International Journal of Epidemiology, 2022, e167–e176
https://doi.org/10.1093/ije/dyab266
Advance Access Publication Date: 11 January 2022
Cohort Profile

Cohort Profile

Cohort Profile: The Longitudinal Ageing Study in India (LASI)

Arokiasamy Perianayagam [1,2]* David Bloom,[3] Jinkook Lee,[4] Sulabha Parasuraman,[1] TV Sekher,[1] Sanjay K Mohanty,[1] Aparajita Chattopadhyay,[1] Dipti Govil,[1] Sarang Pedgaonkar,[1] Sangeeta Gupta,[1] Arunika Agarwal,[3] Ashok Posture,[1] Albert Weerman, [4] and Santanu Pramanik[2]

[1]International Institute for Population Sciences (IIPS), Mumbai, India, [2]National Council of Applied Economic Research (NCAER), New Delhi, India, [3]Harvard T. H. Chan School of Public Health (HSPH), Boston, MA, USA and [4]University of Southern California (USC), Los Angeles, CA, USA

*Corresponding author. International Institute for Population Sciences, Deonar, Mumbai 400088, India.
E-mail: parokiasamy@gmail.com; aperianayagam@ncaer.org

Received 30 March 2021; Editorial decision 23 November 2021; Accepted 13 December 2021

Why was the cohort set up?

Population ageing, which entails an increasing share of older persons in a population, represents an unprecedented global demographic transformation and is expected to intensify during the remainder of the 21st century. India, home to 1.38 billion people,[1] is undergoing population ageing at a much faster rate than expected. In 2011, the elderly population aged 60 and older accounted for 8.6% of the total population in India, numbering 103 million older people.[2] This share is projected to rise to 19.5% (319 million people) by 2050.[1] Including the pre-retirement phase, the share of the older adults (aged 45 and above) will be more than 40% (655 million people) of the total population of India by 2050. Furthermore, between 2011 and 2050, the number of the oldest-old people (aged 75 and older) is expected to increase by 340%.[1] These demographic changes present complex health, social and economic challenges to which this heterogeneous country must rapidly adapt, both in the present and continuing in the future.[3]

Although ageing and its associated issues are increasingly investigated in India, currently no comprehensive and internationally comparable national survey data in the country collect the full range of topics necessary to understand the health, economic, social and psychological aspects of the ageing process. The Longitudinal Ageing Study in India (LASI), a survey of 72 250 individuals aged 45 and older and their spouses less than 45 years, is designed to fill this gap.

Led by: the International Institute for Population Sciences (IIPS), Mumbai; the Harvard T. H. Chan School of Public Health (HSPH), Boston; and the University of Southern California (USC), Los Angeles, LASI was launched in 2016. LASI is India's first ageing study and the world's largest in terms of sample size, and will provide comprehensive longitudinal data for designing policies and programmes targeted toward the overall well-being of the older population. LASI is well powered to provide meaningful estimates of both national- and state-level indicators, thus promoting cross-state analysis.

Who is in the cohort?

The target population for Wave 1 of LASI included all Indian adult men and women aged 45 and older and their

Key Features

- The Longitudinal Ageing Study in India (LASI) is a nationwide panel survey of adults aged 45 and older and their spouses less than 45 years, collecting comprehensive data on their health, social and economic well-being.
- LASI Wave 1 collected data from 35 of India's 36 states and union territories (excluding Sikkim) and its sample size was 72 250 individuals aged 45 and older and their spouses less than 45 years, including over 31 000 elderly aged 60 and above; follow-up waves are planned every 2–3 years for the next 25 years.
- Household, individual and community data were collected using computer-assisted face-to-face personal interviews and direct health measurements including both molecular (dried blood spots) and non-molecular (physical health) biomarkers.
- The survey design, instruments and protocols are reasonably harmonized with the Health and Retirement Study (HRS) and its sister studies around the world, enabling cross-national comparisons.
- LASI Wave 1 report and microdata can be accessed at [https://www.iipsindia.ac.in/lasi]; [www.data.gov.in]; [https://lasi-india.org/]; and [g2aging.org].

spouses regardless of age, who reside in the same household. Eligibility for the LASI survey has no upper limit. The lower cut-off of 45 years was chosen to (i) harmonize the LASI survey with its sister health and retirement studies across the world; (ii) understand pre-retirement behaviour, as people often begin to change their employment, health, and consumption behaviours before they retire; and (iii) study the transitions and the ageing process. Additionally, it is important for India to have a relatively younger age group (45–60 years) in the survey, because unlike developed countries where the onset of non-communicable chronic diseases occurs at the age of 55 or older, in India these diseases occur much earlier, around the age of 45.[3,4]

