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Cohort Profile: The Spanish longitudinal study on Ageing and Health (*Edad con Salud*)

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Key Features

- *Ageing and Health* was set up to examine longitudinal ageing trajectories of health-related outcomes and their key time-invariant and/or time-varying determinants among the Spanish population.

- This is an ongoing large-scale study combining a longitudinal cohort (2011 cohort) from three waves (2011, 2014-2015, and 2018), and a refreshment sample (2019 cohort) which includes a follow-up study conducted during the COVID-19 pandemic.

- The 2011 cohort comprised 4753 participants (2151 men and 2602 women) aged 18+ years at the baseline survey while the 2019 cohort, whose data collection took place between 2019 and 2021, included 3002 respondents (1302 men and 1700 women). A total of 4579 individuals from both cohorts are currently involved in the study.

- The survey protocol includes questionnaires, a standardized physical examination and a neuropsychological test battery assessment covering contents related to physical and mental health, risk factors and preventive health behaviours, subjective wellbeing, social participation, and work history, among others.

- Data are not publicly available but proposals from external researchers are welcomed via request to José Luis Ayuso-Mateos or Josep Maria Haro (e-mail: parcsanitari.edadconsalud@sjd.es).

MAIN TEXT

Why was the cohort set up?

In 2006, the European Commission identified the ageing of the population as one of the greatest societal challenges of the 21st century. Data projections from the United Nations[1] estimate that the number of individuals over 65 years will double, from 727 million persons in 2020 to 1.5 billion people in 2050. Within this context, Spain is one of countries with the highest shares of older individuals.[2]

Studies to increase comparable and valid longitudinal data on ageing trajectories of health are highly needed for evidence-based policy-making. *Ageing and Health* (ageingandhealth.com) is an ongoing large-scale study combining a longitudinal cohort and a refreshment sample. Data from the baseline core sample was part of the *Collaborative Research on Aging in Europe* (COURAGE in Europe) study.[3] Launched in 2011, the *COURAGE in Europe* project was a cross-sectional, population-based survey including 10800 non-institutionalized adults from Finland, Poland, and Spain. These countries were selected to give a broad representation across different European regions, in light of their population and health characteristics. Its main objectives were: i) to develop valid assessment instruments based on the International Classification of Functioning, Disability and Health[4] to measure key health and health-related outcomes in the adult general population; ii) to validate the assessment instruments to create a scientific evidence base for health and disability determinants in ageing; iii) to produce substantial innovation in ageing survey methodology; and iv) to provide cross-population analysis and a baseline for longitudinal data collection.[5] The Spanish sample was then followed up three and six years later under the *Ageing and Health* study. In addition, this study included a refreshment sample that were first assessed between 2019 and 2021, and from

which a subsample of individuals was interviewed again during the first COVID-19 lockdown in the so-called COVID-19 substudy.

Ageing and Health aims to examine longitudinal trajectories of health-related outcomes and their key determinants, including a wide range of factors such as lifestyles, sociodemographic characteristics, multimorbidity, or psychological indicators. These outcomes mainly refer to depression and suicidal behaviours, cognitive functioning and decline, subjective well-being, and social variables such as loneliness or social participation. Examples of specific objectives include: analysing the role of heterogeneous trajectories of depression on disease burden, disability, and premature death; studying the course of cognitive functioning depending on the onset of depression; exploring different patterns of loneliness and their association with cognitive function status over time; assessing changes in mental health during the COVID-19 pandemic in Spain. Although the main focus of this study is on mental health, data have been collected within the context of a multiple purpose epidemiological cohort, so that a large number of hypotheses can be tested.

Ageing and Health was first funded by the European Community's Seventh Framework Programme (FP7/2007–2013) under the umbrella of the *COURAGE in Europe* study. Additional funding for the follow-ups and to increase the sample size of the baseline cohort was obtained from the Instituto de Salud Carlos III, the European Regional Development Fund, and the Spanish Ministry of Science and Innovation. Support for data collection has been also obtained from the Centro de Investigación Biomédica en Red de Salud Mental. A number of researchers were awarded with career development grants within this project. Please refer to the **Funding section** for further details.

