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Do subjective memory complaints predict falls, fractures and healthcare utilization? A two-year prospective study based on a cohort of older women recruited from primary care

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Key words
Subjective memory complaints; fractures; falls; bone density; COSHIBA; healthcare utilisation

KEY POINTS

1. The prevalence of SMCs within older women from the primary health care setting is 11%.
2. SMCs are multifactorial and changeable, with approximately half having intermittent SMC. Low socio-economic background and falls at baseline were risk factors for persistent SMCs two years later.
3. This study reports that SMC at baseline is associated with future frailty, falls, fractures and health service utilisation over the following two years. The association between SMC and fractures is mainly explained by falls.
4. Reporting of SMC by patients to their GP should initiate further assessment followed by interventions to reduce falls where appropriate. Routine questioning of older women within the primary health care setting about SMC should be considered, to allow targeting of healthcare to reduce falls, fractures and healthcare utilisation.

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Abstract

Objective: A substantial proportion of older individuals report subjective memory complaints (SMC), which are thought to predict the development of cognitive impairment and dementia. Previous studies based in secondary care suggest that SMC is also associated with a number of other adverse health consequences including falls, fractures and increased healthcare utilisation. In this study, we aimed to establish whether similar findings are observed in the wider population.

Methods: Prospective analysis of the Cohort for Skeletal Health in Bristol and Avon (COSHIBA), a population based cohort recruited from primary care. Data were collected by self-completion questionnaire at baseline and two years. SMC was assessed at baseline. Fractures, measures of falls and mobility and healthcare utilisation were assessed two years later. A random 5% subsample of data were validated against GP records. Logistic regression was used to identify independent associations, following adjustment for a range of confounders assessed at baseline.

Results: Data were available on 3184 women. Three hundred and fifty participant (11.0%) reported SMC. They were older (73.3±4.5 vs 72.0±4.2 years) and less mobile compared to those not reporting SMC. SMCs at baseline were associated with an increased risk of upper limb fractures over the following 2 years (OR 1.72, 95%CI 1.02-2.90). SMCs were also associated with an increased risk of falls (OR 1.83, 95%CI 1.41-2.38) and increased healthcare utilisation (OR for hospital appointments 2.20, 95%CI 1.26-3.86). No association was observed with bone mineral density (BMD) at any site.

Conclusions: SMCs are important markers of adverse health outcomes and should prompt interventions to reduce fractures such as physiotherapy-led falls reduction programmes.

INTRODUCTION

Cognition can be defined as the process of 'knowing' (Yasuhara, Takahashi et al. 2013) and reflects our ability to perceive, learn, concentrate and communicate. A change in cognition can affect an individuals' socialisation and self-care, including food preparation, taking medication and managing their finances(Wagster, King et al. 2012). Cognitive impairment will also impact on how well an individual can cope with the effects of aging such as illness or injury(Hendrie, Albert et al. 2006). Symptoms of memory loss, or Subjective Memory Complaints (SMCs) can be one of the first signs of cognitive impairment(Guo, Chen et al. 2013), and are defined as everyday memory concerns expressed by an individual with or without objective evidence of memory deficit on neuropsychological testing(Abdulrab and Heun 2008).

The prevalence of SMC varies according to the population studied and method of capturing the SMC data. In one meta-analysis of 30,000 people (mean age 71.6 years) from around the world mainly identified through community-based surveys, SMC was reported in approximately 50%(Mitchell, Beaumont et al. 2014). Other studies from primary health care (Jessen, Wolfsgruber et al. 2014) and specialist clinics (Visser, Verhey et al. 2009) have reported similar prevalences (41-52%). SMC increases with age: for example, there is a reported prevalence of 10% at 65 years of age (Jungwirth, Fischer et al. 2004) increasing to 88% in those aged 85 years and older (Bassett and Folstein 1993). SMC is commonly associated with cognitive impairment. In one longitudinal cohort study of 2228 individuals (75 years and older) from Primary Care, those with SMC were more likely to be formally diagnosed with mild cognitive impairment (MCI) within three years, compared to those without SMC (Luck, Riedel-Heller et al. 2010). As well as potentially identifying those more likely to develop future cognitive decline(Gauthier, Reisberg et al. 2006) or dementia(Reisberg, Shulman et al. 2010) SMC has a positive correlation with depression(O'Connor, Pollitt et al. 1990), and anxiety(Jorm, Christensen et al. 2001).