Sampling design

The LASI sampling frame included only the household population; persons living in collective institutional living arrangements were excluded. Considering the longitudinal design and the geographical and socioeconomic disparities in India, LASI adopted a multistage stratified area probability cluster sampling design.[5] Within each state, researchers followed a three-stage sampling design in rural areas and a four-stage sampling design in urban areas. Figure 1 illustrates the key sampling principles of LASI. The 2011 Census state-wise listing directory[2] of districts, sub-districts-tehsils [which are primary sampling units (PSUs)], villages/urban wards [which are secondary sampling units (SSUs)] with their household size was used for the selection of PSUs and SSUs. However to update SSU-wise household sampling frames to the survey period of 2017–18, a mapping and listing operation was conducted in all selected SSUs; and from the updated household list, LASI households were randomly selected.

Sample size

Using the sample size estimation criteria and based on the average prevalence of selected chronic diseases,[6,7] a minimum sample size of 1000 age-eligible persons was considered appropriate for the smaller states/union territories with a population of less than 10 million people. For large states, which have populations greater than 10 million people, larger geographical areas and greater heterogeneity in the socioeconomic profile of the population, a larger sample size proportionate to the population size of the state was considered. Table 1 provides the sample size allocation by state. The state-level population figures for 2016 were estimated using Census 2011 population figures.[2] In addition, we oversampled the metro cities of Delhi, Mumbai, Chennai, Kolkata and elderly aged 65 and older, to achieve better representation of these population groups in the sample.

Baseline

Wave 1 of LASI is a nationally representative survey of more than 72 000 older adults aged 45 and older and their spouses less than 45 years in 35 of India's 36 states/union territories (excluding Sikkim). This sample includes over 31 000 elderly aged 60 and older. Table 1 provides numbers of household rosters completed, numbers of age-eligible households, numbers of age-eligible individuals and numbers of households and individuals interviewed across states/union territories in LASI Wave 1.

Recruitment strategy

Sampled households and individuals were interviewed between April 2017 and December 2018 by trained field investigators. Individual surveys also included direct health

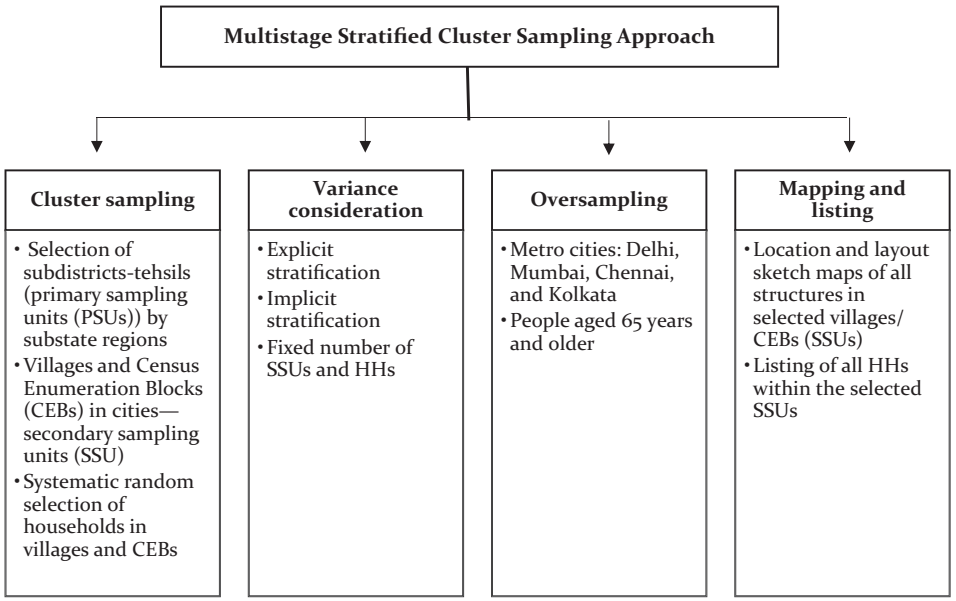

Figure 1 Multistage stratified cluster sampling approach

measurements and collection of dried blood spots by trained health investigators. Once an eligible household was identified, household and individual interview respondents were asked to provide written informed consent, in their preferred language. The English version of the LASI instrument was professionally translated into 16 regional languages to enhance response rates and data quality. Respondents who were unable to read, were read out the consent form, and asked to provide signature or inked fingerprint as signature. A signed copy of the consent forms was provided to the respondents. Of the 65 342 households identified for the LASI survey in 35 states and union territories, 44 462 households were found to have at least one age-eligible participant, of whom 42 949 participated in the household interviews. Of the total 82 650 individuals identified as age-eligible for the LASI survey, 72 250 participated in the individual interviews across 35 states and union territories in India. Proxy interviews were conducted for 704 participants who were incapable, mostly cognitively, of giving the full interview.

