28. Jolly K, Lip GY, Taylor RS *et al* The Birmingham Rehabilitation Uptake Maximisation study (BRUM): a randomised controlled trial comparing home-based with centre-based cardiac rehabilitation. Heart 2008.
29. Witt BJ, Thomas RJ, Roger VL. Cardiac rehabilitation after myocardial infarction: a review to understand barriers to participation and potential solutions. Eura Medicophys 2005; 41: 27–34.

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Comparison of centre and home-based health assessments: early experience from the Irish Longitudinal Study on Ageing (TILDA)

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Abstract

Background: some cohort studies of ageing and health supplement questionnaire-based surveys with in-home measurements of biological parameters and others have required respondents to attend assessment centres. Centre-based assessments facilitate detailed measurements and novel technologies, but may differentially influence participation. The aim of this paper is to compare the characteristics of participants who attended a centre with those who chose a home assessment and those who did not have a health assessment.
Methods: trained field workers administered a computer-assisted personal interview (CAPI) to a random sample of community-dwelling people aged 50 and over in the participants' homes. All questionnaire respondents were invited to attend an assessment centre for a comprehensive physical assessment. Participants who refused or were unable to attend a centre were offered a home assessment.
Results: of the 291 participants who completed the CAPI, 176 had a health assessment: 138 in an assessment centre and 38 in their own home. The centre, home and no visit respondents differed in demographic characteristics, behavioural factors, physical functioning and health. Lower socio-economic status, physical inactivity and current smoking were the most robust predictors of non-participation in the health assessment. Home respondents had the highest levels of physical disability and were much weaker (grip strength) and slower (walking speed) than centre respondents.
Conclusion: home and centre physical assessments are required to avoid systematically over-representing healthier and wealthier respondents.

Keywords: *ageing, health assessment, cohort study, elderly*

Introduction

In order to describe fully the health and well-being of older people, both questionnaire and biological measurements are required [1, 2]. A number of ongoing nationally representative cohort studies of older people, which were originally developed based on the collection of questionnaire data by personal interviews, have supplemented their data collection

with measurements of biological parameters [3–5]. These studies have tended to focus on a limited number of important biological variables such as blood pressure, grip strength, balance assessment and blood sampling that can be undertaken easily at home. Other studies with home-based assessments have included more comprehensive assessments [6] but have generally included smaller numbers of participants or have not used nationally representative samples. An alternative to in-home assessments has been to require respondents to attend dedicated assessment centres for detailed physical assessments [7, 8]. The use of assessment centres facilitates the inclusion of novel technologies and is cost- and time-efficient [9] but may introduce selection bias among participants [10].

In common with other countries worldwide, Ireland is currently facing a changing demographic with increasing numbers of people surviving into old age [11]. The Irish Longitudinal Study on Ageing (TILDA) is a nationally representative prospective observational cohort study of the social, economic and health circumstances of older people living in Ireland [12]. The health component of TILDA has the dual task of describing the current health and well-being of the older population and of investigating innovative health measurements using novel technologies. The comprehensive nature of the physical assessment combined with the complexity and size of some of the procedures resulted in a preference for a centre-based assessment for TILDA and this approach was tested in the first TILDA pilot study. However, there were concerns that individuals who chose to attend an assessment centre would differ systematically from those who refused or were unable to attend. For the second pilot, a core set of measurements that could be undertaken at home was identified and a home assessment was offered to those respondents who were unable or unwilling to attend an assessment centre. In the absence of the option of a home visit, these participants would have been considered non-responders. We hypothesized that the type of visit in the TILDA pilot would be related to key demographic, lifestyle, health and physical functioning characteristics of the study population.