In addition, an association has been reported between SMCs and frailty, poorer balance(Shin, Han et al. 2011), fractures(Lee, Na et al. 2012), reduced quality of life(Mol, Carpay et al. 2007), and increased health care utilization(Waldorff, Siersma et al. 2009). However, the usefulness of these studies is limited by lack of control groups, and difficulty extrapolating their findings to the general population, because the majority were set in secondary care. It is essential that these relationships are examined further particularly as there are effective interventions available to reduce the risks of falls(Choi and Hector 2012) and fractures(Beard 2012) and therefore decrease morbidity and improve quality of life.

An additional benefit to identifying individuals with SMC is that educational, lifestyle and medical interventions are most likely to be helpful when initiated at an early stage. Furthermore a number of individuals with SMC may have a treatable cause for their symptoms detected such as infection, vitamin deficiency or depression(Small 2001). In recognition of this, the 2012 Dementia Commissioning for Quality and Innovation (CQUIN) has developed a new pathway aimed to improve the identification of patients with dementia and cognitive impairment by asking all inpatients aged 75 years and over (or their relatives) ''Have you/ has the patient been more forgetful in the past 12 months to the extent that it has significantly affected your/their daily life''(Matussek, Boluki et al. 2010). However, this CQUIN only applies to the inpatient setting and does not identify people in primary care with subjective memory impairment.

The Cohort for Skeletal Health in Bristol and Avon (COSHIBA) was set up to trial a screening tool for osteoporotic vertebral fractures in 3200 women aged 65 to 80 years from primary care in the UK(Clark, Gould et al. 2012). At baseline all participants were asked about SMCs and were then followed up for two years. The objective of this study was to evaluate the prevalence and natural history of SMC in the primary care population of older women, and identify whether SMC are associated with future falls, fractures or healthcare utilisation.

METHODS

Study design

Prospective analysis of a population-based cohort of 3200 post-menopausal women with two years follow-up.

Study population

COSHIBA consists of 3,200 postmenopausal women with a date of birth between 1st January 1927 and 31st December 1942. Full descriptions of the method of recruitment have been published previously(Clark, Gould et al. 2012), but briefly participants were recruited for a randomized controlled trial of a screening programme to identify women with osteoporotic vertebral fractures (ClinicalTrials.gov NCT00463905). There were no exclusion criteria, although some GPs did not invite women they thought would be inappropriate through illness. Data for this study is from the self-completion questionnaires on entry to the study and over the two-years of follow-up. As previously described(Clark, Gould et al. 2011) a random 5% subsample were verified against electronic GP records and in general there was good agreement. Ethical approval was obtained from the Gloucestershire Research Ethics Committee (REC 07/Q2005/47).

Main exposure: Self-reported memory complaint (SMC)

Data on SMC was collected by asking 'Do you or have you suffered from memory problems in the last two years?'. The response was a binary Yes/No, and participants who did not answer were regarded as having missing data. The same question was repeated at the end of the two years follow-up. Our primary exposure was self-reported SMC at baseline. Participants were further classified as persistent SMC (pSMC) if they self-reported SMC at both baseline and two-years, or intermittent SMC (iSMC) if they self-reported SMC at baseline but not at two years.

Outcomes

All outcome data were collected via self-completion questionnaires during the two-years of

follow-up and after baseline SMC was recorded.

Fractures: Self-reported data were collected at six-month intervals during the two-year follow-up about any new fracture occurring since entry to the study. As previously described the majority of fractures were upper limb fractures(Clark, Gould et al. 2011). A random 5% subsample of reported fractures were verified against GP records and 79.5% were confirmed, similar to that found by other researchers(Boissonnault 2005).

Falls: Self-reported data on falls experienced over the previous two years were collected at two years after baseline data collection. Falls were categorised into those who had one or more falls per year, and those who had fewer. As previously reported (Clark, Gould et al. 2011), a random 5% subsample of self-reported falls were verified against GP records and 69.2% of those reporting falling more than once per year had no falls recorded on the computerised GP records, suggesting that these electronic records underestimate the true prevalence of falls.

