of female residents, average hours spent on housework, caste, and number of young people in the household.

3.2. Associations between household members with an ADL limitation and mental health

Turning our attention to the subsample who reported on their own mental health (Table 3), the adults were mostly female (70 %) and married (80 %), with an average PHQ-9 score of 5.8 (SD = 5.9) and GAD-7 score of 4.8 (SD = 5.1). Approximately 61 % of the sample had no other adult household members with an ADL limitation, 24 % had one household member with an ADL limitation, and 15 % had two or more members with an ADL limitation. Among children aged 8–19, 49 % were female with an average age of 14 (SD = 3.2), a mean RCADS score of 5.8

Table 1

Characteristics of households across levels of household ADL limitations (N = 26,214).

	No ADL Limitation Households	Some ADL Limitation Households	All ADL Limitation Households	Total
Average ADLs of hh members	0.0 (0.0)	1.0 (0.7)	2.2 (1.0)	0.7 (1.0)
Proportion of adult hh members with an ADL	0.0 (0.0)	0.5 (0.1)	1.0 (0.0)	0.3 (0.4)
Urban household	33.4 %	40.8 %	29.8 %	34.1 %
Average hours spent on housework				
Adults (20+ years old)	3.3 (1.3)	3.3 (1.5)	3.7 (1.4)	3.4 (1.4)
Young People (5–19 years old)	1.4 (1.0)	1.1 (1.0)	1.4 (1.1)	1.4 (1.1)
Total household size	3.7 (1.2)	4.1 (1.5)	3.4 (1.4)	3.7 (1.3)
Number of young people in the household	1.0 (1.1)	0.8 (1.0)	0.9 (1.1)	0.9 (1.1)
Average age of hh members	35.0 (9.6)	39.9 (10.0)	41.8 (15.3)	37.4 (11.5)
Proportion of hh members aged 65+	0.02 (0.10)	0.11 (0.18)	0.14 (0.29)	0.07 (0.18)
Proportion of female hh member	0.45 (0.16)	0.47 (0.16)	0.47 (0.15)	0.46 (0.16)
Proportion of hh members employed	0.46 (0.19)	0.40 (0.20)	0.39 (0.24)	0.43 (0.21)
Household income (in rupees)	24507.0 (24820.6)	24824.8 (22365.0)	18360.8 (16402.8)	23257.8 (22915.6)
Education group of household				
Low	41.5 %	35.0 %	47.4 %	41.5 %
Moderate	28.9 %	35.1 %	28.0 %	29.9 %
High	29.6 %	29.8 %	24.6 %	28.6 %
Caste				
Scheduled caste/ scheduled tribes	29.0 %	28.5 %	27.1 %	28.5 %
Other backward classes	42.6 %	39.2 %	38.6 %	41.1 %
Intermediate	8.7 %	9.6 %	13.1 %	9.8 %
Upper	19.7 %	22.7 %	21.2 %	20.7 %
Percent of Sample	58.53 %	20.11 %	21.36 %	100.00 %

Notes: ADL = activities of daily living; HH = household.

No ADL Households = no adults in the household have an ADL limitation; Some ADL Households = at least one adult in the household (but not all) has at least one ADL limitation; All ADL Households = all adults in the household have at least one ADL limitation.

(SD = 5.9), and mean SCAS score of 3.3 (SD = 3.6).

Models 1 and 3 in Table 4 present the relation between the number of adult household members with an ADL limitation (excluding own ADL limitations) and mental health among the subsample of adults with data on depression and anxiety symptoms. Results indicate that having one household member with an ADL limitation was related to higher symptoms of depression and anxiety. For example, compared to those with no household members with an ADL limitation, having one household member with an ADL limitation was related to a 0.11-point higher PHQ-9 score (Model 1; 95 % CI: 0.04–0.19) and a 0.17-point higher GAD-7 score (Model 3; 95 % CI: 0.11–0.24). We did not find any evidence for additional worsening of mental health with additional

Table 2
Weighted frequency of activities of daily living limitations among adults (N = 73,346).