Who is in the cohort?

Ageing and Health is a longitudinal, prospective study of a representative sample of the Spanish adult population aged 50+ years, with an over sampling of the oldest old, and a comparison representative sample of individuals 18-49 years (called 2011 cohort from now on). Potential respondents were selected by a stratified, multistage, clustered area probability design without replacement, according to the Spanish regions and population size. The primary sampling unit consisted of municipalities. From each of them, a number of census units were chosen (secondary sampling unit). Both municipalities and census units were randomly selected with probabilities proportional to the population size (i.e., <10000 inhabitants; 10000-50000 inhabitants; 50001-250000 inhabitants; and >250,000 inhabitants). Next, age strata were used to randomly choose ten households within each census unit (tertiary sampling unit). Data on households were provided by the Spanish Statistical Office. Selected households received a notification letter with an invitation to participate and an information brochure about the study aims a few days before the interviewer's visit. Finally, a list of household occupants was created, from which one participant was randomly selected following age quotas. Institutionalized individuals were not included at the baseline interviews. However, those who moved to institutions after the first assessment were attempted to retain and interview. The baseline (wave 1) survey started in July 2011 and ended in May 2012, when the target sample was reached (n=4753). The first follow-up (wave 2) was conducted from December 2014 to June 2015 and included 2528 respondents. The second follow-up (wave 3) was carried out from April to November 2018 and comprised 1577 individuals. The baseline response rate is based on the percentage of all eligible participants from which a completed interview was obtained. Initially, there were 7409 feasible interviews at wave 1, of which 4634 were successfully completed. In order to boost response rate at wave 1, an end-game strategy was used afterwards, where the

weight of each interview was equal to the proportion 1:4. In this second phase, 599 eligible individuals were also approached and 119 interviews were finally conducted. The final response rate was 69.9% and was calculated upon the response rates in both phases. Follow-up response rates show the percentage of completed interviews obtained from respondents participating in previous waves who were still alive. The final response rate was 69.5% during the first follow-up, and 73.0% in the second follow-up.

The sample was refreshed in 2019 to compensate for attrition (e.g., deceases, dropouts). This 2019 cohort was recruited following a similar study design with some differences. Data was collected in the Madrid and Barcelona provinces to facilitate the collection of biological data. Household selection was also multistage. At the primary sample unit level, households were defined using predefined routes and a jump factor. Households were assigned to one of two age-groups (i.e., 18–49 household or 50+ household) and the letter of invitation was hand delivered by the interviewers to the selected households. All household residents from the age-eligible group were invited to participate in the survey. Three thousand and two individuals were eventually interviewed at their homes between June 2019 and March 2021, including a forced pause due to the COVID-19 outbreak. In most cases, one individual per household participated in the study while a maximum of four people per household completed the survey. The household response rate reflects the percentage of eligible households from which at least one complete interview was conducted, divided by the total of all eligible households. Starting at 3920 eligible households, completed interviews were obtained in 2666 households, leading to a household response rate of 68.0%. Individuals from the 2019 cohort who had participated in the study up to March 2020 were also approached between 21 May 2020 and 30 June 2020 through a telephone interview (n=1935). From this number, we excluded 81 individuals who did not give their consent to be re-contacted and 215 individuals without re-contact information,

deceased or having out of order telephone lines. The COVID-19 substudy included 1166 participants and the individual response rate was 71.1%.

Sampling weights were generated for both cohorts to adjust the differential probabilities of selection into the sample and non-response. Comparisons of sex and age groups of the baseline 2011 cohort against the Spanish population at the time of sampling are provided in **Table 1**.

How often have they been followed up?

