

The difficulty of opening medicine containers in old age: a population-based study

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Key words

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Abstract

Objectives: To investigate elderly people's ability to open medicine containers, and how this ability correlates to some common disorders that may cause functional or cognitive impairment.

Methods: Cross-sectional study of older people age 81 years and older, from the second follow-up (1994–1996) of the Kungsholmen project, a population based study of very old people in an urban area of Stockholm, Sweden. Six hundred and four persons (mean age 86.7 years) were tested for their ability to open three types of medicine containers. The disorders studied were rheumatoid arthritis, stroke, Parkinson's disease, cognitive impairment (measured by mini-mental state examination, MMSE) and impaired vision.

Results: We found that 14% were unable to open a screw cap bottle, 32% a bottle with a snap lid, and 10% a blister pack. Female gender, higher age, living in an institution, Parkinson's disease, rheumatoid arthritis, cognitive impairment and impaired vision were all associated with a decreased ability to open the containers. Less than half of the elderly people who were unable to open one or more of the containers received help with their medication. Among those living in their own homes only 27% received help.

Conclusion: Older peoples' ability to open medicine containers is impaired by several conditions affecting physical and cognitive functioning. Many elderly people who are unable to open medicine containers do not receive help with their medication, particularly those living in their own homes.

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Introduction

Effective drug therapy is dependent upon many factors including understanding instructions, reading the label, managing medicine containers and administering the actual drug. One of the important steps in the medication process is the ability to open the medicine container and take out a tablet. This is difficult for many elderly people. With increasing age, deterioration occurs both in physical and cognitive status. Elderly people are the largest group of medication consumers^{1,2}.

The problem was discussed in scientific literature already in the late seventies when Sherman commented on the problems many elderly people experience with the opening of child-resistant containers³. Several descriptive studies followed during the eighties^{4–7}.

Several studies have correlated the opening of medicine containers with cognitive function and vision^{8–11}. Other studies investigated the situation for those persons who suffer from rheumatic disorders^{12–15}.

Most of the previous studies were not population based, but included selected groups such as patients in emergency care. In addition, the ability to handle medicine containers in old age may depend on many different factors including somatic and neurological disorders, limited hand function, as well as disorders affecting cognition. As mentioned above, a few studies have described how impaired cognition and vision^{8–11}, and rheumatic disorders^{12–15} can hinder the ability to open medicine containers. However, to our knowledge there are no studies on the influence of other medical conditions affecting physical functioning, such as Parkinson's disease or stroke, nor has the effect of diagnosed dementia been investigated.

The aim of the present study was to examine the ability to open medicine containers among very old people. Our study was based on data from the second follow-up of the Kungsholmen project (1994–1996), that included data on drug use and tests for the ability to open medicine containers, as well as dementia and other medical diagnoses, in a large population of very old people. We have studied the ability to open three commonly used medicine containers and how this ability correlates to gender, age and types of housing. We have also investigated to what extent rheumatoid arthritis, stroke, Parkinson's disease, dementia, cognitive impairment and impaired vision were correlated with the ability to open the containers. Finally, to have examined how many of the people who had difficulties opening containers actually received help with their medication.

Method

The present study is based on data from the Kungsholmen project, a population based study of aging and dementia^{16–18}. The study began in 1987 when all inhabitants of the Kungsholmen area, in central Stockholm, Sweden, age 75 years or older, were invited to participate.

A baseline study with 1810 participants was conducted in 1987–1989, consisting of a screening phase and a clinical phase. The subjects were interviewed about their health and social life, and were screened with the Mini Mental State Examination (MMSE)¹⁹. The clinical phase was conducted to obtain a diagnosis of Alzheimer's disease or other dementia. Subjects with an MMSE score of ≤ 23 and a sample of sex and age-matched subjects with a MMSE score of ≥ 24 were extensively evaluated using a comprehensive clinical examination and a structured health interview. The MMSE was also used as a variable in the analyses ($n = 600$), divided into intervals: 24–30 ($n = 415$), 18–23 ($n = 105$), 12–17 ($n = 47$), 6–11 ($n = 16$) and 1–5 ($n = 17$). The clinical examination included a medical history, physical and neurological examina-

tions, and laboratory and neuropsychological evaluations. The diagnosis of dementia was based on DSM III-R criteria²⁰. In the follow-ups, approximately every third year, this procedure was employed for all participants.

Data about drug use was obtained from the interviews. In cases where the older person could not be interviewed, a relative, caregiver or health care personnel answered the questions. If the person was living in an institution, the information was collected from medical records. Both prescription and non-prescription drug use were recorded and drug prescriptions and containers were examined for confirmation. The subjects were also asked if they received any form of help with preparing a dose of their medications and if they received any help with administering doses.