	Percent
Difficulty remembering or concentrating	15.1 %
Difficulty walking 100m	12.9 %
Difficulty climbing a set of stairs	14.5 %
Difficulty lifting/carrying >5 kgs	15.5 %
Difficulty dressing or putting on shoes	7.1 %
Sum of ADLs (Mean, SD)	0.65 (1.20)
0	70.2 %
1	11.2 %
2	8.3 %
3	6.0 %
4	2.4 %
5	1.9 %

Notes: ADLs = activities of daily living.

Table 3
Weighted analytic sample descriptives.

	Adults (ages 20+)	Young People (ages 8–19)
Mental Health		
PHQ-9	5.8 (5.9)	
GAD-7	4.8 (5.1)	
RCADS		5.8 (5.9)
SCAS		3.3 (3.6)
ADL limitations		
Total number of ADLs of the respondent	0.7 (1.3)	
Number of adult hh members with an ADL limitation (excluding own ADL limitations)		
0	0.61	0.62
1	0.24	0.11
2+	0.15	0.27
Controls		
Average hours spent on housework	4.1 (2.4)	1.4 (1.1)
Someone in hh has a chronic condition	14.7 %	8.1 %
Education group of household		
Low	39.9 %	48.1 %
Moderate	31.7 %	29.7 %
High	28.4 %	22.2 %
Household income	23278.5 (22520.5)	19797.9 (18065.2)
Number of adults in the household	3.0 (1.1)	2.6 (1.0)
Urban household	33.6 %	27.9 %
Age	44.7 (14.2)	14.2 (3.2)
Female	69.8 %	49.2 %
Caste		
Scheduled caste/scheduled tribes	27.3 %	28.3 %
Other backward classes	41.8 %	46.2 %
Intermediate	9.3 %	5.5 %
Upper	21.5 %	19.9 %
Mean age of hh members	37.9 (11.2)	28.9 (5.8)
Employed	24.9 %	
Married	79.8 %	
Self-reported ADLs	59.7 %	
N	42,469	8062

Notes: ADL = activities of daily living; HH = household.
The analytic sample was the subset of respondents with mental health data.

household members with ADL limitations. Results from analyses with young people aged 8–19 similarly show that having household members with ADL limitations is related to higher mental health symptomology (Table 5). However, in this group, the association emerges only with having two or more household members with an ADL limitation, but not one. Specifically having two or more members with ADL limitations is related to a 0.74-point (Model 1; 95 % CI: 0.53–0.96) higher RCADS score and 0.39-point (Model 3; 95 % CI: 0.26–0.53) higher SCAS score compared to those with no household members with an ADL limitation.

Table 4
Number of adult household members with an ADL limitation and adults' mental health (individual N = 42,469; household N = 26,188).

VARIABLES	PHQ-9		GAD-7	
	Model 1	Model 2	Model 3	Model 4
<i>Number of adult household members with an ADL limitation (excluding own ADL limitations) (ref. = 0)</i>				
1	0.11** (0.04–0.19)	0.31*** (0.18–0.44)	0.17*** (0.11–0.24)	0.24*** (0.13–0.35)
2+	0.03 (-0.09–0.15)	0.28** (0.09–0.48)	0.16** (0.06–0.26)	0.40*** ^a (0.24–0.56)
Urban household	-0.09* (-0.17 to -0.00)	0.01 (-0.08–0.11)	-0.07* (-0.14 to -0.00)	-0.01 (-0.09–0.07)
<i>Household members with an ADL limitation (ref. = 0) x Urban</i>				
1 household member x Urban		-0.27*** (-0.41 to -0.13)		-0.09 (-0.21–0.03)
2+ household members x Urban		-0.33** (-0.54 to -0.13)		-0.33*** (-0.50 to -0.15)
Intercept at the household level	3.77 (3.65–3.89)	3.76 (3.64–3.88)	2.44 (2.36–2.52)	2.44 (2.36–2.52)

Notes: CIs in parentheses; ***p < 0.001, **p < 0.01, *p < 0.05.
^a p < 0.05 for comparison of 1 and 2+ household members with an ADL.
ADL = activities of daily living.
Models control for total ADLs of the respondent, hours spent doing housework, whether someone in the household has a chronic condition, household education, household income, the number of adults in the household, age in years, sex, caste, mean age of household members, whether the respondent was employed, married, self-reported their ADLs, and interviewer fixed effects.