Ethical considerations

Ethical approvals were obtained from the following collaborating organizations: Indian Council of Medical Research (ICMR), Delhi; IRB, International Institute for Population Sciences (IIPS), Mumbai; IRB, Harvard T.H. Chan School of Public Health (HSPH), Boston; IRB, University of Southern California (USC), Los Angeles; IRB, ICMR-National AIDS Research Institute (NARI), Pune; and IRB, Regional Geriatric Centres (RGCs), MoHFW. The survey participants were informed of the purpose of the survey, ways of protecting their privacy and the safety of the health assessments as part of the informed consent process. In accordance with human subject protection protocols, four consent forms were used in LASI: household informed consent, individual informed consent, consent for dried blood sample collection for storage and future use and a consent for proxy interview. Additionally, as part of the recommended ethics protocols, participants received a copy of the consent forms, biomarker results report card and referral letters to the public health facility if their health measurements were found to be outside the normal range.

Data quality control

Rigorous multilayered supervision and monitoring protocols were implemented to minimize non-sampling error and ensure robust quality of data. Supervisors were assigned 10% of the completed households for back-checks and validation purposes. Field teams received feedback based on direct observations, supervisor validations and quality control analysis of data to minimize errors. Real-time data quality checks were performed, and weekly reports were shared with each survey team to take appropriate actions.

Response rates

Two types of response rates, namely household response rate and individual response rate, were calculated. The household response rate is defined as the number of households that participated in the survey divided by the total number of age-eligible sampled households. The individual response rate is the number of individuals who participated in the survey divided by the total number of eligible

Table 1 Targeted and achieved sample sizes across states and union territories of India, Longitudinal Ageing Study in India (LASI) Wave 1, 2017–18

State/union territory (UT)	Targeted samples	Household rosters completed (age-eligible + non-age-eligible)	Age-eligible households	Age-eligible households interviewed	Age-eligible individuals identified	Age-eligible individuals interviewed
Andaman & Nicobar (UT)	1000	1089	736	725	1347	1244
Andhra Pradesh	2000	2264	1568	1511	2854	2679
Arunachal Pradesh	1000	1163	704	702	1291	1215
Assam	2000	2281	1540	1511	2817	2366
Bihar	3000	3336	2109	2083	3828	3520
Chandigarh (UT)	1625	1107	708	651	1373	1026
Chhattisgarh	1625	1943	1259	1189	2272	2055
Dadra & Nagar Haveli (UT)	1000	1370	741	631	1373	1090
Daman and Diu (UT)	1000	1236	662	577	1271	991
Delhi	1250	1283	776	754	1494	1319
Goa	1250	1147	958	877	1857	1427
Gujarat	2000	2159	1579	1455	3039	2341
Haryana	1625	1821	1285	1251	2391	1898
Himachal Pradesh	1250	1081	838	805	1683	1388
Jammu & Kashmir	1250	1435	963	957	1813	1613
Jharkhand	2000	2236	1451	1408	2758	2464
Karnataka	2000	2018	1555	1488	2981	2420
Kerala	2000	1883	1542	1411	3000	2497
Lakshadweep (UT)	1000	894	694	627	1328	1139
Madhya Pradesh	2500	2790	1727	1690	3241	2914
Maharashtra	3000	3293	2446	2421	4675	3973
Manipur	1000	1180	862	860	1594	1369
Meghalaya	1000	666	636	636	1056	969
Mizoram	1000	1188	765	732	1410	1246
Nagaland	1000	1207	803	799	1367	1316
Odisha	2000	2306	1670	1645	3102	2917
Puducherry (UT)	1000	1173	848	839	1542	1428
Punjab	2000	1769	1296	1234	2519	2124
Rajasthan	2000	2200	1336	1302	2493	2244
Sikkim	1000	–	–	–	–	–
Tamil Nadu	3000	3248	2176	2150	3845	3530
Telangana	2000	2272	1487	1418	2703	2475
Tripura	1000	1099	748	721	1374	1195
Uttar Pradesh	4000	4721	2820	2747	4965	4567
Uttarakhand	1250	1256	878	863	1566	1358
West Bengal	3000	3201	2296	2279	4428	3933
India	61 000	65 342	44 462	42 949	82 650	72 250

Survey in the state of Sikkim was delayed due to administrative issues and later due to the COVID-19 pandemic.

individuals in the age-eligible sampled households. Table 2 provides household and individual response rates by place of residence and by states/union territories. For India, the overall household response rate was 95.8% and the overall individual response rate was 87.3%. Both household and individual response rates were higher in rural than in urban areas. Across the states, the household response rates ranged from 99.2% in Arunachal Pradesh to 86.0% in Daman and Diu. The individual response rates ranged from 96.3% in Nagaland to 76.7% in Goa.

