COHORT PROFILE

Cohort Profile: The Irish Longitudinal Study on Ageing

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How did the study come about?

Ireland shares with other developed countries the prospect of rapid and sustained population ageing. The age distribution of the Irish population is undergoing a dramatic change at present and this trend is predicted to continue into the future.[1] People are living longer, and older persons represent a larger proportion of the population. In Ireland, the proportion of the population aged ⩾65 years has remained steady at ∼11% for the past 40 years. However, it is projected that this proportion will rise to 14% by 2021 and to 19% by 2031.[2] The greatest increase will be in the oldest old, aged >80 years, which is expected to more than treble by 2036.[2] This change in the demographic profile of the Irish population poses a major public health challenge.

Unlike the situation in the USA,[3,4] the UK[5] and many other developed countries,[6,7] there have been no large population-based cohort studies in Ireland to inform research on healthy ageing. Whereas a number of studies have provided population-based data on the health status of older people living in Ireland,[8–10] many questions remain unanswered. The Irish Longitudinal Study on Ageing (TILDA) is a large prospective cohort study of ageing, which includes an assessment of the social, economic and health circumstances of community-resident older people living in Ireland. The study has been harmonized with leading international research so as to ensure adoption of best practice and comparability of results. The Irish government, The Atlantic Philanthropies and Irish Life plc have provided funding for the study. Ethical approval has been obtained from the Trinity College Dublin Research Ethics Committee.

Who is in the sample?