3.3. Variations by urban-rural residence

Models 2 and 4 in both Tables 4 and 5 introduce the interaction term between the number of adult household members with an ADL limitation and urban-rural residence. For adults, we find a significant interaction between having one (95 % CI: -0.41 to -0.13) or multiple (95 % CI: -0.54 to -0.13) household members with an ADL limitation and urban-rural residence on PHQ-9 (Table 4). In particular, predicted PHQ-9 scores are similar by urban and rural residence for those who do not have any household members with an ADL limitation (Fig. 1). However, when comparing individuals with the same number of household members with ADL limitations, predicted PHQ-9 scores are higher for those living in rural areas, while staying mostly flat for those in urban areas. We find similar results for GAD-7 (Fig. 2), except there are only marginal differences in anxiety scores between urban and rural residents who have one household member (95 % CI: -0.21 to -0.03) with an ADL limitation.

These associations are weaker among young people (Table 5). For RCADS, young people living in urban and rural areas have similar mental health scores for those with no or one household member with an ADL limitation (Fig. 3). This pattern diverges among those with multiple household members with an ADL limitation, with rural residents having higher RCADS scores than urban residents. There is no significant difference in SCAS scores by the number of household members with an ADL limitation by urban-rural residence (95 % CI: -0.08 – 0.46).

Table 5
Number of adult household members with an ADL limitation and young people's mental health (individual N = 8,062; household N = 5,177).

VARIABLES	RCADS		SCAS	
	Model 1	Model 2	Model 3	Model 4
<i>Number of adult household members with an ADL limitation (ref. = 0)</i>				
1	0.18 (-0.02–0.39)	0.07 (-0.30–0.43)	0.07 (-0.06–0.20)	–0.08 (-0.31–0.16)
2+	0.74*** ^a (0.53–0.96)	1.00*** ^a (0.69–1.31)	0.39*** ^a (0.26–0.53)	0.50*** ^a (0.30–0.70)
Urban household	–0.30*** (-0.45 to –0.15)	–0.22* (-0.41 to –0.03)	–0.19*** (-0.29 to –0.09)	–0.18** (-0.30 to –0.05)
<i>Household members with an ADL limitation (ref. = 0) x Urban</i>				
1 household member x Urban		0.15 (-0.27–0.57)		0.19 (-0.08–0.46)
2+ household members x Urban		–0.35* (-0.67 to –0.03)		–0.14 (-0.35–0.07)
Intercept at the household level	2.66 (2.49–2.85)	2.66 (2.48–2.84)	0.81 (0.74–0.89)	0.81 (0.74–0.89)

Notes: CIs in parentheses; ***p < 0.001, **p < 0.01, *p < 0.05.
^a p < 0.05 for comparison of 1 and 2+ household members with an ADL.
ADL = activities of daily living.
Models control for hours spent doing housework, whether someone in the household has a chronic condition, household education, household income, the number of adults in the household, age in years, sex, caste, mean age of household members, and interviewer fixed effects.

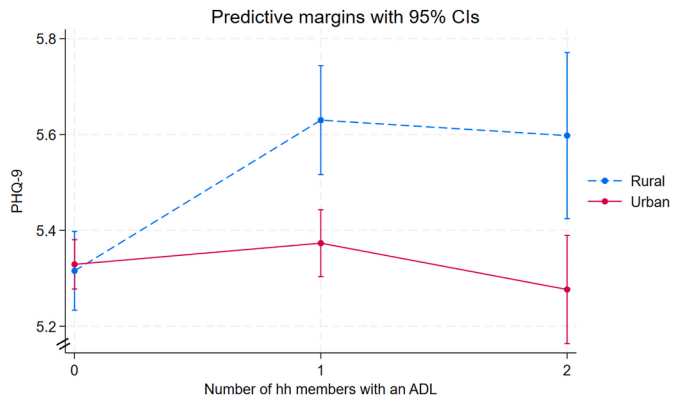


Fig. 1. Predicted PHQ-9 scores by number of household members with an ADL limitation and urban-rural residence
Notes: ADL = activities of daily living; hh = household; Model based on Table 4, Model 2.