In this study we have used data from the second follow-up, which was performed between 1994 and 1996. The number of participants in the second follow-up was 683, and a full record on medication use was obtained for 681 of these persons.

In this phase of the Kungsholmen project the clinical protocol also included factors involved in the medication process, including tests of the ability to open different kinds of medicine containers. The participants were given three types of containers to open: a plastic bottle with a snap lid, a glass bottle with a screw cap and a blister pack. The process was divided into three steps: opening the lid, taking out one tablet and closing the container again. For the blister pack the process only involved taking out one tablet. All three steps needed to be completed for the bottles, or the single action for the blister pack, in order to be judged as successful.

There were some older persons (79) who did not try to open the containers or only tried one or two of them. Since we do not know whether this was due to inability to open the containers or to some other reason, these subjects were excluded from the analyses. The study population therefore included 604 subjects. Almost all of the persons with missing data were interviewed in their own home and not, as for most interviews, in our research facility. In some cases the interviewer gave a reason for non-participation, such as weakness, blindness or not understanding the question. To know more about the missing cases we compared them with the rest of the population on a number of variables: number of drugs used, MMSE scores, age, housing arrangement, medical diagnoses, vision and help received.

The housing variable was categorized into (1) own home, either owned or rented; (2) sheltered accommodation (individual apartments with communal facilities with non-medically-skilled caregivers) and old peoples' home; and (3) institution: different forms of institutions where medical staff is available around the clock.

Medical diagnoses were gathered from self- or proxy report in the interviews, from the physician's diagnoses at the clinical examination, and from the inpatient registry covering all hospitals in Stockholm since 1969.

Vision was evaluated by the examining physician to be normal ($n = 336$), impaired ($n = 227$) or blind/almost blind ($n = 25$). The evaluation was based on how the subject managed the interview, both during

the physical examination and talking with the physician, but also in reading and understanding the instructions for the MMSE. Data about vision were recorded for 588 subjects.

Data were analyzed with the SPSS program (SPSS for Windows, 11.5, SPSS Inc. 1989–2002). Descriptive statistics were used to explore the prevalence of difficulties with the medicine containers by demographic variables (age, gender and housing). We used logistic regression to analyze the correlation between age, gender, housing, dementia, rheumatoid arthritis, Parkinson's disease, stroke, MMSE and vision and the ability to open containers.

The ethical committee of the Karolinska Institute has approved the Kungsholmen project. Written informed consent was obtained from each participant or close relative (proxy) with the right to refuse participation at any stage of the project.

Results

Demographic data of the study population are shown in Table 1. There were 77.6% women, and the mean age in the whole population was 86.7 years.

In order to determine how the study population of 604 subjects differed from the total cohort examined in the second follow-up (683), we compared the subjects with missing data to the study population on several parameters (Table 2). We found that the group with missing data used more drugs, were older, were more likely to live in sheltered accommodation or in an institution, had a higher prevalence of dementia, a significantly lower score on the MMSE, had a higher prevalence of impaired vision and more often received help with their medication.

Table 1 also shows how the ability to open different kinds of medicine containers varied with demographic characteristics, as well as with medical conditions that may affect vision, cognition or physical functioning. Table 3 shows the results of the statistical analysis using logistic regression, controlling for age, gender, dementia, diagnosis of Parkinson's disease, rheumatoid arthritis, stroke, and vision. In these analyses we found that women had significantly more problems than men with the snap lid bottle. The ability to open decreased significantly with age for the bottle with a snap lid and the blister pack. Elderly persons living in sheltered accommodation performed significantly worse on all types of containers compared to those in their own homes. Rheumatoid arthritis was associated with a decreased ability to open the bottle with a screw cap. Parkinson's disease was correlated with a decreased ability to open the snap lid bottle. Dementia was associated with a marked decrease in the ability to open all the containers. Impaired vision decreased the ability to open the blister pack. If dementia was excluded from the model, there was a significant association between living in a nursing home and a decreased ability to open the snap lid (OR 3.34; 95% CI 1.34–8.29) and the blister pack (2.15; 1.16–3.98) compared to living in one's own home. Introducing MMSE as a covariate in the model cancelled out the association with dementia, as expected, but had no effect on the other correlations.