Sample weights

The LASI sample weights computation process consisted of aggregating the selection probabilities of primary sampling unit (PSU), secondary sampling unit (SSU) and household levels.[7] Non-response and post-stratification adjustments were made to represent population characteristics accurately. For post-stratification adjustments, the external control totals (total number of individuals aged 45 and older in urban and rural areas) were obtained from population projections based on the 2011 Census.[2]

Table 2 Response rates by states/union territories, India, Longitudinal Ageing Study in India (LASI) Wave 1, 2017–18

State/union territory (UT)	Household response rate (%)			Individual response rate (%)		
	Total	Rural	Urban	Total	Rural	Urban
Andaman & Nicobar Islands (UT)	98.5	98.3	98.9	92.3	93.0	90.9
Andhra Pradesh	95.6	96.6	92.9	93.9	95.0	90.8
Arunachal Pradesh	99.2	98.9	100.0	94.0	93.1	97.1
Assam	98.1	98.4	95.5	84.0	84.3	81.9
Bihar	98.4	98.6	97.3	92.0	92.1	90.6
Chandigarh (UT)	89.4	88.8	89.4	74.3	68.4	74.3
Chhattisgarh	94.4	96.3	86.5	90.4	91.3	86.8
Dadra & Nagar Haveli (UT)	85.1	86.1	83.4	79.7	83.4	73.7
Daman & Diu (UT)	86.0	88.3	84.8	78.0	77.1	78.5
Delhi	96.1	90.0	96.2	88.2	78.8	88.4
Goa	91.0	91.1	91.0	76.7	73.1	79.3
Gujarat	91.8	94.4	88.2	77.0	81.7	70.9
Haryana	96.8	96.9	96.8	79.3	80.1	77.6
Himachal Pradesh	95.2	95.0	96.3	82.5	83.3	77.1
Jammu & Kashmir	96.2	98.4	90.7	88.9	90.0	85.9
Jharkhand	96.0	97.2	91.7	89.2	90.2	85.8
Karnataka	94.6	96.6	90.7	81.1	82.0	79.3
Kerala	88.9	90.1	87.7	83.3	84.6	81.9
Lakshadweep (UT)	90.1	89.8	90.2	85.9	91.4	84.3
Madhya Pradesh	97.3	98.3	95.0	89.9	92.2	84.5
Maharashtra	98.1	99.7	96.6	84.5	89.1	80.3
Manipur	99.5	99.8	99.0	85.9	89.1	80.0
Mizoram	94.8	96.3	93.5	88.4	90.6	86.5
Nagaland	99.3	99.3	99.1	96.3	97.7	92.9
Odhisha	98.1	98.8	94.4	93.8	95.4	86.5
Puducherry (UT)	98.2	99.6	97.6	92.5	95.1	91.3
Punjab	93.4	94.5	91.0	84.2	86.4	78.9
Rajasthan	97.2	97.5	95.8	90.0	91.3	85.5
Tamil Nadu	98.0	98.8	97.4	91.8	94.1	90.3
Telangana	94.9	97.6	89.4	91.6	94.4	86.4
Tripura	96.1	97.4	92.2	87.1	89.1	81.1
Uttar Pradesh	96.8	98.5	91.1	91.9	94.3	83.9
Uttarakhand	97.7	97.6	98.0	86.8	88.8	82.0
West Bengal	98.4	99.7	97.2	88.8	90.4	87.2
India	95.8	97.2	93.4	87.3	89.6	83.6

Two sets of survey weights were calculated. One set of weights was calculated for generating national-level indicators and another set to produce state-level indicators. Each set has household weights and individual weights. The steps for survey weight calculation included separate computation and then integration of rural and urban weights for each state and for India.

How often will they be followed up?

LASI is a panel survey planned to be conducted every 3 years, with the baseline wave conducted in 2017–18. The sample size estimation involved 10% oversampling at the household level and 15% oversampling at the individual level. A larger sample size than required was considered to account for non-response rates and to ensure a sufficient sample size in the follow-up waves of LASI, considering possible attritions due to death, migration and displacement. The first follow-up wave was planned in mid-2020; however, because of the COVID-19 pandemic, it has been delayed to early 2022.