Healthcare utilisation: At two-years follow-up participants were asked how often they had appointments with practice nurses, GP (face to face at surgery or for home visits), hospital out-patients, or physiotherapists during the past year. Data on number of nights spent in hospital were also collected.

Potential confounders and other data

Age was calculated from date of birth. Medication use was identified by classifying whether participants had ever taken oral steroids for more than three months, HRT, osteoporosis treatment, use of anxiety pills or sleeping pills. Data were also collected on age, socio-economic status (housing tenure categorised as owned/mortgaged, private rental/housing association or council housing; and highest achieved educational qualification categorised into none/basic matriculation, vocational, O-levels or equivalent, A-levels or equivalent, or university degrees). Data were also collected on current and previous smoking, current and previous heavy alcohol intake defined as more than one alcoholic drink per day.

Frailty: At baseline participants were asked how far they could walk (divided into more than 400

yards, or zero to 400 yards), and whether they used a walking aid regularly. Reduced mobility was used as a proxy for frailty, based on Fried's frailty criteria(Abizanda, Romero et al. 2013).

Data were also collected at baseline on the number of falls experiences over the preceding five years. Body mass index (BMI) data were also collected at baseline. In addition data were collected on self-reported diagnosis of osteoporosis, although this was analysed separately and not as a confounder. Bone density was assessed in a subgroup by dual energy X-ray absorptiometry at the lumbar spine, right total hip and right femoral neck as previously described(Clark, Carter et al. 2014).

Statistical Analysis

Statistical analysis was carried out using Stata vs13 software by UA. Simple descriptive statistics including mean/standard deviation (SD) for age and proportions for categorical data were calculated. Univariable associations between SMC and outcomes were assessed using Chi-squared tests. Logistic regressions analyses were used to calculate odds ratio (OR) and 95% confidence interval (CI) for outcomes according to presence or absence of SMC at baseline. Multivariable logistic regression was used to estimate associations between SMC and outcomes after adjusting for baseline confounders. Data collected at baseline were used as confounders, chosen as a 'confounding set' through literature review and knowledge of SMC and fractures: the confounding set wasage, baseline socioeconomic statuses and frailty. Standard methods for assessing confounding were used i.e. change in size of effect of more than 10%. Once associations between SMC and outcomes at two years were identified, a Directed Acyclic Graph (DAG) was used to direct the further statistical analysis and to encode our assumptions(Greenland, Pearl et al. 1999). The role of a-priori DAGs are to (1) develop the statistical model: Figure 1 shows our assumed association between SMC and fractures, and (2) consider the robustness of the assumptions encoded within the DAG. Participants with missing data for specific items were excluded from the relevant analyses. Sensitivity analyses were performed using a different

definition of SMC: self-reported SMC at both baseline and two years follow-up (persistent SMC) compared to no self-reported SMC at either baseline or follow-up. All fractures were used as one of the primary outcomes followed by upper limb fractures only as a sub-analysis: upper limb fractures are the most common osteoporotic fracture of older women whereas 'all fractures' will also include those occurring after high trauma.

Figure 1 place

RESULTS

Full data were available on 3184 participants. Three hundred and fifty (11.0%) reported SMC at baseline (see Figure 2). Of those with SMC at baseline, 145 (53.7%) still reported SMC two years later (persistent SMC), compared to 125 (46.3%) who no longer reported SMC at two-years (intermittent SMC). At two years, 138 (5.5%) of those without SMC at baseline now self-reported SMC. 80 (22.9%) of those with SMC at baseline were lost to follow-up during the two years compared to 347 (12.2%) of those without SMC. Women who reported SMC at baseline and were lost to follow-up had lower socio-economic status as reflected by housing tenure compared to women with SMC and follow-up date (67% owned or mortgaged their own home vs 82%, P=0.006). Similarly, those women with SMC and lost to follow up had reduced mobility (for example 46% could walk less than 400 yards vs 27% with full data collection, P=0.031) and were more likely to smoke compared to those women with SMC and follow-up at two years (16% vs 7%, P=0.015).