3.4. Sensitivity analyses

We ran sensitivity analyses to investigate whether the association between the number of household members with an ADL limitation and mental health varied by sex or age. Findings suggest no significant differences by sex (Appendix A and B). Additionally, the results by age

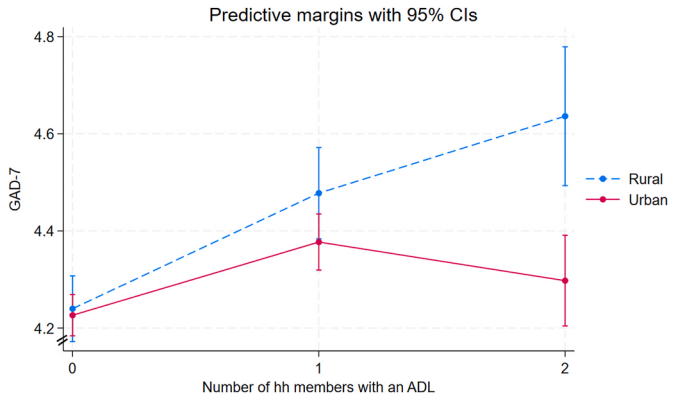


Fig. 2. Predicted GAD-7 scores by number of household members with an ADL limitation and urban-rural residence
Notes: ADL = activities of daily living; hh = household; Model based on Table 4, Model 4.

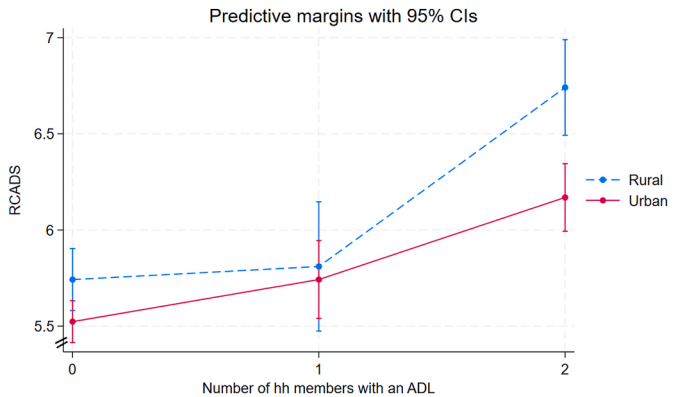


Fig. 3. Predicted RCADS scores by number of household members with an ADL limitation and urban-rural residence
Notes: ADL = activities of daily living; hh = household; Model based on Table 5, Model 2.

suggest no significant difference in this association for young people (Appendix C). However, among adults there are some significant differences in PHQ-9 (Appendix D) and GAD-7 (Appendix E) scores by age and number of household members with an ADL limitation. Although most of these differences are due to older adults having higher mental health symptomology overall, there is some evidence that older adults (aged 65+) with a household member with an ADL limitation experience worse mental health compared to their counterparts at younger ages.

4. Discussion

As activity of daily living (ADL) limitations, such as difficulty walking or dressing, become increasingly prevalent, it is important to examine their implications across different contexts in order to tailor interventions and provide necessary supports (Zajacova and Montez, 2018). In this study, we use data from India to assess household level ADL limitations and their associations with the mental health of co-resident adults and children. Examining ADL limitations at the household level, allows us to explore their distribution, the interconnectedness of ADL limitations at the household level and mental health, and how these relations vary by broader contextual factors such as urban-rural residence. We present three key findings.

First, we find that ADL limitations are prevalent in India, with vulnerable households disproportionately affected. In our sample, representing 98 % of India's area, about 40 % of households have at least

one household member with an ADL limitation and in 21 %, all adults in the household had at least one limitation. This indicates the scope of ADL limitations as the population of India ages, and highlights the number of households that may need additional support. Households with a higher proportion of residents with an ADL limitation were mostly rural households that were older in age on average and had lower rates of employment, education, and income. These findings indicate that ADL limitations and socio-economic vulnerability cluster together, a finding also reported in high income countries (Shandra et al., 2012). ADL limitations may be more common in low-resourced households because these households may be less likely to live in an environment that has the necessary accommodations and supports available, thus progressing their limitation to affect daily living activities (Fang et al., 2023). Additionally, the financial burden of providing or paying for such accommodations for household members with ADL limitations may further exacerbate existing economic disadvantage (Morris and Zaidi, 2020). Interventions and accommodations that take a broader contextual approach to ADLs, by focusing on the household instead of individuals, could help slow the disablement process so that impairments do not progress to impact these daily living activities. Socially disadvantaged households may be particularly affected and therefore warrant special attention in these efforts.