Three waves of data collection have been obtained at 3.5-yearly intervals for the 2011 cohort. Starting from the baseline sample, 13.9% of participants were lost to follow-up during the second assessment, 5.5% were died, 18.1% refused to participate and 9.3% could not be interviewed due to other reasons. From respondents interviewed at wave 2, 14.9% individuals were not located, 15.0% declined to participate, 7.3% died, and 0.4% cases dropped-out for other incidents during the third wave (**Figure 1**). **Table 2** shows the differences between the respondents participating in all three waves and those who were not followed-up on. Individuals lost to follow-up were older, reported higher alcohol consumption and higher disability, showed lower scores in cognition, and were more likely to conduct a proxy interview at the baseline survey. As for the 2019 cohort, 1166 participants were also interviewed by telephone during the first COVID-19 lockdown. The main reasons for non-response in the COVID-19 substudy were: refusal to participate (16.2%), decease (0.8%), untraceable (8.6%), and other events (14.2%) (**Figure 1**). Funding for additional assessments have been secured and are planned for both cohorts, scheduled to be performed in 2022 and 2023 for the 2011 and 2019 cohort samples respectively.

Baseline characteristics of the 2011 and 2019 cohorts are shown in **Table 3**. The mean age was 60.4 (SD=16.2) and 58.2 (SD=17.9) years for the 2011 and 2019 cohorts respectively.

Both samples included a higher percentage of women (54.7% vs 45.3%, 56.6% vs 43.4%). The level of education showed some variability between both cohorts, with the highest percentage of respondents with tertiary education found in the 2019 cohort. Both cohorts showed similar distribution of lifestyle behaviours. Responses on verbal fluency and disability were also alike. Overall, an important proportion of participants in both cohorts had hypertension (>40.0%), while diabetes was present for around 10-15% of the participants.

What has been measured?

The baseline assessment interview was based on the World Health Organization's Study on Global Ageing and Adult Health (SAGE) questionnaire,[6] which was previously validated as part of the COURAGE study.[5]

The survey protocol includes questionnaires, a standardized physical examination, and a neuropsychological test battery assessment. It covers an extensive range of contents related to physical and mental health, risk factors and preventive health behaviours, subjective wellbeing, social participation, and work history, among others. Efforts have been made to include validated and established instruments whenever possible. The survey protocol has remained largely unchanged across the multiple waves of data collection to allow comparison between waves. However, additional measures have been included successively to explore new topics. Further information on the data collection measures and their distribution across domains, cohorts and waves is provided in **Table 4**. In addition to the above, biological samples of DNA data are expected to be collected by non-invasive procedures in consecutive evaluations of the 2019 cohort.

Face-to-face structured interviews were performed by trained personnel using a computer-assisted personal interview (CAPI), making the survey more efficient by automating data collection. Interviewers were involved in an instruction course to learn about the materials

required to conduct the assessment tool and the procedures to fill in questionnaires in an accurate, clear, and complete way. Special attention was paid to the methodology for administering performance tests. Quality assurance procedures (e.g., inconsistent skip patterns or deviation of responses from the expected range) were included to optimize data collection and minimize errors.[7] In addition, the survey protocol was adapted to obtain reliable follow-up data (e.g., skip patterns based on previously reported information). Show cards were used for highly sensitive questions (e.g., income, suicidal ideation) and those of repeated response categories to avoid measurement errors or higher non-response rates. The whole interview lasts about 90 minutes to complete, including the health examination. For those individuals with severe (cognitive or physical) problems, a shorter version of the questionnaire was administered via a proxy respondent. It contains the IQCODE[8] along with a limited set of questions about the respondents´ health status and health care use.

Information on vital status and date of death was ascertained via linkage to the Spanish National Death Index. This procedure was conducted before the follow-up assessments and updated during the household visits. In addition, mortality data was obtained through the follow-up interviews. In the case of participant death, a verbal autopsy questionnaire was performed face to face by the interviewers or by telephone by clinicians to a next-of-kin or another caregiver, consisting of a brief interview about the circumstances of the death.