What has been measured?

The LASI survey instrument comprises three survey schedules as follows.

Table 3 Survey instrument, domain content, and measures included in the Longitudinal Ageing Study in India (LASI), Wave 1, 2017–1

Survey schedules and modules	Domain content	Measures
Household survey		
Household environment	Housing, electricity, water, sanitation,and indoor air pollution	• Households with separate bedrooms and kitchen • Households by types of toilet facility • Sources of drinking water and their location • Exposure to indoor pollution and its type
Household consumption	Household food consumption in the past 7 days and non-food consumption in the past year Household health expenditures for outpatient and inpatient care	• Monthly per capita consumption expenditure • Share of expenditure on food and non-food items • Out-of-pocket health expenditure
Household assets and debts	Ownership and list of housing assets and commercial property, agricultural and nonagricultural land, agricultural assets and livestock, and nonfinancial assets. Details of debts and personal loans	• Value of household wealth including nonfinancial and financial assets • Income generated from assets • Households with loans, mortgages and reverse mortgages
Household income	Income from agricultural and allied sources. Nonagricultural business income. Individual earnings from wages and salaries. Income from self-employment. Pension income/transfers. Other household income	• Annual per capita household income • Share of income by sources income and per capita income of household
Household health insurance	Health insurance coverage and premium paid	• Household insurance coverage
Individual survey		
Demographics	Age, sex, education, marital status, religion, caste, language, and migration	• Demographics of survey participants
Work, retirement and pension	Past and current work. Job characteristics. Social insurance. Retirement and pension characteristics	• % of survey participants ever worked/currently working • Type of industry of work/type of occupation • Quality and satisfaction with job • % individuals officially retired from organized sector • % of survey participants receiving pension
Self-reported health	Diseases and health conditions. Functional limitations and helpers. Family medical history. Mental health: cognition and depression. Women's health. Health and behaviour. Food security	• Self-reported diagnosed chronic health conditions: cardiovascular diseases, diabetes, lung diseases, bone and bone-related diseases, eye problems, hearing problems, angina, sleep problems, family medical history, women's health problems • ADL and IADL limitations • Mental health disorders: dementia and depression; severity of these disorders • Levels of cognitive ability and cognitive limitations • Tobacco, alcohol, physical activity and yoga • Type of health care provider for diagnosis and treatment of health conditions • Functional limitations in activities of daily living and instrumental activities of daily living • Use of various aids or any other supportive devices • Tobacco/alcohol consumption and duration of smoking • Food insecurity
Health care access and utilization	Healthcare utilization in the past 12 months. Hospitalization in the past 12 months. Most recent outpatient visit. Health insurance	• Availability of and accessibility to health care services • Outpatient rate • Inpatient (hospitalization) rate • Mean out-of-pocket expenditure on outpatient/inpatient care

(Continued)

Table 3 Continued

Survey schedules and modules	Domain content	Measures
		• Indirect cost of hospitaliation • Coverage of health insurance and benefits received by people through various schemes • Awareness and coverage of health insurance • Quality of care and family support during hospitalization
Family and social networks	Spouse, children and grandchildren network. Parents, siblings and friends network. Living arrangements. Social support and social activities. Instrumental care. Intra-household decision making. Psychosocial measures and Center for Epidemiological Studies-Depression (CESD)-scale	• Living arrangements • Frequency of communication with family and friends • Received/provided financial support from/to family members • % providing care to family members in their daily activities, type and frequency of care provided, and whether caregiving interferes with other roles/responsibilities • Participation in social organizations/social activities • Decision making and life satisfaction • Type of social support network • Experience of ill-treatment and neglect, type of ill-treatment and perpetrators of ill-treatment
Social welfare schemes	Social welfare schemes for older people (aged 60 years and older)	• Awareness of various welfare schemes and concessions given by the government • Received benefits/concessions
Experimental modules	Time use/expectations/social connectedness/ vignettes	• Time use patterns, life expectations, level of social connectedness, and anchoring of vignettes
Direct health examinations		
Biomarkers	Blood pressure, pulse rate, hand grip strength, timed walk, balance tests, vision tests, spirometry, height, weight, hip and waist circumference, dried blood sample collection for blood-based tests: Hb, HbA1c, hs-CRP (tests are in progress)	• Measurement of systolic and diastolic blood pressure; prevalence of hypertension and undiagnosed hypertension • Prevalence of chronic obstructive pulmonary disease • Prevalence of underweight, overweight and obesity • Prevalence of high-risk waist-hip ratio • Prevalence of anaemia, diabetes and risk for chronic inflammatory conditions • Prevalence of anaemia, diabetes and high-risk chronic inflammatory diseases
Community survey		
Community questionnaire	• Rural community survey • Urban community survey	• Basic demographics and socioeconomic information collected from Census 2011 • Availability of and access to health infrastructure facilities: subcentre, primary health centre and community health centre • Availability of public infrastructure facilities and basic amenities such as: transportation; drinking water, electricity, drainage and sanitation facilities; roads; post offices; police stations; banks; playgrounds; parks; public distribution shops; and government and private educational institutions • Access to government health and social welfare programmes