Methods

Study design and sample selection

The Irish Longitudinal Study on Ageing (TILDA) is a population-based longitudinal study of ageing. The second pilot for TILDA was a nationally representative cross-sectional survey of people aged 50 and over and comprised an in-home questionnaire and a comprehensive physical health assessment [12]. The pilot sample was selected using the updated RANSAM sampling system which was developed by and is maintained by the Economic and Social Research Institute and has been used in a number of studies in Ireland [13–16]. The sampling frame was the Irish Geodirectory, a comprehensive and up-to-date listing and mapping of all residential addresses in the Republic of Ireland [17]. Addresses were selected by means of a three-stage process: (i) selection of 20 first-stage units using proportionate stratification by socio-economic status, age structure and geographical location; (ii) selection of a systematic random sample of fixed size (60 addresses) within each cluster; (iii) selection of a random 'primary respondent' within each address on the basis of a 'next birthday' rule by the fieldworker. Each address in the country had an equal probability of selection. The sampling procedure generated 1200 addresses (60 addresses in each of the 20 clusters). A total of 720 addresses were found to be ineligible (of which 535 did not contain a person aged 50 or over) giving 480 valid addresses. Each of these 480 addresses was visited by a fieldworker and one household member aged 50 or over was selected as primary respondent for the survey. The primary respondent's spouse (of any age) was also selected for interview.

Study procedures

Questionnaire

Structured interviews were undertaken in the respondents' homes by trained professional social interviewers using computer-aided personal interviewing (CAPI). The questionnaire collected information on the health and well-being of participants, including demographics, socioeconomic status, medical history, personal health behaviours, physical functioning and medication use.

Physical health assessment

All participants who completed the CAPI were invited to attend one of two dedicated assessment centres for a health assessment. Interviewers provided participants with a description of the measures undertaken in the centre. Participants who refused or were unable to attend a centre were offered a home assessment and were informed that the home assessment was a subset of the centre measurements with less technology. Respondents who refused a physical health assessment were asked to indicate a reason from a list provided to them. The health assessments were undertaken in one of two dedicated centres in Cork or Dublin or in the respondents' homes. Costs of attending the centres were reimbursed to participants. All assessments were undertaken by trained study nurses. A core set of measurements that could be measured identically in the centres and homes was identified. The physical measurements included height and weight, blood pressure, walking speed and grip strength. Global cognitive function was assessed by the mini-mental status examination (MMSE) [18] and the Montreal Cognitive Assessment (MOCA) [19]. Blood samples were collected by venepuncture and samples were analysed for lipid profile by a commercial laboratory.

Statistical analysis

Standard descriptive statistics were used to describe the characteristics of subjects at baseline. For all comparisons, study participants have been classified according to type of physical health assessment: centre, home or none. The linear distance in kilometres from each address to the Dublin and Cork health centres was calculated using references from the Irish Grid map. The shorter distance from the home to a centre was used in analyses comparing average distances. Characteristics of respondents were compared across visit type using analysis of variance for continuous measures and chi-square tests for categorical variables. Multinomial logistic regression was used to compare CAPI participants across visit type (centre, home or none), with the centre visit as the reference group. The dependent variable was the type of health assessment (none/home/centre). For the purposes of the multinomial logistic regression analyses, health insurance (private versus no private insurance), marital status (married vs. not), employment status (currently employed versus not), education (third level versus less), self-rated health (excellent, very good or good versus fair or poor), depression (CES-D score ≥16) and age (<62 versus ≥62) were included as binary categorical variables. Variables that were significant at $P < 0.05$ in univariate analyses were included in the multivariate model. All statistical analyses were performed using the SAS software version 9.1.

Ethics

Ethical approval for the study was obtained from the Trinity College Research Ethics committee. All participants provided written informed consent prior to participating in the study.