The *COVID-19* substudy was conducted to collect information about quality of sleep, social aspects, mental health and well-being, health status, pain, physical activity, tobacco and alcohol consumption, time spent in front of screens, household economic situation, and occupational status during the first wave of the COVID-19 pandemic in Spain. In most cases, instruments were adjusted to ask for a 30-day time span in order to account for an onset while the lockdown measures were in effect. COVID-19 related questions were also considered,

including infection with COVID-19 and its severity, co-habitation with a relative isolated by COVID-19, and concerns about a relative/friend infected by COVID-19.

We have devoted efforts to automating the curation of interview data in order to fulfil the current standards of reproducibility, as well as reduce the time and effort needed for curating the data and minimize the risk of errors. State-of-the-art tools such as R,[9] Rmarkdown,[10] and Stata[11] have been integrated in the data post-processing workflow.

What has it found?

More than 60 scientific articles covering a wide variety of topics, including studies on suicide,[12, 13] health,[14, 15] cognition,[16-18] loneliness,[19, 20] depression,[21, 22] or well-being[23, 24] have been produced based on the *Ageing and Health* data. In order to describe longitudinal trends, the group has performed advanced statistical methods including mixed models with repeated measures, generalized estimating equations models and growth mixture modelling.[25, 26] The research team has also published neuropsychological normative data[27] and validated assessment instruments.[28, 29] Scientific publications can be followed-up at edadconsalud.com/articulos. A selection of findings is outlined below.

The research team has published a significant number of studies about depression. For example, Domènech-Abella[19] reported that loneliness was related with small social networks among individuals with depression, while among those without depression, loneliness was associated with being married. Olaya[18] found that cognitive decline was independent of depressive symptoms as they appear to continue even after the affective episode has remitted. On the other hand, findings revealed that a history of depression might not be associated with increased risk of cognitive deficits unless there is an episode later in life. Subjective well-being is another key study topic within this group. Moreno-Agostino[30] showed heterogeneous

trajectories of subjective well-being in the older population, with depression, loneliness, loss of the spouse or unemployment being risk factors for the membership to the worst trajectories. Understanding premature mortality has also been a focus of interest. Studies from the research team have showed that experiencing positive emotions[31] and consuming five or more servings of fruits and vegetables per day increases the probability of surviving in the general older population,[32] while loneliness is associated to increased mortality risk in young- and middle-aged adults.[33] More recently, Ayuso-Mateos[34] assessed the factors associated with the incidence of a depressive episode or suicidal ideation during the first wave of the COVID-19 pandemic in Spain. Younger individuals and those feeling loneliness exhibited a higher risk of developing depression during the lockdown period, while resilience showed a protective effect against the risk of depression and suicidal ideation.

Ageing and Health has also been harmonized with other existing international longitudinal ageing studies[35, 36] For example, de la Torre-Luque[37] explored the network structures of late-life depressive symptoms in community-dwelling populations from Nigeria and Spain. They found that the network structures of symptoms were similar, when considering broad categories of psychological and somatic symptoms, according to universal nature of depression. Slow thinking and low energy were important in the symptom network of the Nigerian sample, while lack of self-confidence and hopelessness influenced the network derived from Spanish population.

What are the main strengths and weaknesses?

This study is the only one of its kind in the Spanish population. Data from the *Ageing and Health* study started with a nationally representative sample of the Spanish non-institutionalized adult population. This project comprises a large variety of measurements, including validated instruments and objective indicators of physical health and cognitive performance to cover a