i. Household survey schedule, administered one per household in all consenting selected households; the information was collected from one or more knowledgeable adults in the household.
ii. Individual survey schedule, administered to each consenting participant aged 45 and older and their spouses less than 45 years in the sampled households. The individual schedule also includes direct health examinations on a range of physical, performance, anthropometric and blood-based biomarkers.
iii. Community survey schedule, administered at the community level (i.e. villages in rural areas and census enumeration blocks in urban areas). This was targeted to key informants, including village-level elected representatives, panchayat staff, government health programme staff and community leaders.

Table 3 provides detailed description of measures covered in household, individual and biomarker surveys.

What has been found to date?

Baseline findings

LASI is designed to provide reliable estimates for various health measures and social and economic well-being indicators for adults aged 45 and older, supporting development and promotion of appropriate policies and programmes targeted toward healthy ageing in India.

Supplementary Tables 1 and 2, available as Supplementary data at *IJE* online, present the sample characteristics of baseline survey participants and of households. In addition, Supplementary Figure 1a and b, available as Supplementary data at *IJE* online, compares the percentage of baseline households with members aged 60 and above and the percentage of baseline survey participants aged 60 and above, respectively. The following present preliminary findings from the first wave of LASI conducted in 2017–18.

Socioeconomic status

Overall, 54% of individuals interviewed in LASI Wave 1 were adults aged 59 years or younger, and 46% were aged 60 and older. Around 58% of LASI survey participants were women, and 42% were men; 68% of LASI survey participants were from rural areas and 32% were from urban areas; 82% of LASI participants were Hindu, 11% were Muslim, 3% were Christian and 4% were of other religions. Most (76%) of the LASI participants were married; 22% were widowed; and 3% were either divorced, separated or deserted. Almost half (49%) of the LASI survey participants had no schooling, 11% had less than 5 years of schooling, 22% had 5–9 years of schooling and only 19% had 10 or more years of schooling. Half (50%) of the LASI participants were working at the time of the survey, 26% had worked in the past but were not working at the time of the survey, and 28% had never worked. Regardless of age, the proportion of women engaged in agriculture and allied activities was higher than that of men.

Health status

Figure 2 provides prevalence of major chronic health conditions based on self-reports and direct health examinations among adults aged 59 years or younger and the elderly population aged 60 and older.

Among the non-communicable diseases, cardiovascular diseases (CVDs), diabetes, chronic lung diseases and mental health conditions were found to be highly prevalent among older adults in India. More than a third of the elderly aged 60 and older (35%) and a fifth of the participants aged 59 years or younger (22%) in India reported that they have been diagnosed with CVD such as hypertension, heart disease and stroke. More than half of the elderly aged 60 and older in Goa (60%), Kerala (57%), Chandigarh (55%), Andaman and Nicobar (51%) and Jammu and Kashmir (51%) reported that they have been diagnosed with CVD. Additionally, 14% of the elderly aged 60 and older reported that they have been diagnosed with diabetes mellitus. The prevalence of diabetes mellitus is found to be higher in the demographically advanced states/union territories of Kerala (35%), Puducherry (28%), Lakshadweep (28%), Goa (27%), Delhi (26%), Tamil Nadu (26%) and Chandigarh (25%). Around 8% of the elderly aged 60 and older reported chronic lung diseases. Chronic lung diseases are more prevalent in the states/union territories of Rajasthan (15%), Puducherry (13%), Kerala (12%), West Bengal (11%) and Karnataka (10%) than in other states. With regard to mental health problems, the prevalence of depression based on the Composite International Diagnostic Interview-Short-From (CIDI-SF) scale is 8.3% among the elderly aged 60 and older in India. Strikingly, around one in five (19%) elderly aged 60 and older reported bone/joint diseases, with arthritis (11%) as the major bone/joint-related issues prevalent among them. The prevalence of heart diseases, stroke, diabetes mellitus, chronic lung diseases and neurological problems are higher among elderly men than among women; whereas a larger proportion of elderly women than men reported that they have been diagnosed with hypertension, anaemia, bronchitis, depression, Alzheimer's disease and dementia, any bone/joint disease and any cancer.