Second, findings indicate that household ADL limitations are associated with mental health in both adults and young people with variation by the number of household members with an ADL limitation. For adults, having at least one household member with an ADL limitation was associated with higher depression and anxiety symptoms. For young people, we only found a relation between mental health symptomology and household ADL limitations for those who had multiple adults in the household with an ADL limitation. Although our results are meant to be descriptive, several factors could explain these results. For example, for adults, a higher number of household members with ADL limitations beyond one was not associated with additional higher symptoms, and this could primarily be due to their entry into caregiving duties (Smith et al., 2022). That is, once caregiving for a household member with an ADL limitation, there may not be as much perceived additional caregiving burden, or cumulative association, if they have another household member with an ADL limitation. However, for young people, worse mental health was observed only when two or more household members had ADL limitations, a case when a young person may be asked to take on more caregiving duties (Lacey et al., 2022). Additionally, when there are multiple household members that have an ADL limitation, time and resources may be more constrained, potentially limiting the time adults can spend with children in the household (Amilon et al., 2025; Shandra and Penner, 2017). It is also possible that adults and young people with elevated mental health symptoms have reduced capacity to provide adequate care, which, in turn, could contribute to the deterioration of health among ill household members. Future research should explore these mechanisms. Regardless of the underlying mechanism, the observed correlation indicates that ADL limitations of household members are related to the health of others in the household, underscoring the need for additional household-level supports. Overall, these associations are smaller in magnitude than what has been typically observed in the literature that focuses explicitly on caregiver mental health (Chakraborty et al., 2023; Han et al., 2021). However, our sample includes all members of the household, regardless of their caregiving duties. Further research should continue to investigate how different aspects of household ADL limitations are related to mental health across different members of the household.

Third, we find that household ADL limitations and mental health are more strongly related for rural households. That is, having a household member with an ADL limitation is associated with worse mental health among adults living in rural areas compared to those living in urban areas. Interestingly, among urban households, PHQ-9 scores did not rise with the number of household members with ADL limitations as they did among rural households, although anxiety scores did. Rural areas

generally have less access to resources and infrastructure such as health care access, paved roads, and public transportation (Balarajan et al., 2011; Ingle and Nath, 2008). The lack of accommodations and supports in these environments can put a larger burden on household members to provide assistance to those with ADL limitations, potentially creating stress and financial strain for these households and worry about how household members with ADL limitations will receive the care they need (Bobinac et al., 2010; Wittenberg et al., 2013). The lack of association with PHQ-9 among urban households, in contrast to GAD-7, also points to the potential role of social isolation, which is a strong risk factor for depression (Ge et al., 2017). Thus, better infrastructure and resources, particularly in rural areas, could help in providing necessary accommodations for those with ADL limitations. While our analyses distinguish between urban and rural areas, this binary classification may mask important heterogeneity within each category in terms of resource availability, health infrastructure, and related factors. Future research should examine the availability of these resources as potential moderators of the association between household ADL limitations and mental health. Moreover, continued investigation of these questions across diverse groups and environments is needed. In addition to SEHAT, other studies such as the Longitudinal Ageing Study in India (LASI; Perianayagam et al., 2022), have examined ADL limitations in India and provide rich data for further exploring these topics (Chauhan et al., 2022; Sharma et al., 2021).

These findings highlight the importance of providing support for households that have residents with an ADL limitation, particularly for rural households. Whether an impairment is disabling depends on the roles, expectations, and context of the individual with the impairment, and whether accommodations are needed that match these factors (Verbrugge and Jette, 1994). Although individual-level solutions, are important, on their own they are not enough. Individuals are embedded in contexts, systems, and social networks. Developing interventions without this embeddedness in mind provides an incomplete picture and reduces the impact these interventions can have. Therefore, in addition to health services, family/household centered approaches that integrate family members into care plans and consider the environmental and social context are important (Amilon et al., 2025; Kokorelias et al., 2019). In addition to helping the individual with the ADL limitation(s), these types of approaches also addresses the needs of household members, thus recognizing the household as an inter-connected system. Household and family approaches that include caregiver education, psychosocial support, and economic assistance may help improve the mental health of household members living with someone with an ADL limitation. Policies to support households with residents with ADL limitations should also take into account the higher burden of physical and mental illness these household members also experience (Schulz et al., 2020; Smith et al., 2022). Additionally, increasing accessibility of the built environment and building supportive infrastructure can have community-wide benefits (Latham-Mintus and Cordon, 2023; Rosso et al., 2011).