broad-ranging research. Although data have been collected within the context of a multipurpose epidemiological cohort, the focus is on mental health. The standardised assessment interview providing a clinical diagnosis for some mental health disorders and the evaluation of suicidal behaviours represent key areas of the survey protocol. Moreover, this study is one of the few including a baseline evaluation of the participants some months before the COVID-19 pandemic and then a telephone interview right after the first wave of the pandemic outbreak in Spain. The robust study design, together with the comprehensive and multidisciplinary approach, allows the examination of numerous variables over a long period of time and enhances the generalizability of the findings. Thus, this study will provide crucial insights to set priorities and enact or change policies, improving the synergies among health data collection systems, improving public health preparedness, and creating high-quality information to guide intervention and prevention efforts within the National Health System. For example, regarding the use of social and health resources in order to prevent and treat depression. Additionally, having included participants with a broader age range enables the analyses of long-term trajectories of healthy ageing more confidently. In turn, the inclusion of a refreshment sample provides an opportunity for cross-cohort comparisons. Furthermore, this study is aligned with other international research projects. The harmonization of *Ageing and Health* with other datasets contribute to the understanding of the heterogeneous and dynamic process of ageing at a global level. Finally, this is an ongoing project that will allow the analyses of health, behavioural, and social changes in the long-term.

Concerns about *Ageing and Health* mainly relate to attrition and response rates, which indeed are common weaknesses in large longitudinal cohort studies. Even with our best efforts to minimize non-response and retain participants, we should not disregard the modest response rate at the follow-ups, with significant declines as for the unconditional response rates. In

response to this threat, a refreshment sample was drawn to recover sample size. Notwithstanding the above, the sample representativeness may be compromised as the 2019 cohort was drawn from two Spanish provinces. Proxy interviews are highly valuable to understand trajectories of ageing, as they allow the inclusion of data from individuals with a more vulnerable profile. However, proxy interviews were short in terms of contents and extension, which may affect hypothesis-testing.

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

Data collected is securely stored in each of the study institutional servers in compliance with all the applicable data protection legislation in addition to adhering to the FAIR principles (Findable, Accessible, Interoperable and Reusable). Hard copy documents (e.g., written informed consents) are preserved in a secure locker, separated from the survey protocol collected data. At this stage of the project, data are not publicly available. However, opportunities for collaboration are open and proposals from external scientists are more than welcome. Interested researchers are invited to contact the study principal investigators (José Luis Ayuso-Mateos or Josep Maria Haro) through e-mail at parcsanitari.edadconsalud@sjd.es. Access to the datasets involves completion of a request form, detailing the proposal of the analyses the applicants aim to conduct. If approved by the Scientific Board, researchers must sign a data-use agreement. Up-to-date information can be found on the Ageing and Health study website (ageingandhealth.com) or via e-mail to parcsanitari.edadconsalud@sjd.es.

Ethics approval

The study protocol was reviewed and approved by the Ethics Review Committees of Fundació Sant Joan de Déu in Barcelona (study protocol numbers PIC-12-11, PIC-129-17, PIC-03-20, PIC-88-20), and Hospital Universitario La Princesa, Madrid (study protocol numbers PI-364,

PI-2399, PI-2801, PI-4057). Written informed consent was obtained from all respondents in all waves in both cohorts, except for the COVID-19 substudy for which respondents were interviewed by telephone and provided oral consent. Individuals providing data on the participants´ medical history and circumstances preceding death (i.e., verbal autopsy) also gave their consent before participation.

Data availability

See Can I get hold of the data? Above.

Author contributions

JMH and JLA-M conceived and designed the study; MM, BO, JMH, and JLA-M acquired funding for data collection; EL, MM, and BO oversaw the study implementation and data collection; EL, FC, DM, and BO contributed to data curation; EL drafted the article and performed the analyses; all authors have critically revised the manuscript; all authors have approved the final version of the article.

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Conflict of interest

None declared.

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Figure 1. Participant flow across waves and cohorts.
[1] 7409 eligible individuals in phase 1 and 599 additional eligible individuals in phase 2, where an end-game methodology was used.
[2] All household residents from the age-eligible group were invited to participate
[3] Individuals for which interviews were attempted were those who had participated in the study up to March 2020 and also gave their consent to be recontacted.
Note. This is an ongoing project. New data is expected to be collected in the coming years.

Table 1. Comparison between Ageing and Health 2011 cohort with the Spanish adult population by sex and age-groups.