Functional health

With respect to functional health, around a quarter (24%) of the elderly aged 60 and older reported having at least one limitation of activities of daily living (ADL). Almost half (48%) of the elderly aged 60 and older reported

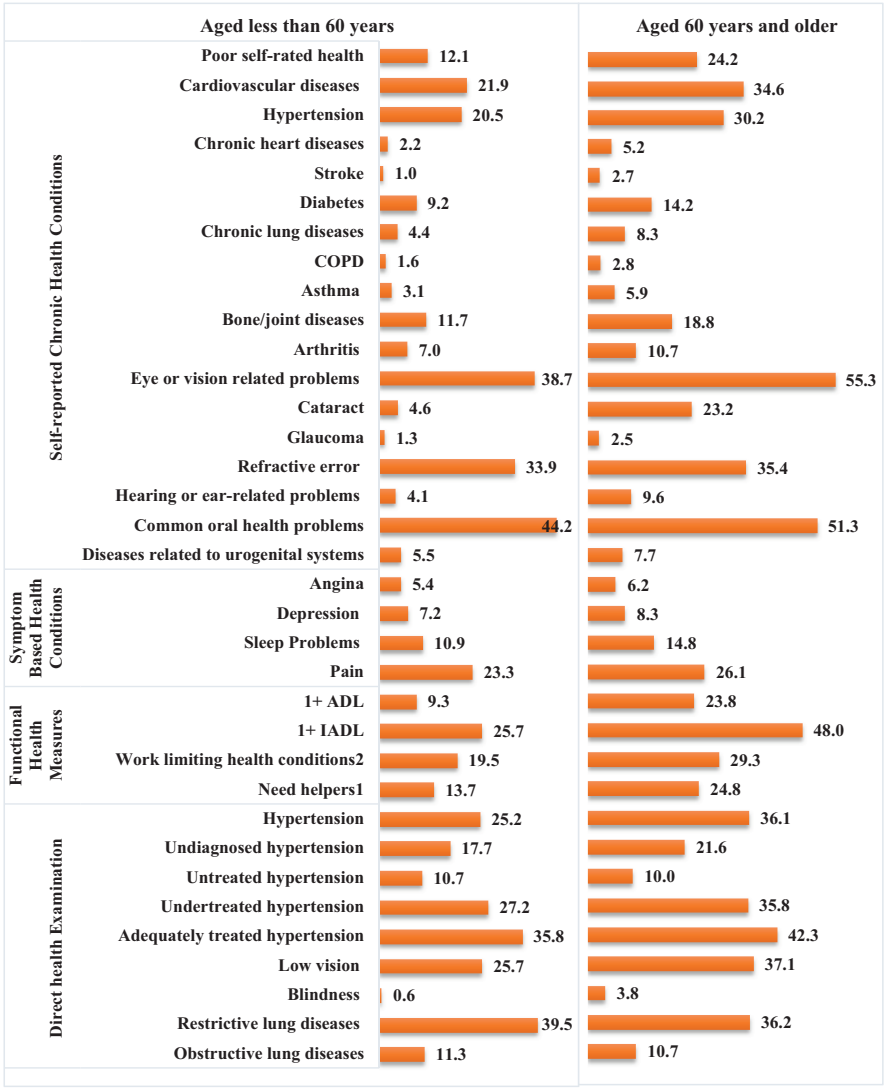

Figure 2 Prevalence of key health measures (weighted %) among adults aged less than 60 years and elderly aged 60 years or older in India, Longitudinal Ageing Study in India (LASI) Wave 1, 2017–18.

having at least one limitation of instrumental activities of daily living (IADL).

Cognitive health

Cognitive abilities were assessed on five cognitive domains: memory, orientation, arithmetic function, executive function and object naming. The mean composite cognition score among older adults aged 45 and older was 25. A higher percentage of the elderly aged 60 and older (15%) than the adults aged 59 years or younger (6%) were in the lowest 10th percentile of composite cognition score. Sex differences in the cognitive score were more pronounced among the elderly aged 60 and older; 7% of elderly men were found in the lowest 10th percentile of composite cognition scores compared with 22% of elderly women.

Biomarkers

The measurements of physical health biomarkers (direct health examination) such as blood pressure, lung function, vision acuity, metabolic risk and functional ability, and symptom-based conditions, such as angina and depression, reveal higher prevalence of these conditions than the self-reported prevalence, indicating a considerable proportion of undiagnosed cases of these diseases among older adults in India. Weight measurements revealed that almost half of the 60+ elderly were malnourished, either underweight (27%) or overweight/obese (22%). Among elderly aged 60 and older, the prevalence of high-risk waist-to-hip ratio was higher in urban (86%) than in rural areas (76%) and higher among elderly women (80%) than among elderly men (78%).[7]

What are the main strengths and weaknesses?