This study has numerous strengths, including expanding previous literature by examining household ADL limitations in a large, representing 98% of India's area, however, several limitations should be noted. First, only those who were present in the household when the survey was conducted was administered the mental health questionnaires and thus were included in our analytic sample for the regression analyses. The adults in our analytic sample were mainly married (80 %) women (70 %) who had low levels of employment outside the home (25 %). Although the share of women in our sample who provided mental health data is higher than the proportion of women in the population, possibly because they are more likely to be home, these findings can still provide key insights into how ADL limitations of other household members are associated with mental health. We controlled for these factors—sex, marriage, employment status—to address bias. We also ran stratified analyses by sex and find no meaningful differences in the results. While these analyses suggest minimal differences in this

association by sex, we do not draw larger conclusions on sex differences given the imbalance of men and women in our sample. Future research should disentangle these sex differences. Although our findings are meant to be descriptive only, there are likely other variables that may be biasing our results, including common prior causes that explain both household ADL limitations and mental health of others in the household that future research should explore. Second, this study uses cross-sectional data, so we are not able to determine causality or temporality. However, even if the underlying drivers of the observed associations meant that mental health difficulties come first and lead to ADL limitations among other household members, our key conclusions about vulnerable families needing support would remain unchanged. Future research should examine these questions using longitudinal data. Third, this study focused on whether household members had any ADL limitations out of a list of five prespecified activities. It is possible that there is heterogeneity in the association between specific types of ADL limitations or who has that limitation (e.g. someone in the breadwinner role or young adult child) and mental health, which are areas for further inquiry. Additionally, some respondents' ADLs were proxy reported, which could present bias in reporting. However, we find that reported ADL limitations were quite high in our sample. We adjust for this by including an indicator of whether the respondent self-reported their ADLs in the analyses. Fourth, our effect sizes are small compared to the literature on caregiving. This could be attributable to the heterogeneity in our large sample as well as the inclusion of all household members, rather than just caregivers. However research suggests that even small differences in mental health on average can translate into meaningful differences at the population level (Carey et al., 2023).

In sum, this study highlights the importance of examining ADL limitations at the household level to better understand the clustering of ADL limitations and how this is related to the mental health of other household members. Using household and individual level survey data in India, we find that around 40 % of households have at least one resident with an ADL limitation, with ADL limitations more likely in households that are in rural areas, have older residents, and that are socioeconomically disadvantaged. Furthermore, having at least one household member with an ADL limitation is associated with increased symptoms of depression and anxiety in adults, while for young people, this association is observed when multiple household members have ADL limitations. This association between household ADL limitations and mental health is stronger among adults in households in rural areas compared to households in urban areas, showcasing the additional vulnerability of rural households. Together, these findings suggest the need for family and household centered approaches for ADL accommodations tailored to the social and environmental context in which people live.

CRedit authorship contribution statement

Kaitlin Shartle: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Jennifer E. Lansford:** Writing – review & editing, Funding acquisition, Conceptualization. **Marcos Vera-Hernández:** Writing – review & editing, Funding acquisition, Conceptualization. **Arnab Mukherji:** Writing – review & editing, Funding acquisition, Conceptualization. **Manoj Mohanan:** Writing – review & editing, Funding acquisition, Conceptualization. **Joanna Maselko:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This work was supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health [grant number R01HD107420, PI: Mohanan and Maselko]. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. SEHAT is also supported by additional funding from the Sanford School of Public Policy at Duke University. We'd additionally like to thank Sandy Askew, Kendal Swanson, and Jennifer Hurtgen. We are grateful to Mahesh Vyas and the team at Centre for Monitoring Indian Economy (CMIE) for the partnership with CPHS and for enabling the creation of the SEHAT study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmmh.2025.100547>.

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