



Rural-urban health differences among aging adults in India

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ABSTRACT

Background: The aim of this study was to determine the rural-urban health differences among aging adults in India.

Methods: The national cross-sectional data of 67,489 individuals (≥ 45 years) in 2017–2018 from 35 states and union territories of India (excluding Sikkim) in 2017–2018 were analysed. Various sociodemographic data, well-being indicators, lifestyle factors and physical conditions were assessed by face-to-face interviews and physical measurement. Univariable and multivariable logistic regression was utilized to assess the predictors between residence status (rural dweller, urban migrant, and urban dweller) and various health indicator outcomes.

Results: Majority (70.4 %) of the participants lived in rural areas, 10.3 % were urban migrants and 19.3 % urban dwellers. In the multivariable logistic regression analysis, urban migrants and urban dwellers had a higher self-rated health status, cognitive functioning, physical inactivity, overweight or obesity and abdominal obesity than rural dwellers, while urban migrants and/or urban dwellers had lower functional disability, insomnia symptoms, current smokeless tobacco use, current smoking, heavy episodic drinking and underweight than rural dwellers. Furthermore, urban migrants and/or urban dwellers had higher odds of diabetes, hypertension, heart disease, cancer, high cholesterol than rural dwellers, while urban migrants and/or urban dwellers had lower odds of persistent headaches, major injury, recurrent fall, physical pain, periodontal disease, vision impairment, and gastrointestinal problems than rural dwellers.

Conclusion: Among 30 health indicators assessed, 16 had an urban migrant and/or urban dweller advantage, 8 had urban migrant and/or urban dweller penalty, and 6 did not differ between rural-urban groups. Public health promotion and health care should address differing health care needs of rural and urban middle-aged and older adults.

1. Introduction

Social health determinants include social environments (e.g., socioeconomic status and discrimination), physical environments (e.g., residence status, traffic conditions, and building environments), and health services (e.g., access and quality of health care, and medical coverage) [1]. Living in rural or urban areas may determine one's health status in a positive or negative way due to a number

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of socio-cultural and environmental factors [2]. On the one hand, “urban health advantage” may be associated with better health protection opportunities, such as infrastructure development, access to health care, social support and economic opportunities, in the cities [3], and on the other hand, “urban health penalty” may be associated with people being exposed to harmful factors such as pollution, stress and health compromising behaviour in cities impacting negatively on health [4,5]. Moreover, the “healthy migrant hypothesis” proposes that migrants are a selective population with better health status than the non-migrant population [6]. For example, a systematic review of cardiovascular disease (CVD) risk found that most CVD risk-factors were higher in urban dwellers than migrants and rural dwellers [7]. Urbanization is occurring at a fast pace in low resourced countries, including in India [8], and may be associated with an urban health advantage and/or urban health penalty. After decades of planned development, there has been a sharp increase in rural-urban differences in India [8]. There is a poor understanding of rural-urban health differences in middle-aged and older adults in India.

Regarding well-being and health status indicators, urban residence was found associated with better self-rated health status [9], higher happiness, high life satisfaction [10], and better cognitive functioning [11–13], and rural residence was associated with major depression [11], insomnia [14], functional limitations [15] and higher grip strength [16].

In terms of lifestyle factors, rural residence was associated with alcohol use [2,17,18], tobacco use [17,19], a higher prevalence of falls [20], serious injuries resulting from traffic accidents [17], and underweight [21,22], while urban residence was associated with physical inactivity [23,24], overweight, obesity [2,18,22,23,25], and raised waist circumference [2,23]. In a study in India, urban migrants had a higher prevalence of obesity than rural dwellers [26].

Urban residence was found associated with chronic lung disease [27], hypertension [28–30], stroke [31], diabetes [2,13,27,28,30], hypercholesterolaemia [32], oral health problems [13], and rural residence was associated with chronic gastroenteritis/peptic ulcer [33], gastrointestinal diseases [34], physical pain [35], heart disease and arthritis [33].

This study aimed to evaluate the rural-urban health differences in middle-aged and older community-dwelling adults in India.

2. Method

2.1. Participants and procedures

We analysed cross-sectional data from the National Longitudinal Ageing Study (LASI) Wave 1, 2017–2018: “the overall household response rate is 96%, and the overall individual response rate is 87%” [36]. A household survey collected “interview, physical measurement and biomarker data from persons aged 45 and over and their spouses, regardless of age, from 35 union states and territories of India (excluding Sikkim)” [36]. We restricted our analysis to those who had complete rural, urban, and rural-urban migration status. Details on the sampling methodology are found elsewhere [36]. Briefly, LASI Wave 1 adopted a three-step sampling model in rural areas and a four-step sampling model in urban areas. In each State/United States Territories, the first phase included the selection of primary sampling units (PSUs), i.e. sub-districts (Talukas/Tehsils), and the second phase included the selection of wards in urban areas and villages in rural areas in the selected PSUs [36]. In rural areas, households from selected villages were chosen in the third phase. However, the sampling of urban areas (>5000 inhabitants) involved a randomly selected a census numbering unit (CEB), from which households were selected [36]. Sample size was calculated based on the estimate of prevalence; while the prevalence of any diseases of 5 % (average of WHO-SAGE India, 2007), design effect 2, margin of error of 2 % point with 95 % level of confidence. The minimum sample size was 912, the survey increased number to minimum sample of 1000 for the smallest states of the country [36].