Results

In total, 291 CAPIs were completed in 216 households (of 480 eligible households: household response rate 45%). Of these 291 CAPI respondents, 162 agreed to attend a centre, 44 were undecided and chose to discuss the assessment further with the study nurse and 85 refused a centre assessment and were offered a home assessment (Supplementary data are available in *Age and Ageing* online). Owing to time restrictions, not all participants who agreed to a health assessment had one completed prior to the end of the pilot study and the proportions affected were similar among clinic and home respondents [36 (21%) centre versus 9 (19%) home; $P = 0.5$]. Overall 176 respondents (response rate: 60%) underwent a health assessment (138 centre and 38 home). Although participants who refused an assessment lived on average 24 km further from an assessment centre than respondents (160 versus 136 km; $P = 0.01$), there was no difference in the average distance for centre compared with home respondents (133 versus 148 km; $P = 0.2$). Reasons for refusing a physical health assessment are summarized in Supplementary data available in *Age and Ageing* online. The two leading reasons were the perception that their doctor already had the information or that they had enough of medical tests. While 'mobility problems' was a frequently cited reason for refusing a centre assessment, it was not a reason for refusing a home assessment.

The demographic, physical, psychological and behavioural health characteristics of respondents were compared by type of visit (Table 1). Respondents opting for a home visit were older, had lower levels of educational attainment, were less likely to have private health insurance and were more likely to be widowed than centre or no visit respondents. The no-visit respondents were similar in age to the centre respondents, but were less likely to have private health insurance and were more likely to be widowed. There was a clear gradient in self-rated health with the centre respondents self-reporting higher levels of general health and the no-visit respondents intermediate between the centre and the home respondents. The no-visit respondents had levels of physical disability and mobility problems that were similar to the centre respondents, but had the highest levels of current smoking and were much more likely to be physically inactive than the centre respondents. Objective physical and cognitive measurements which were undertaken as part of the physical assessment were available only for the centre and home respondents and are summarized in Table 2. The home respondents had higher levels of global cognitive impairment, walked more slowly and had lower grip strength.

Table 3 reports the findings of the multivariate model. Higher education level and having private health insurance were associated with an increased likelihood of attending a centre than having a home visit or no visit when adjusted for the other factors in the multivariate model. In comparison with those who had no visit, centre attendees were less likely to be current smokers and were more likely to be physically active and to be married.

Discussion

This study reports on the large differences between participants who agreed or refused to have a health assessment. Among those who agreed, it contrasts those who chose to be assessed in their own homes with those who agreed to attend a health assessment centre. A clear pattern of respondent health and well-being by type of assessment emerged, with centre respondents being younger, fitter (more physically active) and faster (timed up and go) than those who were assessed at home. They performed better in cognitive tasks and had lower levels of mood disturbance. Many of the variables reported in the univariate analyses are likely to be highly correlated and the relative importance of these is assessed in the multivariate analyses.

Table 1. Socio-demographic and health characteristics overall and by type of health assessment

	CAPI (*N* = 291)	Centre (*N* = 138)	Home (*N* = 38)	No visit (*N* = 115)	*P*-value
Socio-demographics					
Age (mean, se)	63.7, 9.8	62.3, 8.7	70.1, 10.1	63.3, 10.2	<0.0001
Gender (*N*, % male)	132 (45.4)	63 (45.7)	17 (44.7)	52 (45.2)	1.0
Private health insurance, *N* (%)	165 (56.7)	101 (73.2)	14 (36.8)	50 (43.5)	<0.0001
Married[a], *N* (%)	181 (62.2)	105 (76.6)	17 (44.7)	59 (51.3)	<0.0001
Employed, *N* (%)	100 (34.4)	57 (41.3)	4 (10.5)	39 (33.9)	0.002
Third-level education, *N* (%)	76 (26.1)	55 (39.9)	2 (5.3)	19 (16.5)	<0.0001
Physical, behavioural and mental health, *N* (%)					
Poor self-rated health[b]	25 (8.6)	5 (3.6)	12 (31.6)	8 (7.0)	<0.0001
Current smoker	61 (21.0)	17 (12.3)	7 (18.4)	37 (32.2)	0.001
Low physical activity	101 (34.7)	34 (24.6)	20 (52.6)	47 (40.9)	0.008
Physical disability[c]	31 (10.7)	5 (3.6)	15 (39.5)	11 (9.6)	<0.0001
Depressed mood[d]	30 (10.5)	11 (8.1)	8 (21.1)	11 (9.8)	0.07
Orientation[e]	246 (84.5)	124 (89.9)	31 (81.6)	91 (79.1)	0.05