Recruitment for the first wave of TILDA began in October 2009 and fieldwork was completed in February 2011 when the target sample of more than 8000 participants had been achieved. The health assessment component (described below) is ongoing and will be completed by July 2011. The sampling frame is the Irish Geodirectory, a comprehensive and up-to-date listing and mapping of all residential addresses in the Republic of Ireland compiled by 'an Post' (the Irish Postal Service) and Ordnance Survey Ireland.[11] An initial multi-stage probability sample of addresses was chosen by means of the RANSAM sampling procedure,[12] developed by the Economic and Social Research Institute. Addresses were selected by means of a three stage process: (i) selection of first stage units (clusters which are subdivisions of District Electoral Divisions comprising between 500 and 1180 addresses) using proportionate stratification by socio-economic status (per cent in professional/managerial occupations), age structure (per cent of population aged ⩾50 years) and geographical location. Selection of first stage units was based on probability proportionate to size, the size measure used being the estimated number of addresses containing a person aged ⩾50 years in the cluster. (ii) Selection of a systematic random sample of fixed size (50 addresses) within each cluster. Each residential address in the country had an equal probability of selection. The selected addresses were randomly partitioned into two groups: an initial sample list of 25 600 addresses (40 addresses in each of the 640 clusters, Figure 1) for immediate issue and a reserve list of 6400 addresses (10 randomly selected from each of the
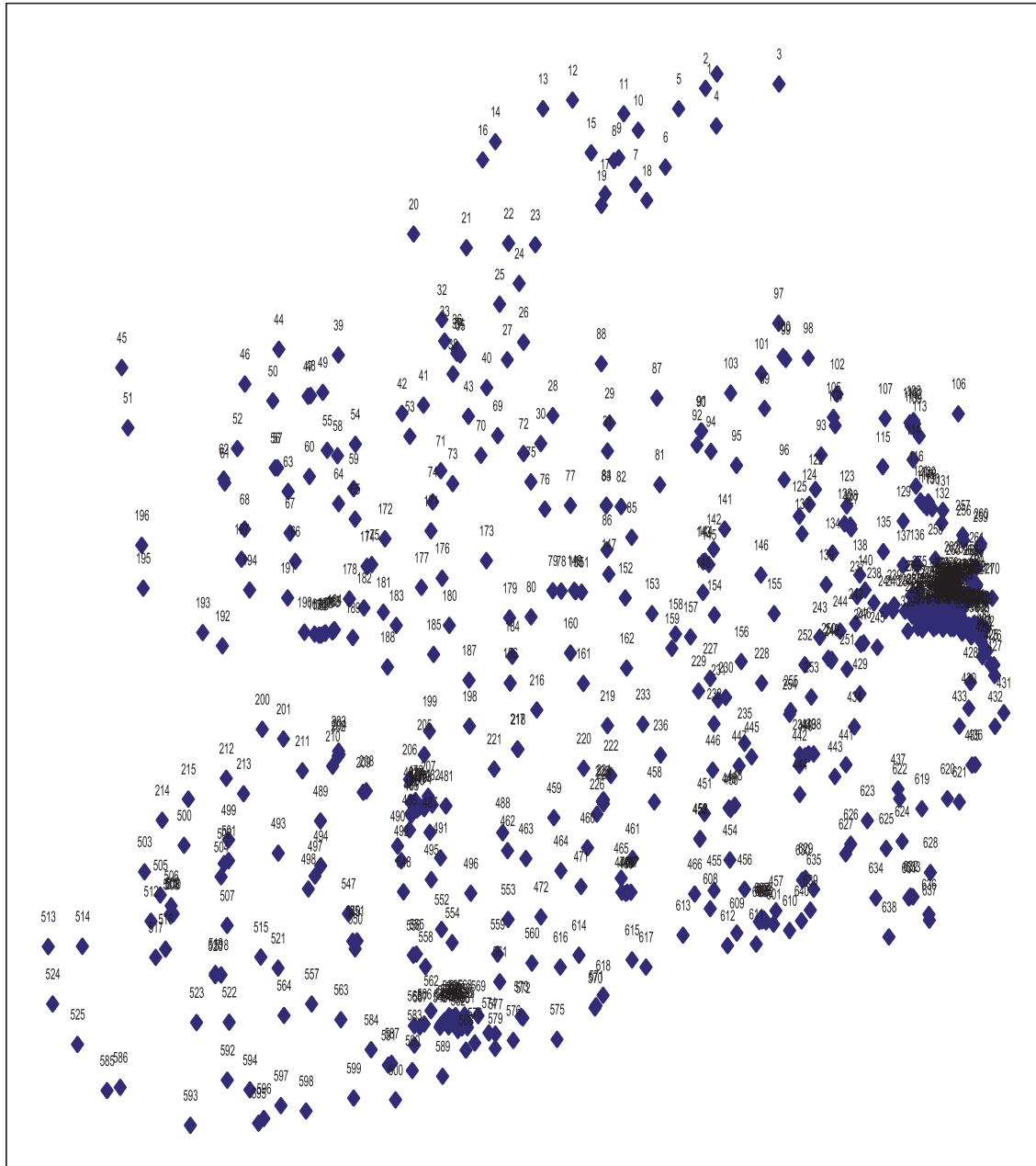
Figure 1 Map of selected addresses—the location of the 640 clusters

640 clusters). As the target sample size was achieved using the initial sample list, the reserve list was not utilized. A listing and location map of the selected residential addresses were provided to the social interviewers on Global Positioning System (GPS) devices which also had the coordinates of the selected addresses. Selected households with a unique address were sent a letter of invitation to participate in the study by post. Advance letters were hand delivered by the interviewers to those households with a non-unique address (~40% of Irish addresses are non-unique and there is no national postcode or

zipcode system). The letter of invitation was followed up after 1 week by a home visit from a member of the field staff to determine whether there was an eligible person living in the household. (iii) All household residents aged ⩾50 years were eligible to participate in the study (primary respondent). The spouses/partners (of any age) of respondents were also invited to participate (secondary respondent). The sample was designed to give each household in the country an equal probability of selection and, since all members aged ⩾50 years in each household were eligible, each person aged ⩾50 years also had an

equal probability of selection. The spouses aged <50 years were interviewed mainly to provide couple- or household-level data and will not in general be included in person-level analyses.

What does it cover?