Permission to use the LASI data at the Gateway to Global Aging Data was granted. The study was approved by the Ethics Committee of the Indian Medical Research Council (ICMR) in January 2017 and participants provided informed consent [36]. As an analysis of de-identified, publicly available data, this study did not require approval of human subjects research by an institutional review board. It complies with the Declaration of Helsinki.

2.2. Assessment instruments

2.2.1. Health variables (outcomes)

Self-rated health status was defined as 1 = “good, very good or excellent” and 0 = “poor or fair” [36].

Life satisfaction, 5-item Satisfaction With Life Scale (SWLS) [37]; Cronbach’s alpha 0.86. We used a cut-off of 26 or more (above the median) for high life satisfaction.

High happiness in the past week, was defined as 1 = “often (3 or 4 days), or most or all of the time (5–7 days)” and 0 = “rarely or never (<1 day), or sometimes (1 or 2 days)” [36].

Impaired cognition based on the Mini-Mental State Exam” (total scores 0–32), including orientation, serial 7s, ad word recall (immediate and delayed), was defined as 10th percentile of the total score [38].

Weak hand grip strength (HGS) was defined as “<30 kg for men and <20 kg for women” based on the average value of the four (each hand twice) HGS assessments [39] measured with a “Baseline Smedley Spring type dynamometer” [36].

Functional disability was sourced from 6 items of “Activities of Daily Living (ADL)” and 7 items of “Instrumental Activities of Daily Living (IADL)” [40,41]; (Cronbach alpha for the combined scale was 0.89). Responses were “Yes/No” and were dichotomized into 0 or 1, and ≥ 2 ADL/IADL items.

Insomnia symptoms (defined as any positive of 4 items) were assessed with the “Jenkins Sleep Scale (JSS-4)” (Cronbach alpha 0.86) [42].

Major depressive disorder (past 12 months) was sourced from the Composite International Diagnostic Interview short form (CIDI-SF), using a cut-off score of ≥ 3 [43,44].

Substance use included current tobacco use, current smokeless tobacco use, and heavy episodic alcohol use (at least once a month 5 or more drinks on one occasion) [36].

Physical inactivity: “hardly ever or never engaging in vigorous physical activity” [36].

Anthropometry: “Height and weight were measured using the Seca 803 digital scale” [36] and classified as “Body Mass Index = BMI: “underweight (<18.5 kg/m²), normal weight (18.5–22.9 kg/m²), overweight/obesity (≥ 23.0 kg/m²)” using Asian criteria [45].

Central/abdominal obesity was defined for men ≥ 90 cm and for women ≥ 80 cm (using South Asian criteria) [46].

Hypertension/raised blood pressure (BP) was measured based on the last two averaged of three BP readings: “systolic BP ≥ 140 mm Hg and/or diastolic BP ≥ 90 mm Hg or where the participant is currently on antihypertensive medication.” [47].

Other health professional diagnosed chronic conditions included:

“1) Diabetes or high blood sugar; 2) Cancer or malignant tumor; 3) Chronic lung disease such as asthma, chronic obstructive pulmonary disease/Chronic bronchitis or other chronic lung problems; 4) Chronic heart diseases such as Coronary heart disease (heart attack or Myocardial Infarction), congestive heart failure, or other chronic heart problems; 5) Stroke; 7) Arthritis or rheumatism, Osteoporosis or other bone/joint diseases; 8) High cholesterol (Yes/No), and 9) Gastrointestinal problems (GERD, constipation, indigestion, piles, peptic Ulcer)”, having had persistent headaches in the past two years, and physical pain “troubled by pain and required some form of medication or treatment for relief of pain” [36].

Major injury in the past two years (Yes/No), and recurrent (2 or more) falls in the past two years [36].

Periodontal disease was assessed any affirmative response to the three questions, “In the last 12 months, have you ever been diagnosed with or suffered from bleeding gums, swelling gums or ulcers lasting more than two weeks?” [36].

Impaired vision was defined as “low vision (0.01–0.25 decimal) if he or she had either low near or far vision in both eyes” based on visual acuity measurement using a tumbling “E” log MAR chart [48,49].

Table 1

Sample information by sociodemographic and well-being indicators and rural-urban status in aging adults in India, 2017–2018.