[a]Married or living with a partner as if married.
[b]Self-rated health reported as poor on scale of excellent, very good, good, fair or poor.
[c]Requiring assistance in activities of daily living or instrumental activities of daily living.
[d]CESD score ≥16.
[e]Orientated in person, place and time.

Table 2. Objective physical measures by type of physical assessment

	Centre (*N* = 138), mean (SE)	Home (*N* = 38), mean (SE)	*P*-value
Cognition			
MMSE	28.4 (1.9)	26.8 (2.9)	<0.0001
MOCA	25.3 (3.0)	21.2 (5.3)	<0.0001
Cardiovascular			
Systolic blood pressure	136 (20)	145 (20)	<0.01
Diastolic blood pressure	82 (12)	83 (10)	0.7
Total cholesterol	5.5 (1.0)	5.2 (1.1)	0.07
Body mass index	28.2 (5.2)	30.1 (6.7)	0.2
Mobility			
Timed up and go	9.0 (1.8)	13.7 (7.0)	<0.0001
Strength			
Grip strength	27.5 (8.8)	23.1 (9.1)	<0.01

Table 3. Odds ratio of no visit or home visit compared with a centre visit

	No visit			Home visit		
	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Age group	1.01	0.48, 2.11	1.0	0.63	0.23, 1.76	0.4
Male sex	0.91	0.49, 1.67	0.7	0.85	0.34, 2.13	0.7
Married	0.36	0.19, 0.67	0.001	0.48	0.19, 1.18	0.1
Employed	1.23	0.58, 2.60	0.6	0.53	0.20, 1.43	0.3
Private insurance	0.38	0.21, 0.69	0.001	0.45	0.19, 1.09	0.08
Higher education	0.32	0.18, 0.59	0.001	0.11	0.04, 0.33	0.007
Self-rated health	1.32	0.60, 2.91	0.5	0.55	0.20, 1.55	0.3
Orientation	1.22	0.56, 2.67	0.3	0.74	0.27, 2.00	0.3
Disability	1.16	0.39, 3.46	0.8	5.56	1.68, 18.46	0.02
Physical activity	0.67	0.46, 0.99	0.04	0.81	0.56, 1.18	0.5
Current smoker	3.24	1.53, 6.86	0.002	1.85	0.60, 5.68	0.3

The most robust predictors of participation in a health assessment were indicators of social position such as education level and having private health insurance as well as lifestyle behavioural factors of smoking and physical activity.

In general, data on non-responders are not easily accessible and may depend on the availability of routine demographic data [20]. The comprehensive nature of the social interview in TILDA with questions on social and economic circumstances, lifestyle factors and physical and emotional well-being provided an opportunity to compare the characteristics of those who refused a physical assessment and those who attended an assessment centre or had an in-home visit. The participants who chose to be assessed in their homes would have been considered non-respondents if the home option was not available. The findings of this study indicate that the home respondents differed markedly not only from the centre attendees but also from the no-visit respondents with whom they would otherwise have been considered. However, as the response rate to the TILDA pilot was only 45%, the questionnaire respondents themselves are already a self-selected sample of the Irish population. Comparing the TILDA respondents with the census population, there is clear evidence of selection bias with TILDA respondents having much higher levels of education than the overall Irish population. Among the pilot participants, education level was a significant predictor of participation in the health assessment as those with higher levels of education were about twice as likely to attend a centre. The large differences reported between centre, home and no-visit respondents may be an underestimate of the underlying differences in a less selected sample of the Irish population.