Characteristic		2011 cohort[a]	Spanish total population[b]
		n=4753	*N=38601631*
Sex			
	Men	2151 (49.1)	18691529 (49.1)
	Women	2602 (50.9)	19640102 (50.9)
Age groups			
	18-49 years	962 (59.4)	23178676 (60.0)
	50-79 years	3312 (35.5)	13302694 (34.5)
	80+ years	479 (5.1)	2120261 (5.5)

[a]Unweighted numbers and weighted percentages.

[b]National data was obtained from the Spanish Statistics Office (2011 census).

Table 2. Baseline characteristics of the 2011 cohort with and without follow-up data.

Characteristic		Individuals followed-up	Individuals not followed-up	*p*-value*
		n=1577	*n*=3176	
Sex				0.343
	Men	729 (46.2)	1422 (44.7)	
	Women	848 (53.8)	1754 (55.2)	
Age groups				<0.001
	18-49 years	315 (19.9)	647 (20.4)	
	50-79 years	1165 (73.9)	2149 (67.7)	
	80+ years	97 (6.2)	380 (11.9)	
Level of education[a]				0.071
	No/basic education	417 (26.4)	957 (30.1)	
	Primary	447 (28.3)	859 (27.1)	
	Secondary	493 (31.3)	943 (29.7)	
	Tertiary	220 (14.0)	416 (13.1)	
Physical activity levels				0.671
	High	485 (31.1)	979 (32.4)	
	Moderate	595 (38.1)	1129 (37.4)	
	Low	480 (30.8)	915 (30.2)	
Alcohol consumption				0.031
	Lifetime abstainer	448 (28.7)	897 (29.7)	
	Occasional drinkers	449 (28.8)	975 (32.3)	
	Non-heavy drinkers	612 (39.2)	1059 (35.0)	
	Heavy drinkers	51 (3.3)	92 (3.0)	
Tobacco consumption				0.841
	Never smokers	788 (50.5)	1551 (51.3)	
	Former smokers	392 (25.1)	757 (25.0)	
	Current smokers	380 (24.5)	715 (23.7)	
Comorbidities				

	Depression	169 (10.8)	341 (11.3)	0.649
	Diabetes	213 (13.5)	448 (14.1)	0.574
	Hypertension	568 (37.6)	1137 (39.9)	0.127
	Stroke	68 (4.3)	141 (4.4)	0.840
Verbal fluency[c] [0+] (mean, *SD*)				
		18.6 (7.8)	17.4 (8.2)	<0.001
Disability[d] [0-100] (mean, *SD*)				
		9.6 (16.4)	11.5 (18.4)	0.001
Proxy interview				
		17 (1.1)	153 (4.8)	<0.001

Notes. Values are unweighted frequencies and percentages for each category unless otherwise indicated.
Some percentages are based on an incomplete sample because of missing data. Followed-up participants have been interviewed three times.
Abbreviations: SD=Standard Deviation.
[a]Level of education followed the International Standard Classification of Education (ISCED-11).
[b]Lifetime conditions were determined through the use of combined criteria (except for diabetes) including self-reported diagnosis, symptoms-based algorithms or blood pressure measurement. Furthers details have been published elsewhere [38].
[c]Higher scores indicate better cognitive function.
[d]Higher scores indicate higher levels of disability.
* The difference between groups was tested by Chi-squared tests and Student's t-tests for independent samples for categorical and continuous variables respectively.

Table 3. Characteristics of the study samples at their baseline assessment.