Variable	Variable specification	Total	Rural	Urban migrant	Urban	p-value
		N (%)	n (%)	n (%)	n (%)	
Sociodemographic factors						
All		67,489	44,903 (70.4)	8709 (10.3)	13,877 (19.3)	
Age	Mean (SD)	58.6 (11.8)	59.0 (11.8)	57.8 (12.1)	57.8 (11.4)	<0.001
Age in years	45–59	38,020 (54.0)	24,829 (52.3)	7027 (56.0)	8164 (59.0)	<0.001
	60–69	17,854 (26.8)	12,064 (27.9)	2227 (25.8)	3563 (23.6)	
	70 or more	11,615 (19.2)	8010 (19.8)	1455 (18.2)	2150 (17.4)	
Sex	Female	38,527 (57.1)	25,407 (56.4)	5883 (72.1)	7237 (51.5)	<0.001
	Male	28,962 (42.9)	19,496 (43.6)	2826 (27.9)	6640 (48.5)	
Education	≥1 year schooling	35,745 (49.4)	19,457 (40.5)	5738 (63.0)	10,550 (74.3)	<0.001
	No schooling	31,743 (50.6)	25,445 (59.5)	2971 (37.0)	3327 (25.7)	
Subjective socioeconomic status	Low	22,410 (37.6)	17,082 (42.5)	2304 (29.5)	3024 (23.9)	<0.001
	Medium	26,476 (38.7)	17,188 (38.3)	3626 (40.3)	5662 (39.3)	
	High	16,612 (23.7)	9375 (19.2)	2487 (30.2)	4750 (36.8)	
Marital status	Not married	15,743 (24.2)	10,251 (23.9)	2198 (29.3)	3294 (22.7)	<0.001
	Married	51,745 (75.8)	34,652 (76.1)	6510 (70.7)	10,583 (77.3)	
Well-being indicators all ages						
Good self-rated health status	Yes	42,032 (60.3)	27,056 (57.6)	5651 (64.2)	9325 (67.8)	<0.001
High life satisfaction	Yes	29,400 (43.9)	18,348 (41.8)	4124 (45.6)	6928 (50.6)	<0.001
High happiness	Yes	33,315 (49.2)	21,593 (48.0)	4464 (51.2)	7258 (52.7)	<0.001
Impaired cognition	Yes	6941 (13.0)	5844 (16.1)	542 (8.0)	555 (4.7)	<0.001
Insomnia symptoms	Yes	7801 (12.7)	5497 (13.6)	948 (12.2)	1356 (9.6)	<0.001
Major depressive disorder	Yes	4076 (7.7)	3039 (8.4)	422 (6.2)	615 (5.7)	<0.001
Well-being indicators in aged 45–59						
Good self-rated health status	Yes	26,640 (67.6)	16,962 (65.4)	3620 (70.9)	6058 (73.2)	<0.001
High life satisfaction	Yes	16,547 (43.0)	10,138 (41.6)	2315 (41.2)	4094 (48.7)	<0.001
High happiness	Yes	19,395 (49.9)	12,407 (49.5)	2624 (49.2)	4364 (51.7)	<0.001
Impaired cognition	Yes	2597 (8.3)	2264 (10.6)	163 (5.4)	170 (2.6)	<0.001
Insomnia symptoms	Yes	3716 (10.8)	2589 (11.7)	445 (10.0)	682 (8.3)	<0.001
Major depressive disorder	Yes	2178 (7.2)	1600 (7.8)	237 (6.1)	341 (5.8)	<0.001
Well-being indicators in aged 60 years and more						
Good self-rated health status	Yes	15,292 (51.4)	10,094 (49.0)	2031 (55.5)	3267 (59.6)	<0.001
High life satisfaction	Yes	12,853 (44.9)	8210 (42.1)	1809 (51.3)	2834 (53.4)	<0.001
High happiness	Yes	13,920 (48.5)	9186 (46.5)	1840 (53.9)	2894 (54.2)	<0.001
Impaired cognition	Yes	4344 (18.9)	3580 (22.6)	379 (11.4)	385 (8.0)	<0.001
Insomnia symptoms	Yes	4085 (14.8)	2908 (15.6)	503 (14.9)	674 (11.6)	<0.001
Major depressive disorder	Yes	1898 (8.2)	1439 (9.1)	185 (6.4)	274 (5.5)	<0.001

SD=Standard Deviation.

2.2.2. Exposure variable

Participant's place of residence was classified as urban (wards, town) or rural (village). Following a previous classification [2]:

"Participants were considered 'urban dwellers' if they were a current resident of an urban area and had lived there all their life, or reported living only in other urban areas previously; participants were considered 'rural dwellers', if they were a current resident of a rural area and had lived there all their life, or reported living only in other rural areas previously; participants were considered 'urban migrant' if they were a current resident of an urban area and if they reported that their previous place of residence was rural or village (birth place, place of previous residence, had lived most of their adult life or childhood in a rural area)."

2.2.3. Covariates

Age, sex, education, marital and subjective socioeconomic status [36].

2.3. Data analysis

Descriptive statistics were used to describe sociodemographic and health information, chi-square tests and student-t tests for differences in proportion and means. Univariable and multivariable logistic regression was utilized to assess the predictors between residence status (rural dweller, urban migrant, and urban dweller) and various health indicator outcomes. Covariates in the multivariable logistic regression models included age group, sex, education, and subjective socioeconomic and marital status; variables found significant ($p < 0.05$) in univariable logistic regression analyses were included in the multivariable logistic regression analysis. $P < 0.05$ was accepted as statistically significant, and missing values were excluded. Statistical analyses were conducted using STATA software version 15.0 (Stata Corporation, College Station, TX, USA), taking the complex study design into account.