LASI is India's first longitudinal ageing study and the world's largest in terms of sample size, providing comprehensive, internationally comparable high-quality scientific data on the overall well-being of older adults in India. LASI adopted novel large-scale survey protocols and field implementation strategies with various innovative attributes that most of the existing studies in India lack. The LASI sample is representative at national, state and union territory levels, supporting cross-state analysis. The sample is also representative of the socioeconomic spectrum across India and in each state. Additionally, the longitudinal design, coverage of comprehensive biomarkers, collection of geographical coordinates, collection of community-level data and use of computer-assisted personal interviewing technology for data collection, make LASI an invaluable asset for policy makers and the entire research fraternity.

LASI has many strengths, but it has some limitations too. In addition to the survey administration issues such as challenges of interviewing respondents with no or limited education, and accessing remote areas, the length of the survey might have caused respondent fatigue. Although the LASI instrument has been translated into 16 regional languages with utmost care and by professionals, survey administration in different languages and local dialect posed some challenges. Additionally, researchers should consider the issues related to seasonality, specially while analying agriculture-related data, even though the reference period for such questions was the past 12 months. The first wave of LASI is cross-sectional, so a temporal link between cause and effect may not be established using LASI Wave 1 data; however, the data could help to generate causal hypotheses.

Can I get hold of the data? Where can I find more?

LASI Wave 1 2017–18 microdata and related documentation, including fact sheets, national report and executive summary, are publicly available and can be accessed from: the IIPS website [www.iipsindia.ac.in/lasi]; the data web page of the Government of India [http://www.data.gov.in]; the University of Southern California project website [lasi-india.org]; and the website of the Gateway to Global Aging Data [g2aging.org].

Supplementary Data

Supplementary data are available at the *IJE* online.

Funding

LASI is undertaken under the aegis of the Ministry of Health and Family Welfare, Government of India, with joint financial sponsorship of the National Institute on Aging/National Institutes of Health (NIA/NIH), USA (R01 AG042778). The United Nations Population Fund–India office provided additional financial support during the preparatory phase of LASI Wave 1. The baseline LASI data dissemination through the Gateway to Global Aging Data is funded by the National Institute on Aging, National Institutes of Health, USA (R01 AG030153).

Authors Contributions

A.P., D.B., J.L., S.G. and A.A. prepared the draft. A.P., S.U.P., S.A.P. and S.G. developed the sampling design and weighting procedure. A.P. and S.G. conducted data analysis. All authors reviewed the manuscript in addition to their contribution in survey design, instrument development and data collection and analysis. All authors reviewed and approved the manuscript.

Conflict of Interest

None declared.

References

1. United Nations Population Division, Department of Economic and Social Affairs. *World Population Prospects 2019: Data Booklet (ST/ESA/SER.A/424)*. New York, NY: United Nations, 2019.
2. Registrar General and Census Commissioner of India. *Census of India 2011*. New Delhi: Office of Registrar General of India, 2011.
3. Agarwal A, Lubet A, Mitgang E, Mohanty S, Bloom DE. Population aging in India: facts, issues, and options. In: Poot J, Roskruge M (eds). *Population Change and Impacts in Asia and the Pacific. New Frontiers in Regional Science: Asian Perspectives*. Vol **30**. Singapore: Springer, 2020.
4. Arokiasamy P, Bloom DE, Lee J, Feeney K, Ozolins M. Longitudinal Ageing Study in India (LASI): vision, design, implementation, and preliminary findings. In: Smith JP, Majmundar M (eds). *Aging in Asia: Findings from New and Emerging Data Initiatives*. Washington, DC: National Academies Press, 2012.
5. Heeringa SG. Methodology of longitudinal surveys. *Public Opinion Quarterly* 2012;**76**:190–92.
6. Arokiasamy P, Parasuraman S, Sekher TV, Lhungdim H. *Study on global AGEing and adult health (SAGE) Wave-1, India. National Report*. Mumbai, India: International Institute for Population Sciences; and Geneva: World Health Organization, 2012.
7. IIPS (International Institute for Population Sciences), National Programme for Health Care of Elderly (NPHCE), MoHFW, HSPH (Harvard T. H. Chan School of Public Health) and USC (University of Southern California). *Longitudinal Ageing Study in India (LASI), Wave 1 2017–18. India National Report*. Mumbai, India: International Institute for Population Sciences, 2020.