The study aims are broad and include:

(i) the description of the current economic, social and health circumstances of older people living in Ireland and the creation of a longitudinal database with a combination of social, economic and health data to allow the monitoring of changes in health and well-being over time and

(ii) the exploration of the complex inter-relationships between numerous potential risk factors and protective factors and their impact on longevity and healthy ageing including for example:

(a) the role of early childhood experiences on physical and mental health in later life;

(b) the relationship between physical activity, obesity and frailty;

(c) the influence of mood disturbances including anxiety and depression on cognitive and physical health; and

(d) the effect of cognitive impairment on financial decisions around retirement.

What has been measured?

Participants were visited in their own homes by a member of the field staff. The interview component of the survey was undertaken by trained professional social interviewers. The interviewers used computer-assisted personal interviewing (CAPI) and entered responses directly into a laptop computer. The TILDA questionnaire includes detailed questions on socio-demographics, living standards, income and wealth, physical health, lifestyle and behaviour, social support and participation, use and perceived need for health and social care and attitudes to ageing (Table 1). Following completion of the interview, participants were asked to complete a self-administered questionnaire (Table 1) and were invited to participate in the physical assessment component of the study. The assessments take place in one of the two dedicated clinical assessment centres in Dublin and Cork, which are

Table 1 Summary of data collected in TILDA CAPI and Self-completion Questionnaire (SCQ)

Demographic data	**Physical health**
Education	Self-rated health
Childhood health	Limiting long-standing illness/disability
Migration history	Sensory function
Marital status and marriage history	Cardiovascular disease
Social circumstances	Non-cardiovascular chronic illness
Transfers to (and from) children	Falls/fear of falling/steadiness
Transfers to (and from) parents	Chronic pain
(Instrumental) activities of daily living	Incontinence
Helpers	Medical screening
Social connectedness	**Mental health**
Participation in social/recreation activities	Self-reported mental health
Relationship quality (SCQ)	Depression
Employment and lifelong learning	Life satisfaction
Employment situation	Anxiety (SCQ)
Job history	Worry (SCQ)
Lifelong learning	Loneliness (SCQ)
Retirement and expectations	Perceived stress (SCQ)
Planning for retirement	Stressful life events (SCQ)
Expectations	Quality of life (SCQ)
Income and assets	**Cognitive health**
Sources of income	Self-rated memory
Assets	Orientation
Transport	Word-list learning (immediate and delayed recall)
Transportation	Verbal fluency
Driving	Prospective memory
Medications	**Behavioural health**
Health-care utilization	Smoking
	Physical activity
	Sleep
	Alcohol (SCQ)
	Ageing perceptions (SCQ)

staffed by a team of trained study nurses. Participants are reimbursed for the cost of attending the centres. The duration of the clinical assessment is ~150 min and includes—anthropometric measurements: height, weight and waist circumference; cardiovascular measurements: heart rate variability, blood pressure and pulse wave velocity; gait, balance and sensory measurements: timed up and go, gait assessment using a sensored mat, visual acuity and contrast sensitivity; bone and muscle strength: grip strength, heel ultrasound; cognitive measurements: global cognition, sustained attention, executive function, visual memory, speed of processing and assessment of macular degeneration: macular pigment optical density and retinal photograph (Table 2). TILDA-specific software has been developed to electronically capture all data collected in the clinical assessments and to transfer the data to a secure database. Where possible, the measurements are recorded directly and uploaded onto a file that is linked to the participants' unique identifier. For those data items that require direct data entry (such as height and weight), the programme has built-in functions to avoid missing items and minimize errors. Respondents who are unable or refuse to attend a clinical assessment centre are given the option of a home visit by a study nurse for a subset of the clinic physical assessment (Table 2). All participants in the clinical and home assessments are asked to provide a sample of blood. Separate consent is obtained for participation in the physical assessment and the donation of the blood sample. For participants who agree to provide a blood sample, separate consent is requested for immediate analysis, long-term storage and genetic analysis. The consent allows for the blood to be used for unspecified research purposes that are of no direct benefit to the individuals. A total of 25 ml of non-fasting venous blood is collected into 3 vacutainers. At the end of each survey day, the blood samples are transported to a centralized laboratory in temperature-controlled shipping boxes that maintain the samples at 2–8°C for up to 48 h. Immediate analysis is undertaken for lipid profile as this result is provided in feedback to participants. At the central laboratory, the samples are centrifuged and then aliquoted into 10 bar-coded cryovials (8 plasma samples and 2 buffy coat) for storage at −80°C. It is planned that some of the samples will be transferred to nitrogen tanks for long-term storage at the end of the first wave of data collection.