Figure 2 place

Those with SMC at baseline were slightly older and had lower socio-economic status as reflected by housing tenure (see Table 1), but no association was seen with highest achieved educational qualification (results not shown). At baseline, those with SMC had poorer mobility as reflected by walking time and use of a walking aid, were more likely to report previous heavy alcohol intake and were more likely to smoke (currently or given up). Those with SMC at baseline were more likely to have had HRT or medications for anxiety. No association was seen between SMC and baseline BMI, use of steroids or current heavy alcohol intake. Considering all the data available on use of medications (steroids, osteoporosis treatments, HRT, anxiety pills and sleeping pills), 248 (70.9%) of those with SMC used at least one of these medications at baseline compared to 1495 (52.8%) of those without SMC at baseline (P<0.001 for difference). Those with persistent SMC (pSMC) were more likely to have lower socio-economic background at baseline compared to

those with intermittent SMC (iSMC) (see Table 2), and have more falls over the two year follow-up.

Table 1 place

Table 2 place

Self-reported SMC at baseline was associated with upper limb fractures, and increased falls two years later (see Table 3- Model A). For upper limb fractures the size of association did not change after adjusting for baseline confounders and frailty (see Table 3- Model B & C). Similarly, adjustment for baseline confounders and frailty did not change the association between SMC and falls at two years (see Table 3- Model B & C). Sensitivity analyses performed using persistent SMC compared to those who did not report SMC at baseline or follow-up did not change direction of association or size of effect, but due to smaller numbers had wider confidence intervals.

Table 3 place

To further explore the association between SMC and fractures (see Figure 1), we adjusted the association between SMC and fractures for falls. Adjustment for falls at two years attenuated the association between our variables. The association between SMC at baseline and fractures over the following two years is mainly explained by falls over the two years. Sensitivity analyses performed using persistent SMC compared to those who did not report SMC at baseline or follow-up did not change direction of association or size of effect, but due to smaller numbers had wider confidence intervals.

Bone density data from DXA were available on 258 participants at the lumbar spine and 235 at the right hip (total neck and femoral neck). No association was seen between SMC at baseline and this objective measure of bone density. An association was seen between SMC at baseline and self-reported diagnosis of osteoporosis at follow up (OR for self-reported osteoporosis 1.84, 95%CI 1.31 to 2.60, P<0.001). Additionally adjusting the association between SMC and upper limb

fractures for a self-reported diagnosis of osteoporosis slightly attenuated the size of effect: OR for upper limb fractures in those with SMC at baseline, adjusted for baseline confounders and frailty and a diagnosis of osteoporosis 1.61, 95%CI 0.89 to 2.91, P=0.112.

Self-reported SMC at baseline was associated with increased healthcare utilization over the following two years (see Table 3). After adjustment for baseline confounders and frailty, only the association between SMC and consultant hospital appointments remained (OR 2.30, 95% CI 1.25 to 4.23). Additional adjustment for fractures did not change the association between SMC and consultant appointments in hospital (OR for consultant hospital appointments 2.30, 95% CI 1.25 to 4.24, P=0.007).

DISCUSSION

We demonstrate for the first time that self-reported memory complaints within the primary care population of older women are associated with an increased risk of fractures, falls, and consultant appointments in hospital over the following two years. The association between SMC and fractures was mainly explained through increased falls. This highlights that SMCs are an important marker of adverse health outcomes and should prompt a review of falls risk and general health, with a view to improving the health of the individual and reducing societal costs of healthcare. Targeting interventions to older women with SMCs has the potential to be a cost-effective way of identifying a high-risk group that would benefit from interventions such as physiotherapy-led falls reduction programmes. However, at present it is only people attending secondary care that are routinely asked about SMCs in the UK, and our results suggest this should be extended to the primary care population.

One objective of this study was to evaluate the prevalence and natural history of SMC in the primary care population. SMCs have been evaluated in a wide range of settings however comparatively few studies have focused on patients within primary care(Archer, Newson et al. 2015). In our study the prevalence of SMC was 11%. This is similar to other studies which have reported rates of 10%(Jorm, Butterworth et al. 2004) and 23%(Waldorff, Siersma et al. 2012). Although memory complaints can be relatively common in primary care populations, these symptoms may not be volunteered by patients to their GP(Jorm, Butterworth et al. 2004, Waldorff, Siersma et al. 2012), however, those with SMC have (as in our study) been found to present more frequently to their GP(Jorm, Butterworth et al. 2004). We found that those with SMC at baseline had a 60-100% increase in healthcare utilisation over the following two years compared to those without SMC. This concurs with other population based studies that have shown similar utilisation, pointing to increased nursing home placement over a three year period (19). Our results show that SMC is independently associated consultant appointments in

secondary care over a two year period, and this has important economic consequences and suggest that SMC is a key indicator for targeting healthcare in an efficient manner.