3. Results

3.1. Participants

The sample included 67,489 persons (≥ 45 years, mean 58.6 years, SD = 11.8 years), and 42.9 % were male. Majority (70.4 %) of the participants were rural dwellers, 10.3 % were urban migrants and 19.3 % urban dwellers. Half of the participants (50.6 %) had no schooling, 75.8 % were married, and 37.6 % had low subjective socioeconomic status. There were significant differences ($p < 0.001$) in terms of socioeconomic status between rural-urban dwellers, e.g., 59.5 % of rural dwellers, 37.0 % of urban migrants, and 25.7 % of urban dwellers had no education, 19.2 % of rural dwellers, 30.2 % of urban migrants and 36.8 % of urban dwellers had high socioeconomic status. Well-being indicators (good self-rated health status, high life satisfaction, high happiness, impaired cognition,

Table 2

Sample information by lifestyle factors and physical conditions and rural-urban status in aging adults in India, 2017–2018.

Variable	Total N (%)	Rural n (%)	Urban migrant n (%)	Urban n (%)	p-value
Lifestyle factors					
Current smoking	8625 (12.5)	6611 (14.6)	650 (6.1)	1364 (8.6)	<0.001
Current smokeless tobacco use	12,511 (20.1)	9772 (23.3)	994 (10.7)	1745 (13.3)	<0.001
Heavy episodic drinking	2492 (2.9)	1901 (3.3)	167 (1.9)	24 (2.3)	<0.001
Physical inactivity	39,977 (58.1)	24,190 (54.3)	6279 (70.8)	9508 (65.3)	<0.001
BMI overweight/obesity vs. normal weight	26,880 (52.4)	14,333 (44.4)	4835 (67.9)	7712 (69.9)	<0.001
BMI underweight vs normal weight	11,250 (36.7)	9532 (38.9)	687 (28.8)	1031 (24.8)	<0.001
Major injury	7518 (13.1)	5499 (13.9)	816 (10.2)	1203 (11.3)	<0.001
Recurrent fall	4646 (7.8)	3455 (8.4)	518 (6.6)	673 (5.9)	<0.001
Abdominal obesity	30,992 (48.4)	17,522 (41.1)	5447 (67.4)	8023 (67.0)	<0.001
Physical condition					
Weak grip strength	39,296 (69.7)	26,719 (70.3)	4984 (68.7)	7593 (68.2)	<0.001
Functional disability (2 or more)	16,636 (28.9)	12,211 (31.6)	1889 (23.9)	2536 (21.3)	<0.001
Diabetes	7879 (11.2)	3568 (7.6)	1612 (17.7)	2699 (20.9)	<0.001
Hypertension	25,905 (40.0)	15,826 (36.0)	3869 (46.6)	6210 (51.9)	<0.001
Heart disease	2224 (3.6)	1152 (2.8)	393 (4.1)	679 (6.0)	<0.001
Stroke	1113 (1.8)	686 (1.7)	156 (2.4)	271 (1.9)	<0.001
Cancer	438 (0.6)	251 (0.5)	89 (1.3)	98 (0.5)	<0.001
Chronic lung disease	3628 (6.4)	2445 (6.2)	465 (5.8)	718 (7.4)	<0.001
High cholesterol	2212 (2.1)	927 (1.2)	568 (5.0)	717 (3.8)	<0.001
Bone or joint disease	9402 (15.5)	6052 (15.2)	1397 (17.0)	1953 (15.8)	<0.001
Persistent headaches	8683 (12.9)	6198 (13.6)	1098 (11.8)	1387 (11.0)	<0.001
Physical pain	7401 (12.6)	5401 (14.1)	843 (8.3)	1157 (10.5)	<0.001
Periodontal disease	9591 (15.9)	7086 (17.4)	1029 (13.2)	1476 (12.0)	<0.001
Vision impaired	19,485 (34.3)	14,240 (36.9)	2212 (31.0)	3033 (25.7)	<0.001
Gastrointestinal problem	12,239 (17.9)	8516 (19.5)	1612 (16.1)	2111 (13.1)	<0.001

insomnia symptoms and major depressive disorder) for differed by rural dweller, urban migrant, and urban dweller status, overall and among middle-aged and older adults (see Table 1). Likewise, lifestyle factors (current smoking, current smokeless tobacco use, heavy episodic drinking, physical inactivity, overweight/obesity, underweight, major injury, recurrent fall, and abdominal obesity) and physical conditions (weak grip strength, functional disability, diabetes, hypertension, heart disease, stroke, cancer, chronic lung disease, high cholesterol, bone or joint disease, physical pain, periodontal disease, impaired vision and gastrointestinal problem) differed by rural dweller, urban migrant, and urban dweller status (see Table 2).

Table 3

Associations between rural-migrant-urban residence and well-being indicators among all ages and by age group.