Characteristic		2011 cohort	2019 cohort
		n=4753	*n*=3002[1]
Sex			
	Men	2151 (45.3)	1302 (43.4)
	Women	2602 (54.7)	1700 (56.6)
Age groups			
	18-49 years	962 (20.2)	760 (25.3)
	50-79 years	3312 (69.7)	1891 (63.0)
	80+ years	479 (10.1)	351(11.7)
Level of education[a]			
	No/basic education	1374 (28.9)	453 (15.1)
	Primary	1306 (27.5)	761 (25.3)
	Secondary	1436 (30.2)	1152 (38.4)
	Tertiary	636 (13.4)	635 (21.2)
Physical activity levels			
	High	1464 (31.9)	898 (30.9)
	Moderate	1724 (37.6)	1013 (34.9)
	Low	1395 (30.5)	991 (34.2)
Alcohol consumption			
	Lifetime abstainer	1345 (29.3)	871 (30.0)
	Occasional drinkers	1424 (31.1)	1055 (36.3)
	Non-heavy drinkers	1671 (36.5)	846 (29.1)
	Heavy drinkers	143 (3.1)	133 (4.6)
Tobacco consumption			
	Never smokers	2339 (51.0)	1543 (53.0)
	Former smokers	1095 (23.9)	690 (23.7)
	Current smokers	1149 (25.1)	678 (23.3)
Comorbidities[b]			

	Depression	510 (11.1)	198 (6.8)
	Diabetes	661 (13.9)	353 (11.8)
	Hypertension	2484 (52.3)	1178 (39.2)
	Stroke	209 (4.4)	97 (3.2)
Verbal fluency[c] [0+] (mean, *SD*)			
		17.7 (8.0)	18.6 (8.1)
Disability[d] [0-100] (mean, *SD*)			
		11.2 (17.6)	9.0 (18.2)
Proxy interview			
		170 (3.6)	91 (3.0)

Notes. Values are unweighted frequencies and percentages for each category unless otherwise indicated.
Some percentages are based on an incomplete sample because of missing data.
Abbreviations: SD=Standard Deviation.
[1] One individual per household participated in 2347 interviews, two individuals per household completed 612 interviews and three-four individuals per household took part in 43 interviews.
[a]Level of education followed the International Standard Classification of Education (ISCED-11).
[b]Lifetime conditions were determined through the use of combined criteria (except for diabetes) including self-reported diagnosis, symptoms-based algorithms or blood pressure measurement. Furthers details have been published elsewhere [38].
[c]Higher scores indicate better cognitive function.
[d]Higher scores indicate higher levels of disability.

Table 4. Summary measurements in Ageing and Health by domains, cohorts and waves.

	Cohort 2011			Cohort 2019	
Domain Subdomains, examples and references	**Wave 1**	**Wave 2**	**Wave 3**	**Wave 1**	**Covid-19 substudy**
Administrative variables					
Sampling data, interviewer data, contact data	✓	✓	✓	✓	✓*
Household composition					
List of household occupants	✓	✓	✓	✓	X
Socio-demographic characteristics					
Age, sex, date of birth, marital status, education attainment	✓	✓*	✓*	✓	X
Material deprivation households (National Statistics Office)	X	X	✓	✓	X
Subjective Socioeconomic Status	X	X	✓	✓	X
Work history and benefits					
Employment status, type of occupation, sources of individual income	✓	✓	✓	✓	✓*
Physical health					
Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL)	✓	✓	✓	✓	✓
Disability	✓	✓	✓	✓	✓
Falls	X	X	✓	✓	X
Injuries	✓	X	X	X	X
Incontinence	X	X	✓	✓	X
Menopause	✓	✓	✓	✓	X
Multidomain health state measurements [e.g., affect, cognition, hearing, mobility, pain, sleep, vision]	✓	✓	✓	✓	✓*
Self-rated overall health	✓	✓	✓	✓	X