Interestingly, only half of our cohort with SMC at baseline continued to report these symptoms at follow up. This finding mirrors the fluctuation in cognitive performance seen in populations of individuals with 'mild cognitive impairment' (MCI) where there are symptoms of memory complaints and measurable cognitive impairment (Sachdev, Lipnicki et al. 2013). In our population symptoms may have resolved where they were related to a mood disorder or treated reversible cause. Alternatively, this change in perception may represent diminishing insight into cognitive problems, where the cognitive impairment is progressing.

Our finding that self-reported SMC at baseline is associated with increased falls over the following two years in older women from primary care has not to our knowledge been previously reported. Cross-sectional studies based on older people recruited from hospital outpatient clinics(Stijntjes, Pasma et al. 2015) or the community(Mignardot, Beauchet et al. 2014) have shown an association between MCI and reduced standing balance or increased postural sway. Our results add to this literature and suggest that this association between SMC and poor balance may result in increased falls and injuries. This is important, as there are a wide range of interventions available for balance retraining in community-dwelling older adults(Mulligan, Tschoepe et al. 2014), and it has been suggested that these exercise-based interventions may also work in the elderly MCI population(Jeon, Han et al. 2014) with the potential to reduce falls and fractures.

Since the relationship between SMC and fractures was largely attenuated by adjusting for falls which were also increased our results suggest that the relationship between SMC and future fractures is most likely to be due to falls. Conceivably there may also be a pathway via bone fragility. Our study identified an association between SMC and self-reported diagnosis of

osteoporosis, but not with objective measures of low bone mass in a subset. The literature is limited, but it has been suggested that there may be an association between SMC, lower bone mass and early Alzheimer's Disease(Lee, Na et al. 2012), and between osteoporosis and a decline in cognition and function over the following 5 years(Stijntjes, Pasma et al. 2015). However these studies often have small numbers, and may be underpowered to show a relationship between cognitive impairment and fractures.

Our results have implications for health policy and targeting interventions to high risk groups, with an aim of reducing falls and fractures and thereby reducing societal healthcare costs. Our results suggest that SMC within the community population of older women should be a 'red flag', and highlight someone at a high risk of reduced mobility, increased falls and increased healthcare utilisation, to allow initiation of interventions to reduce falls and fractures. Currently there is no country-wide scheme to identify older women with SMC in the community, and the UK-based CQUIN pathway to identify women with SMC in secondary care has been contentious because of no universally agreed 'objective assessment' of women who self-report SMC. Our results suggest that an important component of this assessment should be falls and fracture risk assessment, for which there are already developed pathways. In addition, consideration needs to be given to 'screening' for SMC within the community.

There are limitations to this study. As previously described, the recruited study cohort only included 38.9% of the eligible women(Clark, Gould et al. 2012). In addition, those women with SMC who were lost to follow-up were different to women with SMC who stayed in the study. This likely bias may have implications for the generalisability of our results. However, it is most likely that the women who were not recruited to our study have a higher prevalence of SMC than the women who did take part, and therefore our results will not represent an overestimate of either the prevalence of SMC or the association with reduced mobility, fractures and healthcare utilisation. Another limitation is that data were not specifically collected on depression. However,

all adjusted models included adjustment for use of medications including anxiety and sleeping pills. A further limitation is the use of self-reported fracture data. However, in the 5% random subsample compared against electronic GP records the fracture and falls data do not suffer from any non-random misclassification(Clark, Gould et al. 2011), but we were unable to verify healthcare utilisation data. A final important limitation is the use of self-reported data from people who also self-report SMC. However, it is likely that any recall bias (including under- and over-reporting) associated with SMC will result in random misclassification, and this is most likely to bias our results towards the null rather than create spurious associations.