Outcome variables	Exposure	Univariable analysis: COR (95 % CI)	Multivariable analysis: AOR (95 % CI) ^a
All ages			
Self-rated health status	Rural	1 Reference	1 Reference
	Migrant	1.31 (1.18, 1.47)***	1.25 (1.12, 1.41)***
	Urban	1.54 (1.35, 1.77)***	1.31 (1.15, 1.51)***
Life satisfaction	Rural	1 Reference	1 Reference
	Migrant	1.17 (1.03, 1.31)*	0.99 (0.87, 1.12)
	Urban	1.43 (1.25, 1.62)***	1.10 (0.97, 1.24)
Happiness	Rural	1 Reference	1 Reference
	Migrant	1.13 (1.00, 1.29)*	1.01 (0.89, 1.15)
	Urban	1.20 (1.06, 1.37)**	1.00 (0.88, 1.14)
Impaired cognition	Rural	1 Reference	1 Reference
	Migrant	0.45 (0.37, 0.56)***	0.60 (0.47, 0.77)***
	Urban	0.26 (0.21, 0.32)***	0.44 (0.38, 0.53)***
Insomnia symptoms	Rural	1 Reference	1 Reference
	Migrant	0.88 (0.76, 1.02)	0.92 (0.79, 1.06)
	Urban	0.68 (0.59, 0.78)***	0.75 (0.64, 0.88)***
Major depressive disorder	Rural	1 Reference	1 Reference
	Migrant	0.72 (0.56, 0.93)*	0.79 (0.60, 1.04)
	Urban	0.66 (0.45, 0.96)*	0.79 (0.51, 1.21)
Aged 45–59			
Self-rated health status	Rural	1 Reference	1 Reference
	Migrant	1.29 (1.09, 1.53)**	1.30 (1.09, 1.54)**
	Urban	1.45 (1.15, 1.82)***	1.31 (1.05, 1.64)*
Life satisfaction	Rural	1 Reference	1 Reference
	Migrant	0.98 (0.83, 1.16)	0.86 (0.73, 1.03)
	Urban	1.33 (1.10, 1.61)**	1.07 (0.89, 1.28)
Happiness	Rural	1 Reference	–
	Migrant	0.99 (0.82, 1.19)	–
	Urban	1.09 (0.90, 1.32)	–
Impaired cognition	Rural	1 Reference	1 Reference
	Migrant	0.48 (0.30, 0.77)**	0.66 (0.40, 1.09)
	Urban	0.23 (0.15, 0.35)***	0.36 (0.27, 0.48)***
Insomnia symptoms	Rural	1 Reference	1 Reference
	Migrant	0.84 (0.65, 1.07)	0.85 (0.67, 1.09)
	Urban	0.68 (0.55, 0.84)***	0.74 (0.59, 0.94)*
Major depressive disorder	Rural	1 Reference	–
	Migrant	0.76 (0.53, 1.10)	–
	Urban	0.73 (0.41, 1.29)	–
Aged 60 or more			
Self-rated health status	Rural	1 Reference	1 Reference
	Migrant	1.30 (1.13, 1.49)***	1.20 (1.05, 1.38)**
	Urban	1.54 (1.33, 1.77)***	1.30 (1.14, 1.49)***
Life satisfaction	Rural	1 Reference	1 Reference
	Migrant	1.45 (1.25, 1.68)***	1.17 (1.00, 1.17)
	Urban	1.58 (1.36, 1.85)***	1.14 (1.00, 1.31)
Happiness	Rural	1 Reference	1 Reference
	Migrant	1.35 (1.17, 1.56)***	1.12 (0.97, 1.30)
	Urban	1.36 (1.17, 1.59)***	1.06 (0.93, 1.22)
Impaired cognition	Rural	1 Reference	1 Reference
	Migrant	0.44 (0.37, 0.53)***	0.56 (0.45, 0.68)***
	Urban	0.30 (0.23, 0.38)***	0.51 (0.41, 0.62)***
Insomnia symptoms	Rural	1 Reference	1 Reference
	Migrant	0.95 (0.80, 1.11)	0.97 (0.82, 1.15)
	Urban	0.71 (0.61, 0.83)***	0.76 (0.65, 0.89)***
Major depressive disorder	Rural	1 Reference	1 Reference
	Migrant	0.68 (0.54, 0.86)***	0.73 (0.57, 0.93)**
	Urban	0.58 (0.47, 0.72)***	0.68 (0.55, 0.85)***

CI=Confidence Interval; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^aCovariates included age group, sex, education, marital status, and subjective socioeconomic status; COR=Crude Odds Ratio; AOR = Adjusted Odds Ratio.

3.2. Associations between rural dwellers, urban migrants, and urban dwellers with well-being indicators

In the multivariable logistic regression analysis, urban migrants and/or urban dwellers had a higher self-rated health status, lower impaired cognition, and lower prevalence of insomnia symptoms than rural dwellers. In addition, in age stratified analysis, older (≥ 60 years) urban migrants and urban dwellers had a lower prevalence of major depressive disorder than older rural dwellers. Furthermore, in univariable logistic regression analysis, urban migrants and urban dwellers had greater life satisfaction, and happiness than rural dwellers (see Table 3).