How often will they be followed up?

The interview component of the study will be repeated every 2 years with the clinical assessment component repeated every 4 years. Funding has been

secured for the data collection components of the study until 2016.

What is the response rate?

The questionnaire was administered to 8507 individuals (6282 primary respondents and 2225 secondary respondents) including 8178 respondents aged ⩾50 years and 329 younger partners of eligible individuals. The response rate is the proportion of selected households including an eligible participant from which an interview was successfully obtained. Interviewers were sent to all of the initially allocated 25 600 addresses. Of these, 22 321 were occupied residential addresses. At 11 819 addresses, contact was made and it was determined that no person aged ⩾50 years was at that address. In 9818, it was determined that there was a person aged ⩾50 years. At 684 addresses, either no contact was made or contact was made, but it was impossible to determine whether there was anybody aged ⩾50 living at that address. Based on those households in which eligibility was determined, it is estimated that $9818/(9818 + 11819) \times 684 = 310.4$ of those households were eligible. The estimated number of selected eligible households is therefore $9818 + 310.4 = 10128.4$. Successful interviews were obtained in 6282 households, giving an adjusted response rate of 62%. The response to the self-completion questionnaire is ~84%. Over 80% of CAPI respondents have agreed to a physical assessment and these are scheduled to be completed by July 2011. To date, over 6000 physical assessments have been completed and almost all physical health assessment participants have also provided blood samples.

Comparison with the Irish population using data from the Quarterly National Household Survey (Table 3) demonstrates that individuals with lower levels of educational attainment are under-represented in TILDA, and there are minor differences in response rate among particular age and gender groups. Weights have been derived to allow for this differential non-response by age, gender and level of education. In the majority of analyses, the analytical unit is the individual respondent, but many analyses, primarily those in the social and economic domains, may use the household unit. All analyses will include an adjustment for clustering of responses at the household and geographical primary cluster levels.

What has been found?

As the study sample is large and is nationally representative, the baseline prevalence rates are of interest for describing the current health and well-being of those aged ⩾50 years in Ireland as well as for informing policy for determining future needs. A report of preliminary findings from TILDA was made available

Table 2 Summary of clinical measurements collected in the TILDA health assessment

Variables	Centre	Home	Number of measurements	Equipment used
Height	Yes	Yes	1	SECA 240 wall-mounted measuring rod
Weight	Yes	Yes	1	SECA electronic floor scales or SECA seated scales
Waist size[a]	Yes	Yes	2	Standard tape measure
Hip size[a]	Yes	Yes	2	Standard tape measure
Blood pressure	Yes	Yes	3—2 seated and 1 standing	OMRON^{TM} digital automatic BP monitor
Heart rate	Yes	No	3	OMRON^{TM} digital automatic BP monitor
Grip strength	Yes	Yes	4—2 readings on each hand	Baseline Hydraulic Hand dynamometer
Depression	Yes	Yes	1	8-item CES-D scale
Global cognition	Yes	Yes	2	1. Montreal Cognitive Assessment (MOCA) 2. Mini Mental State Examination (MMSE)
Attention	Yes	Yes	1	Sustained attention response time (laptop)
Visual memory	Yes	Yes	1	CAMDEX Picture Memory Test (Acquisition, free recall, recognition)
Speed of processing	Yes	Yes	1	Choice reaction time test (laptop)
Executive function	Yes	Yes	3	Visual reasoning–CAMDEX Timed Colour Trails 1and 2
Timed up and go	Yes	Yes	1	Standard tape measure/chair/tape
Phasic blood pressure	Yes	No	6—1 at baseline, 1 nadir and 4 at 30-s intervals after active stand	Finometer MIDI
Pulse wave velocity	Yes	No	2	Vicorder
Heart rate variability	Yes	No	1 (10-min) recording	Medilog Darwin AR12
Visual acuity	Yes	No	2—left and right eye	Logmar chart
Contrast sensitivity	Yes	No	2—dim light with and without glare	Stereo Optical Co, Functional Visual Analyzer
Retinal photograph	Yes	No	2—left and right eye	NIDEX—Non-Mydriatic Auto-Fundus Camera
Macular pigment optical density	Yes	No	12—6 measurements per eye	Macular Metrics Densitometer^{TM}
Bone density	Yes	No	1—non-dominant foot	Achilles Insight Heel Ultrasound
Assessment of gait	Yes	No	3—normal walk, walk with manual task,[b] walk with cognitive task[c]	GAITRite sensored mat
Venous blood sample	Yes	Yes	25 ml	Standard blood-taking materials