In conclusion, we present the first prospective data showing an association between self-reported SMC and an increase in falls, fractures and healthcare utilisation over the following two years. This has important implications for policy development and suggests that SMC within the community population of older women should be a 'red flag', and lead to further assessment and interventions. This is likely to be a cost-effective way of targeting healthcare to the older population, with an aim of improving individual's health-related quality of life and reduce societal costs in the longer term.

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FIGURE LEGENDS

Figure 1: The directed acyclic graph (DAG) showing the potential pathways we can explore between baseline subjective memory complaints (SMC) and upper limbs fractures at two years.

Figure 2: Change in self-reported subjective memory complaints (SMCs) between baseline and two years in a primary care-based cohort of older women aged 65-80 years at baseline.

TABLES

Table 1: Description of baseline characteristics of women with and without subjective memory complaints (SMC)

	With SMC Mean (SD) n= 350*	**Without SMC Mean (SD) n= 2,834***	**p-value**
Age/year	73.4 (4.6)	72.6 (4.2)	0.001
BMI (Kg/m2)	26.9 (5.0)	27.0 (5.0)	0.594
	n(%)	**n(%)**	
Socio-economic status			
Housing tenure			<0.001
Owned/mortgaged	262 (79.0)	2324 (87.0)	
Others	71 (21.0)	358 (13.0)	
Mobility and falls			
At least one fall/year			<0.001
No	196 (57.8)	2040 (74.8)	
Yes	143 (42.2)	686 (25.2)	
Mobility			<0.001
>400 yards	228 (68.9)	2146 (77.9)	
≤400 yards	103 (31.1)	609 (22.2)	
Walking aids			<0.001
No	235 (67.7)	2247(80.4)	
Yes	112 (32.3)	549(19.6)	
Other Potential Confounders			
Steroids for > 3 months			0.398
No	284(90.4)	2486(91.8)	
Yes	30 (9.5)	221(8.1)	
HRT (ever)			<0.001
No	196 (56.0)	1963 (69.2)	
Yes	154 (44.0)	871 (30.7)	
OP treatment (ever)			0.060
No	298 (88.1)	2554 (91.2)	
Yes	40 (11.8)	244 (8.7)	
Anxiety pills (ever)			<0.001
No	241 (68.8)	2407 (84.9)	
Yes	109 (31.1)	427 (15.0)	
Current heavy alcohol intake			0.994
No	301 (87.8)	2455(87.7)	
Yes	42 (12.2)	343 (12.3)	
Previous heavy alcohol intake			<0.001
No	313(91.8)	2688(96.0)	
Yes	28(8.2)	111(4.0)	
Current smoking			0.001
Yes, still smoking	30 (8.7)	210 (7.5)	
Yes, given up	136 (47.4)	1060 (37.8)	
Never	151 (43.9)	1533 (54.7)	

Abbreviations: HA Housing Association; NH Nursing Home; SD standard deviation; HRT hormone replacement therapy; OP osteoporosis

* Numbers for each variable may not add up to the total due to missing data

Table 2: Characteristics of participants with persistent SMC (pSMC) and intermittent SMC (iSMC) at baseline and follow-up.

	pSMC n=145	**iSMC n=125**	**P value**
	Mean (SD)	Mean (SD)	
Age/year	73.5 (4.7)	72.7 (4.3)	0.167
BMI (kg/m2)	26.6 (4.6)	27.7 (5.8)	0.131
	N (%)	N (%)	
BASELINE			
Housing tenure			0.037
Owned/mortgaged	106 (77.0)	104 (88.0)	
	31 (23.0)	15 (12.0)	
Mobility			0.389
>400 yards	104 (75.4)	84 (70.6)	
≤400 yards	34 (24.6)	35 (29.4)	
Walking aids			0.539
No	104 (72.2)	86 (68.8)	
Yes	40 (27.8)	39 (31.2)	
Medication use			0.797
No	42 (29.0)	38 (30.4)	
Yes	103 (71.0)	87 (69.6)	
Previous heavy alcohol			0.143
No	133 (94.3)	110 (89.4)	
Yes	8 (5.7)	13 (10.6)	
Current smoking			0.195
Yes, still smoking	6 (4.3)	12 (9.8)	
Yes, given up	67 (46.8)	57 (45.9)	
Never	70 (48.9)	55 (44.3)	
FOLLOW-UP			
At least one fall/year			0.008
No	64 (45.7)	73 (62.4)	
Yes	76 (54.3)	44 (37.6)	
Walking aids			0.323
No	84 (60.4)	79 (66.39)	
Yes	55 (39.6)	40 (33.61)	
Walking distance			0.916
<400 yards	83 (62.4)	70 (63.06)	
>400 yards	50 (37.6)	41 (36.94)	
All fractures			0.312
No	128 (88.3)	115 (92.0)	
Yes	17 (11.7)	10 (8.0)	
GP appointments in clinic per year			0.879
≤ 4 times	101 (69.7)	86 (68.8)	
> 4 times	44 (30.3)	39 (31.2)	