3.3. Associations between rural dwellers, urban migrants, and urban dwellers with life style indicators

In the multivariable logistic regression analysis, urban migrants and urban dwellers had a higher prevalence of physical inactivity, overweight or obesity and abdominal obesity than rural dwellers, while urban migrants and/or urban dwellers a lower prevalence of current smoking, current smokeless tobacco use, heavy episodic drinking, underweight, major injury and recurrent falls than rural dwellers (see Table 4).

3.4. Associations between rural dwellers, urban migrants, and urban dwellers with physical conditions

In the multivariable logistic regression analysis, urban migrants and/or urban dwellers had higher odds of diabetes, hypertension, heart disease, cancer, high cholesterol than rural dwellers, while urban migrants and/or urban dwellers had lower odds of functional disability, persistent headaches, physical pain, periodontal disease, vision impairment, and gastrointestinal problems than rural dwellers. Weak hand grip strength chronic lung disease, stroke, and bone or joint diseases did not significantly differ between rural-urban groups (see Table 5).

4. Discussion

The study found in this nationally sample of ageing adults in India in 2017–2018, an urban migrant and/or urban dweller advantage of well-being indicators (better self-rated health status, higher cognitive functioning, fewer insomnia symptoms, and lower prevalence of major depressive disorder among people 60 years and older), life style indicators (less current smoking, less current smokeless tobacco use, less heavy episodic drinking, less underweight, less major injury, and less recurrent fall) and physical conditions (less functional disability, less persistent headaches, less physical pain, less periodontal disease, less visual impairment, and less gastrointestinal problems). An urban migrant and/or urban dweller penalty was found in terms of lifestyle indicators (physical

Table 4
Associations between rural-migrant-urban residence and life style indicators.

Outcome variables	Exposure	Univariable analysis: COR (95 % CI)	Multivariable analysis: AOR (95 % CI) ^a
Current smoking	Rural	1 Reference	1 Reference
	Migrant	0.38 (0.31, 0.47)***	0.61 (0.51, 0.74)***
	Urban	0.55 (0.45, 0.67)***	0.54 (0.45, 0.66)***
Current smokeless tobacco use	Rural	1 Reference	1 Reference
	Migrant	0.40 (0.33, 0.48)***	0.49 (0.41, 0.60)***
	Urban	0.51 (0.42, 0.61)***	0.52 (0.45, 0.61)***
Heavy episodic drinking	Rural	1 Reference	1 Reference
	Migrant	0.56 (0.29, 1.06)	0.95 (0.49, 1.82)
	Urban	0.69 (0.51, 0.93)*	0.74 (0.55, 0.99)*
Physical inactivity	Rural	1 Reference	1 Reference
	Migrant	2.04 (1.63, 2.57)***	1.89 (1.45, 2.48)***
	Urban	1.58 (1.34, 1.87)***	1.87 (1.59, 2.19)***
BMI overweight/obesity vs. normal weight	Rural	1 Reference	1 Reference
	Migrant	2.65 (2.35, 3.00)***	2.18 (1.93, 2.48)***
	Urban	2.91 (2.60, 3.27)***	2.55 (2.21, 2.94)***
BMI underweight vs normal weight	Rural	1 Reference	1 Reference
	Migrant	0.63 (0.43, 0.94)*	0.67 (0.45, 1.02)
	Urban	0.52 (0.44, 0.62)***	0.62 (0.54, 0.71)***
Major injury	Rural	1 Reference	1 Reference
	Migrant	0.70 (0.61, 0.81)***	0.68 (0.58, 0.79)***
	Urban	0.79 (0.67, 0.94)**	0.80 (0.68, 0.95)**
Recurrent fall	Rural	1 Reference	1 Reference
	Migrant	0.76 (0.63, 0.93)**	0.74 (0.59, 0.92)**
	Urban	0.68 (0.50, 0.93)*	0.73 (0.55, 0.98)*
Abdominal obesity	Rural	1 Reference	1 Reference
	Migrant	2.96 (2.50, 3.51)***	2.19 (1.79, 2.68)***
	Urban	2.91 (2.57, 3.79)***	2.64 (2.26, 3.08)***

CI=Confidence Interval; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^aCovariates included age group, sex, education, marital status, and subjective socioeconomic status; COR=Crude Odds Ratio; AOR = Adjusted Odds Ratio.

Table 5
Associations between rural-migrant-urban residence and physical conditions.