[a]If the difference between two measurements is >3 cm, a third measurement is required, with the values for the last two measurements recorded.
[b]Manual task is carrying a glass of water.
[c]Cognitive task is reciting alternate letters of the alphabet starting at A.

in May 2011.[13] This report highlighted the heterogeneity of the health, economic and social circumstances of people aged ≥50 years living in Ireland. Strong socio-economic gradients in health were consistently observed, with those with greater asset wealth and more completed education being in substantially better health measured by self-reported health status, diagnosed disease and through objective measurement. Comparison of the objective measures of mental and physical health taken during health assessments with self-reports of diagnosed disease measured during the interview revealed a large burden of undiagnosed disease. Although older people did make greater use of many health-care services, health and not age was by far the greater independent determinant of health-care utilization. Descriptive information on the health and well-being of the TILDA cohort are reported in Table 4. Analyses of associations between risk factors and characteristics and morbidity and mortality will begin in a number of years when a sufficient number of events have occurred. In addition to information on socio-demographic, behavioural and physical health factors collected at baseline, the role of possible risk markers in blood—potentially including lipid subfractions, apolipoproteins, coagulation and inflammatory factors, hormones, vitamins and genetic polymorphisms—will also be investigated.

Table 3 Comparison of TILDA cohort at Wave 1 with population in Ireland[a]

| | Educational attainment and sex | | | | | |
| | Primary, N (%) | | Secondary, N (%) | | Tertiary, N (%) | |
Age at interview (years)	Male	Female	Male	Female	Male	Female
50–64						
TILDA	471 (5.5)	486 (5.7)	967 (11.4)	1152 (13.5)	643 (7.6)	949 (11.2)
Population	95 600 (8.0)	80 800 (6.7)	176 300 (14.7)	187 000 (15.6)	79 100 (6.6)	82 000 (6.8)
65–74						
TILDA	457 (5.4)	408 (4.8)	337 (4.0)	391 (4.6)	275 (3.2)	294 (3.5)
Population	72 800 (6.1)	65 900 (5.5)	44 400 (3.7)	56 600 (4.7)	20 000 (1.7)	21 200 (1.8)
≥75						
TILDA	323 (3.8)	361 (4.2)	151 (1.8)	266 (3.1)	124 (1.5)	119 (1.4)
Population	57 300 (4.8)	86 800 (7.2)	20 600 (1.7)	33 800 (2.8)	9600 (0.8)	10 600 (0.9)

[a]The numbers for the population are from the Quarterly National Household Survey (QNHS), which is a large-scale, nationwide survey of households in Ireland conducted by the Central Statistics Office.