The under-representation of elderly people in clinical trials has been clearly demonstrated [21, 22], and the same factors that determine participation in trials are likely to impact on the type of person who agrees to participate in observational research. Age and cognitive impairment have been shown to be the two main predictors of attrition in cohort studies of older people [23]. Less information is available about factors that determine attrition early on in cohort studies [24]. The pilot study for the Newcastle 85+ study found that over half of participants would have been unwilling to attend a hospital for assessment [6]. Extended recruitment efforts might be expected to improve participation but inevitably add to the cost and complexity of the study design [25]. Ongoing large longitudinal studies have tended to utilize either a home-based or centre-based assessment at the baseline visit (Supplementary data are available in *Age and Ageing* online), and as a consequence, there is very limited published experience on the comparability of home- and centre-based populations.

In a review of factors that influence the recruitment and retention of older adults in ageing research, a number of key goals were identified: achieve a representative sample; promote participation; consider feasibility and retain participants in the study [21]. Strategies identified to increase participation included the use of home assessments, as travelling to a study site is recognized as a barrier to participation in research [22]. However, as the inclusion of such visits may increase the cost and complexity of the study, the magnitude of the bias introduced by centre only assessments must be balanced against the additional cost involved in providing home assessments.

Our findings demonstrate the large differences between respondents who are willing and able to attend an assessment centre and those who require a home assessment and indicate the importance of including both approaches to avoid systematically over-representing younger healthier respondents. To date, large nationally representative cohort studies of ageing, such as the Health and Retirement Survey in the US (HRS) and the English Longitudinal Study of Aging (ELSA) and the Survey of Health and Retirement in Europe (SHARE), have tended to incorporate physical measurements into the home visit. Although this may optimize participation, it limits the scope and complexity of the measures that can be undertaken. The inclusion of a home-based option for the physical assessment component of TILDA will maximize the participation of older frailer participants, in particular those with mobility problems who are unable to attend an assessment centre, while allowing the incorporation of more novel assessments at the centre locations. However, it is clear that the 'no-visit' respondents, who chose not to participate in the health assessment, also comprise a distinct subset of participants and additional efforts must be undertaken to ensure that a higher proportion participate in the health assessment during the main wave of TILDA.

Key points

- Centre assessments facilitate more detailed physical assessments.
- Centre, home and no-visit respondents differed in demographic characteristics, behavioural factors, physical function and health.
- Centre and home assessments are required to avoid under-representing older frailer respondents.

Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

Conflicts of interest

None declared.

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References

1. Franco OH, Kirkwood TB, Powell JR *et al* Ten commandments for the future of ageing research in the UK: a vision for action. BMC Geriatr 2007; 7: 10.
2. Franco OH, Karnik K, Osborne G, Ordovas JM, Catt M, van der Ouderaa F. Changing course in ageing research: The healthy ageing phenotype. Maturitas 2009; 63: 13–9.
3. Banks JBE, Lessof C, Nazroo J. Retirement, Health and Relationships of the Older Population in England. The 2004 English Longitudinal Study of Ageing. London: Institute for Fiscal Studies, 2006.
4. Börsch-Supan ABA, Jürges H, Mackenbach J, Siegrist J, Weber G. Health, Ageing and Retirement in Europe: First Results from the Survey of Health, Ageing and Retirement in Europe. Germany: Mannheim Research Institute for the Economics of Aging, 2005.
5. Cigolle CT, Langa KM, Kabeto MU, Tian Z, Blaum CS. Geriatric conditions and disability: the Health and Retirement Study. Ann Intern Med 2007; 147: 156–64.
6. Collerton J, Barrass K, Bond J *et al* The Newcastle 85+ study: biological, clinical and psychosocial factors associated with healthy ageing: study protocol. BMC Geriatr 2007; 7: 14.
7. Ferrucci L. The Baltimore Longitudinal Study of Aging (BLSA): a 50-year-long journey and plans for the future. J Gerontol Ser A Biol Sci Med Sci 2008; 63: 1416–9.
8. Ollier W, Sprosen T, Peakman T. UK Biobank: from concept to reality. Pharmacogenomics 2005; 6: 639–46.
9. Elliott P, Peakman TC, Biobank UK, Elliott P, Peakman TC. The UK Biobank sample handling and storage protocol for