Outcome variables	Exposure	Univariable analysis: COR (95 % CI)	Multivariable analysis: AOR (95 % CI) ^a
Weak grip-strength	Rural	1 Reference	–
	Migrant	0.93 (0.78, 1.10)	
	Urban	0.91 (0.79, 1.04)	
Functional disability (2 or more)	Rural	1 Reference	1 Reference
	Migrant	0.68 (0.60, 0.77)***	0.69 (0.60, 0.79)***
	Urban	0.58 (0.51, 0.67)***	0.74 (0.61, 0.91)**
Diabetes	Rural	1 Reference	1 Reference
	Migrant	2.61 (2.13, 3.19)***	2.31 (1.90, 2.80)***
	Urban	3.21 (2.62, 3.94)***	2.76 (2.08, 3.65)***
Hypertension	Rural	1 Reference	1 Reference
	Migrant	1.55 (1.38, 1.75)***	1.47 (1.27, 1.69)***
	Urban	1.92 (1.65, 2.23)***	1.90 (1.57, 2.31)***
Heart disease	Rural	1 Reference	1 Reference
	Migrant	1.48 (1.17, 1.87)***	1.33 (1.00, 1.77)*
	Urban	2.19 (1.61, 2.98)***	2.01 (2.49, 2.71)***
Stroke	Rural	1 Reference	–
	Migrant	1.40 (0.86, 2.29)	
	Urban	1.10 (0.85, 1.43)	
Cancer	Rural	1 Reference	1 Reference
	Migrant	2.40 (1.21, 4.76)*	2.06 (1.12, 3.78)*
	Urban	1.00 (0.68, 1.46)	0.84 (0.54, 1.30)
Chronic lung disease	Rural	1 Reference	–
	Migrant	0.94 (0.78, 1.14)	
	Urban	1.22 (0.74, 2.01)	
High cholesterol	Rural	1 Reference	1 Reference
	Migrant	4.21 (3.27, 5.42)***	3.31 (2.55, 4.31)***
	Urban	3.18 (2.41, 4.17)***	2.39 (1.81, 3.26)***
Bone or joint disease	Rural	1 Reference	–
	Migrant	1.14 (1.00, 1.31)	
	Urban	1.05 (0.84, 1.31)	
Persistent headaches	Rural	1 Reference	1 Reference
	Migrant	0.85 (0.76, 0.96)**	0.81 (0.68, 0.97)*
	Urban	0.78 (0.62, 1.00)*	0.86 (0.71, 1.03)
Physical pain	Rural	1 Reference	1 Reference
	Migrant	0.72 (0.60, 0.86)***	0.69 (0.58, 0.83)***
	Urban	0.55 (0.45, 0.67)***	0.59 (0.49, 0.72)***
Periodontal disease	Rural	1 Reference	1 Reference
	Migrant	0.72 (0.60, 0.87)***	0.75 (0.63, 0.91)**
	Urban	0.65 (0.55, 0.76)***	0.71 (0.58, 0.86)***
Vision impaired	Rural	1 Reference	1 Reference
	Migrant	0.77 (0.65, 0.90)***	0.85 (0.73, 0.99)*
	Urban	0.59 (0.49, 0.72)***	0.72 (0.62, 0.84)***
Gastrointestinal problem	Rural	1 Reference	1 Reference
	Migrant	0.79 (0.67, 0.94)**	0.78 (0.67, 0.92)**
	Urban	0.63 (0.53, 0.75)***	0.60 (0.51, 0.71)***

CI=Confidence Interval; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; ^aCovariates included age group, sex, education, marital status, and subjective socioeconomic status; COR=Crude Odds Ratio; AOR = Adjusted Odds Ratio.

inactivity, overweight or obesity, and abdominal obesity), and physical conditions (diabetes, hypertension, heart disease, cancer, and high cholesterol).

Among 30 health indicators assessed, 16 had an urban migrant and/or urban dweller advantage, and 8 had urban migrant and/or urban dweller penalty. One possible reason for these urban-rural health differences may be related to the higher socioeconomic status in urban than rural dwellers in this study. In addition, rural middle-aged and older adults may have less access to health care than urban dwellers, calling for improved health access for rural ageing adults in India [8,13]. Overall, urban migrants had slightly higher odds and urban dwellers had higher odds of health indicators than rural dwellers. Similarly, the prevalence of most CVD risk factors increased from rural to urban migrant populations, and further increased from urban migrants to urban dwellers [7]. The urban migrant population may be in between rural and urban dwellers, as they are rapidly taking up urban habits while still maintaining their rural habits [50].

The urban migrant and/or urban dweller advantage in terms of cognitive functioning, self-rated health status, and functional disability found in this study is consistent with most previous research [9,11–13]. Better perceived health status, higher cognitive functioning, and less functional disability, including less difficulty with instrumental activities of daily living, among urban dwellers may be related to higher socioeconomic status, which, in turn, increases cognitive functioning, reduce difficulties with instrumental activities of daily living and provide better health care access and nutrition [11,51].

In agreement with several studies [9–11,14], this study showed that rural residence was associated with poorer mental health (insomnia symptoms, major depressive disorder among those 60 years and older, and poorer life satisfaction and lower happiness in

univariable analysis). It is possible that rural residents, because of their higher prevalence of physical pain and other stressors associated with rural life, develop more insomnia and depressive symptoms than urban dwellers [14]. In a longitudinal study among middle-aged and older adults in China, depression levels decreased with higher urbanization levels [52]. However, similar to a study among older adults in China [53], the rural-urban difference in the prevalence of major depressive disorder was lost after controlling for socioeconomic factors. Better educated ageing adults, and those with higher economic status may have a greater sense of control facilitating adaptive coping strategies with depression triggering events [53,54].