Table 4 Health and well-being of TILDA participants at Wave 1 by age group and sex

| | Age groups (years) | | | | | |
| | 50–64 | | 65–74 | | ≥75 | |
Measure	Men	Women	Men	Women	Men	Women
High blood pressure[a]	30 (28–32)	30 (28–31)	44 (41–47)	46 (43–49)	48 (44–52)	58 (54–61)
High cholesterol[b]	37 (34–39)	37 (35–39)	38 (34–41)	47 (44–50)	29 (25–32)	39 (35–43)
Physical inactivity[c]	23 (21–25)	32 (30–34)	25 (22–28)	40 (36–43)	42 (37–46)	59 (55–63)
Current smoking	22 (20–24)	24 (22–26)	16 (14–18)	17 (15–20)	14 (11–17)	10 (7–12)
Depression[d]	8 (7–9)	14 (12–16)	7 (5–9)	11 (9–13)	6 (4–8)	11 (9–14)
Anxiety[e]	13 (11–15)	17 (16–19)	10 (8–13)	14 (12–17)	5 (3–8)	9 (6–13)

Values are represented as % [95% confidence interval (95% CI)] unless otherwise specified.
[a]Self-report of doctor-diagnosed hypertension.
[b]Self-report of doctor-diagnosed high cholesterol.
[c]Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ). The short form of IPAQ consists of eight items that estimate the time spent performing physical activities (from walking to moderate and vigorous exercise) and inactivity (time spent sitting). The IPAQ classifies people as undertaking low, moderate or high levels of physical activity and those who undertake low levels are considered inactive.
[d]Score of ≥16 on the 20-item Centre for Epidemiologic Studies Depression Scale (CES-D).
[e]Score of ≥11 on Hospital Anxiety and Depression Scale–Anxiety subscale (HADS-A).

What are the main strengths and weaknesses of the study?

The TILDA sampling approach provides a nationally representative sample and will allow inferences about the Irish population. The survey instrument has been developed based on best international practice and has been harmonized with other large cohort studies of ageing. It has been extensively tested and refined in two pilot studies. The clinical assessment component of the study includes detailed physical and cognitive assessments as well as a number of novel measurements. The comprehensive nature of the data will facilitate numerous questions to be addressed, and the inclusion of a broad range of variables will allow complicated inter-relationships of factors to be explored with meaningful adjustment of confounders. The inclusion of both a centre- and a home-based clinical assessment has limited the underrepresentation of older and frailer participants from the health assessment component of the study.[14] Participants were required to provide written informed consent to participate in the study which will have resulted in the exclusion of some individuals with cognitive impairment or dementia. Whereas the questionnaire does include a detailed assessment of cognitive function, the lack of a clinical psychological assessment limits our ability to make a formal assessment of dementia or other psychiatric conditions. Future waves of TILDA will include proxy interviews so that individuals who develop cognitive impairment or dementia over the course of the study and are no longer able to respond to the questions, will remain as study participants.

The large number of items collected by the study, although itself a strength, has the consequence that in some instances, the range of questions asked for any one specific area of enquiry has been limited. Dietary data have not been assessed in the first wave of data collection and this lack of data will limit our ability to assess the role of nutritional status on determining health outcomes, and the impact of health and economic circumstances on diet. Some nutritional questions will be included in the questionnaire for the second wave of the study and it may be possible to analyse nutritional components in the stored blood sample. The major inclusion criterion for the study was being aged ⩾50 years and having a residential address. As a consequence, the study excludes nursing home residents and those resident in other institutions. Detailed information on long-term care of older people in Ireland is limited. However, the Department of Health's Long Stay Activity Statistics shows that in 2008, approximately 21 000 people lived in long-stay institutions in Ireland and over 90% of these are aged ⩾65 years (66% are aged ⩾80 years).[15] Two-thirds of institutional residents are considered high or maximum dependency. The exclusion of long-stay residents has led to an under-representation of the frailer older population. However, as participants move from home to nursing home, they will remain in the study and so over time, TILDA will be able to explore the social, economic and health circumstances of nursing home residents.

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

All collected source data are maintained and stored at the study research office, in the Department of Medical Gerontology, Trinity College Dublin, Ireland. Following completion of data cleaning, processing and preliminary analyses, the data will be accessible from the Irish Social Science Data archive (estimate December 2011). It is planned that these data files will include sets of appropriate weights designed to compensate for differential non-response to different components of the study. Specific proposals for future collaboration would be welcomed. Further information can be found on the study website, www.tilda.ie, or through e-mail to tilda@tcd.ie.

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