Abbreviations: BMI body mass index; GP General Practitioner; HA housing association; NH nursing home

Table 3: Association between baseline subjective memory complaints (SMC) and outcomes of interest at two years. Results shown are mean and SD, with (A) unadjusted odds ratios (OR), (B) ORs adjusted for baseline confounders, (C) additionally adjusted for baseline frailty variables (D1) additionally adjusted for falls at two-year follow-up, (D2) adjusted for potential confounders, baseline frailty and all types of fractures at two years

Outcome at two years	With SMC at baseline n (%)	Without SMC at baseline n (%)	(A) OR for SMC (95%CI), P value	(B) OR for SMC (95%CI), P value	(C) OR for SMC (95%CI), P value	(D1) OR for SMC (95%CI), P value
Fractures						
All fractures						
No	293 (90.4)	2570 (93.0)	1.40 (0.94 to 2.09), P=0.091	1.35 (0.89 to 2.05), P=0.150	1.31 (0.84 to 2.03), P=0.228	1.27 (0.77 to 2.09), P=0.333
Yes	31 (9.6)	193 (7.0)				
Upper limb fracture						
No	218 (92.4)	2174 (95.4)	1.72 (1.02 to 2.90), P=0.039	1.64 (0.95 to 2.85), P=0.074	1.63 (0.92 to 2.88), P=0.093	1.32 (0.70 to 2.47), P=0.384
Yes	18 (7.6)	104 (4.6)				
Falls						
At least one fall/year						
No	137 (53.3)	1587 (67.7)	1.83 (1.41 to 2.38), P<0.001	1.75 (1.33 to 2.31), P<0.001	1.49 (1.10 to 2.01), P=0.009	-
Yes	120 (46.7)	757 (32.3)				
			(A)	(B)	(C)	(D2)
Primary care utilisation						
GP appointments in clinic per year						
≤ 4 times	187 (69.3)	1949 (78.4)	1.60, (1.22-2.11), P=0.001	1.41, (1.05-1.89), P=0.021	1.33, (0.98-1.82), P=0.063	1.33, (0.97-1.81), P=0.068
> 4 times	83 (30.7)	538 (21.6)				
Practice nurse visits in clinic per year						
≤ 4 times	232 (85.9)	2254 (90.6)	1.58, (1.09-2.29), P=0.014	1.39, (0.94-2.06), P=0.098	1.17, (0.75-1.80), P=0.460	1.16, (0.76-1.79), P=0.473
> 4 times	38 (14.1)	233 (9.4)				
Secondary care utilisation						
Consultant appointments in hospital per year						
≤ 4 times	254 (94.1)	2418 (97.2)	2.20, (1.26-3.86), P=0.005	2.27, (1.27-4.04), P=0.005	2.30, (1.25-4.23), P=0.007	2.30, (1.25-4.24), P=0.007
> 4 times	16 (5.9)	69 (2.8)				
Home visits						
Visited by doctor at home						
No	236 (87.4)	2293 (92.2)	1.70, (1.15-2.51), P=0.007	1.47, (0.98-2.21), P=0.060	1.25, (0.80-1.94), P=0.317	1.22, (0.78-1.91), P=0.366
Yes	34 (12.6)	194 (7.8)				

Specific variables in the models are for (B) age, housing tenure, medication use, current and previous heavy alcohol intake, and smoking; for (C) B + baseline falls, baseline mobility, and baseline using walking aids; for (D1) C + falls at two years; and for (D2) C + all types of fractures at two years.