Consistent with several studies [2,17–26], this study showed an association between rural residence and current tobacco use (smoking, and smokeless), heavy episodic drinking, underweight, major injury and recurrent falls, and an association between urban residence and physical inactivity and overweight or obesity, and abdominal obesity. It is possible that rural dwellers are less aware of the dangers of tobacco use and therefore engage more in tobacco use than urban dwellers [50]. There is a need to have rural orientation in the National Tobacco Control Programme of the Indian government [50]. The higher rate of underweight in rural dwellers in this study may be related to the high proportion of chronic food insecurity in rural compared to urban areas [55,56], and the higher rate of injuries and recurrent falls in rural dwellers may be related to environmental factors such as open street channels, low-quality walking paths and unsafe walking areas that prevail in rural areas [57,58].

In line with a number of previous investigations [2,13,21,22,25,27–32], urban residence was in this study associated with various chronic conditions, including diabetes, heart disease, hypertension, cancer, and high cholesterol. Contrary to this, rural residence was associated with diabetes and coronary heart disease in USA [59]. The higher self-reported prevalence of diabetes, heart disease, cancer, high cholesterol, and measured hypertension in urban dwellers as opposed to rural dwellers may be the consequence of a higher proportion of CVD risk factors, such as obesity, physical inactivity, and poor diet [27]. On the other hand, rural residence was associated with persistent headaches, physical pain, periodontal disease, vision impairment, and gastrointestinal problems. Similarly, some previous studies [34,35,60] also found an association between rural residence and gastrointestinal diseases, physical pain, and oral health problems (edentulism, caries) in USA. However, some other studies in Africa [13,61] found urban residence to be associated with oral health problems. The association between rural residence and poor oral health status may be related to the lack of dental care services in rural India [62].

Unlike some previous research [16,17,27,31,33], we did not find rural-urban differences in weak hand grip strength, stroke, bone or joint diseases, and chronic lung disease. Similar findings were shown among ageing adults in six countries, including India, in terms of chronic lung disease, asthma, and arthritis [63]. This could mean that these conditions should be targeted with interventions in both rural and urban dwellers equally.

Study strength include a nationally representative sample of middle-aged and older adults in India, and the use of standardized measures assessing a wide range of health indicators. Study limitations include the cross-sectional design, which reduces the causal understanding between study variables. Furthermore, some variables were assessed by self-report. Older adults in India may under report health problems in the context of relying on physical and financial support from their family [9]. There may also have been a recall bias in reporting particular medical conditions that had been diagnosed by a health care professional [23]. Some variables, such as food consumption and urban slum populations, were not evaluated and should be included in future studies. Furthermore, the study focused on community-dwelling middle-aged and older adults and excluded institutionalised persons. Institutionalised older adults may have poorer health than those living in the community [64].

5. Conclusion

The study found in this nationally sample of ageing adults in India in 2017–2018, an urban migrant and/or urban dweller advantage of well-being indicators (better self-rated health status, higher cognitive functioning, fewer insomnia symptoms, and lower prevalence of major depressive disorder among people 60 years and older), life style indicators (less current smoking, less current smokeless tobacco use, less heavy episodic drinking, less underweight, less major injury, and less recurrent fall) and physical conditions (less functional disability, less persistent headaches, less physical pain, less periodontal disease, less visual impairment, and less gastrointestinal problems). An urban migrant and/or urban dweller penalty was found in terms of lifestyle indicators (physical inactivity, overweight or obesity, and abdominal obesity), and physical conditions (diabetes, hypertension, heart disease, cancer, and high cholesterol). Among 30 health indicators assessed, 16 had an urban migrant and/or urban dweller advantage, 8 had urban migrant and/or urban dweller penalty, and 6 did not differ between rural-urban groups. Results may have implications for policy makers and health care workers. Considering the rural disadvantage in well-being, certain health risk behaviours, such as tobacco use, heavy episodic drinking, underweight, major injury, and recurrent falls, and specific physical conditions, such as functional disability, persistent headaches, physical pain, periodontal disease, visual impairment, and gastrointestinal problems, the government should support policies that increase access to education, health promotion and health care to middle-aged and older adults in rural areas in India. For people in urban areas health promotion policies addressing health risk behaviours including physical inactivity, and overweight or obesity, and programmes for the prevention, screening and management of diabetes, hypertension, heart disease, cancer, and high cholesterol are indicated. Health care providers in urban and rural areas should be aware of rural-urban differences in well-being, lifestyle factors and physical conditions of their patients.

Ethics

Permission to use the LASI data at the Gateway to Global Aging Data was granted. The study was approved by the Ethics Committee of the Indian Medical Research Council (ICMR) in January 2017 and participants provided informed consent [36]. As an analysis of de-

identified, publicly available data, this study did not require approval of human subjects research by an institutional review board. It complies with the Declaration of Helsinki.

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Additional information

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Data availability statement

The data are available at the Gateway to Global Aging Data (www.g2aging.org).

CRediT authorship contribution statement

Supa Pengpid: Writing - original draft. **Karl Peltzer:** Formal analysis, Writing - review & editing.

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.

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