the collection, processing and archiving of human blood and urine. Int J Epidemiol 2008; 37: 234–44.
10. Watts G. UK Biobank gets 10% response rate as it starts recruiting volunteers. BMJ 2007; 334: 659.
11. Central Statistics Office Ireland. Ageing in Ireland. Dublin: Stationery Office, 2007.
12. Kenny R, Whelan BJ, eds. The Design of the Irish Longitudinal Study on Ageing. Dublin: TILDA, 2010. Available at www.tcd.ie/tilda (30 November 2009, date last accessed).
13. Whelan BJ. RANSAM: a random sample design for Ireland. Econ Soc Rev 1979; 10: 169–74.
14. Morgan KMH, Watson D, Perry I *et al* SLÁN 2007: Survey of Lifestyle, Attitudes & Nutrition in Ireland. Dublin: Department of Health and Children, 2008.
15. Whitehead AS, Bertrandy S, Finnan F, Butler A, Smith GD, Ben-Shlomo Y. Frequency of the apolipoprotein E epsilon 4 allele in a case-control study of early onset Parkinson's disease. J Neurol Neurosurg Psychiatry 1996; 61: 347–51.
16. Kiely M, Flynn A, Harrington KE, Robson PJ, Cran G. Sampling description and procedures used to conduct the North/South Ireland Food Consumption Survey. Public Health Nutr 2001; 4: 1029–35.
17. Geodirectory Dublin: An Post GeoDirectory Limited, 2008. Available at http://www.geodirectory.ie (30 November 2009, date last accessed).
18. Folstein MF, Folstein SE, McHugh PR. 'Mini-mental state'. A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975; 12: 189–98.
19. Nasreddine ZS, Phillips NA, Bedirian V *et al* The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. J Am Geriatr Soc 2005; 53: 695–9.
20. Shahar E, Folsom AR, Jackson R. The effect of nonresponse on prevalence estimates for a referent population: insights from a population-based cohort study. Atherosclerosis Risk in Communities (ARIC) Study Investigators. Ann Epidemiol 1996; 6: 498–506.
21. Mody L, Miller DK, McGloin JM *et al* Recruitment and retention of older adults in aging research. [see comment]. J Am Geriatr Soc 2008; 56: 2340–8.
22. Marcantonio ER, Aneja J, Jones RN *et al* Maximizing clinical research participation in vulnerable older persons: identification of barriers and motivators. J Am Geriatr Soc 2008; 56: 1522–7.
23. Chatfield MD, Brayne CE, Matthews FE, Chatfield MD, Brayne CE, Matthews FE. A systematic literature review of attrition between waves in longitudinal studies in the elderly shows a consistent pattern of dropout between differing studies. J Clin Epidemiol 2005; 58: 13–9.
24. Matthews FE, Chatfield M, Brayne C *et al* An investigation of whether factors associated with short-term attrition change or persist over ten years: data from the Medical Research Council Cognitive Function and Ageing Study (MRC CFAS). BMC Public Health 2006; 6: 185.
25. Holle R, Hochadel M, Reitmeir P *et al* Prolonged recruitment efforts in health surveys: effects on response, costs, and potential bias. Epidemiology 2006; 17: 639–43.

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Stop Delirium! A complex intervention to prevent delirium in care homes: a mixed-methods feasibility study

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Abstract

Background: delirium is likely to be particularly common in care homes, given the clustering of known risk factors in these settings. Preventing delirium should result in significant benefits, including better quality of care and improved outcomes for residents.