Self-reported physician's diagnosis, symptom-based algorithms and treatment of chronic conditions [e.g. stroke, hypertension, diabetes, angina, asthma]	✓	✓	✓	✓	X
Sleep quality	X	X	X	✓	✓
Health examination					
Blood pressure and pulse	✓	✓	✓	✓	X
Grip strength	✓	✓	✓	✓	X
Height and weight	✓	✓	✓	✓	✓*
Vision	✓	✓	✓	X	X
Waist circumference	✓	✓	✓	✓	X
Walking speed	✓	✓	✓	✓	X
Cognition					
Cognitive reserve	X	✓	✓	✓	X
Digit span forward and backwards	✓	✓	✓	✓	X
Overall cognition [e.g., orientation, memory, language and visual-spatial skills]	X	✓	✓	✓	X
Proxy rating of participant´s cognitive function	✓	✓	✓	✓	X
Self-rated memory	✓	✓	✓	✓	X
Verbal fluency	✓	✓	✓	✓	X
Word list learning [immediate and delayed recall]	✓	✓	✓	✓	X
Risk factors and preventive health behaviours					
Alcohol and tobacco consumption	✓	✓	✓	✓	✓*
Nutrition	✓	✓	✓	✓	✓*
Physical Activity	✓	✓	✓	✓	✓*
Mental health and well-being					
Agoraphobia	X	X	X	✓	X
Caregiver burden	X	X	✓	✓	X

Depression	✓	✓	✓	✓	✓*
Elder Abuse Suspicion Index	X	X	✓	✓	X
Eudeimonic well-being	X	X	✓	✓	X
Evaluative well-being	✓	✓	✓	✓	✓
Experienced well-being	✓	✓	✓	✓	✓*
Generalised anxiety disorder	✓	✓	✓	✓	✓*
Panic disorder	✓	✓	✓	✓	X
Personality	X	X	X	✓	X
Quality of life	✓	✓	✓	✓	X
Resilience	X	X	X	✓	✓
Stress	✓	✓	✓	✓	X
Stressful life events	X	X	X	✓	X
Suicidal behaviour	✓	✓	✓	✓	✓*
Health system coverage and health care utilisation					
Type, duration and reason for health care services	✓	✓	✓	✓	✓*
Social and community aspects					
Built Environment	✓	X	X	X	X
Loneliness	✓	✓	✓	✓	✓
Social support	✓	✓	✓	✓	✓
Social participation	✓	✓	✓	✓	X
COVID-19 related questions					
Infection, cohabitation with COVID-19 patients, concerns, time in front of screens	X	X	X	X	✓
Mortality					
Date of death, cause of death, place of death	X	✓	✓	✓	✓
Interviewer assessment					

Interviewer observations about the respondent´s engagement with the survey, quality responses, and physical and mental state	✓	✓	✓	✓	X

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*Questions are limited or adapted from previous assessments.

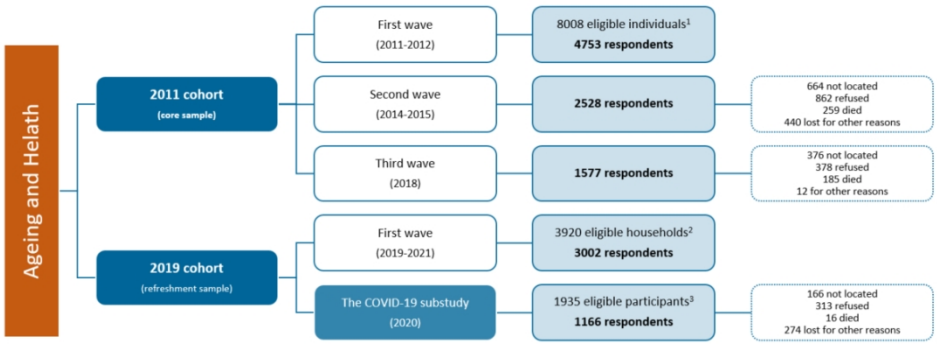

Figure 1. Participant flow across waves and cohorts.
1 7409 eligible individuals in phase 1 and 599 additional eligible individuals in phase 2, where an end-game methodology was used.
2 All household residents from the age-eligible group were invited to participate
3 Individuals for which interviews were attempted were those who had participated in the study up to March 2020 and also gave their consent to be recontacted.
Note. This is an ongoing project. New data is expected to be collected in the coming years.

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