Figure 1 shows the impact of cognitive impairment, as measured by MMSE score, on the ability to open the medicine containers. The analysis was based on 600

Table 1 Description of the study population and proportion (%) able to open the medicine containers

	<i>n</i>	Screw cap bottle	Snap lid bottle	Blister pack
Total	604	85.8	68.2	90.2
Gender				
Male	135	87.4	84.4	94.8
Female	469	85.3	63.5	88.9
Age group				
81–84	215	88.4	84.7	95.8
85–89	244	88.1	71.7	92.2
90+	145	77.9	37.9	78.6
Housing level				
Own home	493	90.5	76.1	96.3
Sheltered accommodation	62	83.9	48.4	83.9
Institution	49	38.8	14.3	36.7
Medical conditions				
Rheumatoid arthritis	28	71.4	67.9	85.7
Stroke	66	72.7	57.6	80.3
Parkinson's disease	8	62.5	37.5	75.0
Dementia	137	65.0	38.7	67.2
Vision				
Impaired	227	88.5	64.3	90.7
Almost blind	25	72.0	60.0	68.0

Table 2 Comparison between persons who did and did not perform the test, by number of drugs, age, housing, medical conditions, MMSE score, vision and help with medication

	Performed the test (<i>n</i> = 604)	Did not perform the test (<i>n</i> = 79)	<i>P</i>
Number of drugs used	4.52	4.85	ns
Age, y	86.7	88.4	***
Housing, %			***
Own home	81.6	32.9	
Sheltered accommodation	10.3	15.2	
Institution	8.1	51.9	
Rheumatoid arthritis, %	4.6	2.5	ns
Stroke, %	10.9	15.2	ns
Parkinson's disease, %	1.3	1.3	ns
Dementia, %	22.7	65.8	
MMSE score	23.8	15.9	***
Vision, %			
Impaired	38.6	41.1	***
Almost blind	4.3	21.4	***
Receive help with medication, %	23.2	62.0	***

Statistical analyses were made using ANOVA or chi-square test. *** *P* < 0.001.

subjects with recorded MMSE. There was a marked decrease in the ability to open all the containers with decreased cognitive function (*P* < 0.001; in the logistic regression analysis adjusting for age and gender).

Overall, 23.2% reported that they received help with their medication. Table 4 shows that 47.8% of those persons who could not open at least one of the containers received help. The most marked differences were seen between different types of housing. Few of those living in their own homes received help, whereas most of the elderly in sheltered accommodation and all in institutions did. In the older age groups there were more people who received help. There was no significant gender difference in receiving help.

Discussion

In this study we found that the ability to open different kinds of medicine containers declined with increasing age. The change was most obvious for the bottle with a snap lid, which could be opened by only 38% of the elderly over 90 years of age. Our results agree well with earlier studies. Atkin et al.⁸ reported that as many as 63% of a sample of geriatric inpatients could not open one or more of the containers tested. Keram and Williams⁶ study on using child-resistant containers showed that only 38% were able to open the most difficult medicine container. Robbins and Jahnigen⁷ also conducted a study on a child-resistant container and found that 75% of their sample of 72 war veterans were able to open it. Similarly, 71% were

able to open the child-resistant medicine container in the study by Darnell and colleagues⁴. However, all three studies were conducted on small samples of fairly healthy individuals. To our knowledge, this is the first study of the ability to open medicine containers based upon a representative population of elderly.

In addition to the age differences, we found that women performed significantly worse than men in opening the snap lid container. Moreover, there were clear differences between living arrangements. Elderly people living in sheltered accommodation and in institutions were generally less able to open the medicine containers compared to those living in own homes. Among institutionalized elderly, only 14% of those who did the test were able to open the container with a snap lid.

In the adjusted model we found no significant association between living in institutions and reported difficulties in opening the medicine containers whereas a significant association was seen among residents of sheltered accommodation. However, when excluding dementia from the model the association was also significant for nursing home residents, for two of the containers. This indicates that the higher frequency of opening difficulties among elderly people in institutions is largely due to the high prevalence of dementia in these settings. In sheltered accommodation, on the other hand, there may be other factors affecting the ability to open drug containers. These factors are probably more of a physical nature that we have not taken into account. For example, we do not have data about other reasons for

Table 3 The likelihood of being unable to open the medicine containers, by gender, age, housing, rheumatoid arthritis, stroke, Parkinson's disease, dementia and vision

	Bottle with a screw cap	Bottle with a snaplid	Blister pack
Gender (women vs. men)	1.13(0.59–2.15)	4.12 (2.24–7.58)	2.48 (0.87–7.10)
Age (y)	1.05 (0.99–1.12)	1.24 (1.17–1.31)	1.15 (1.06–1.25)
Sheltered accommodation (vs. own home)	5.65 (2.38–13.42)	6.07 (2.11–17.49)	17.91 (6.07–52.79)
Institution(vs. own home)	1.12 (0.49–2.54)	1.82 (0.97–3.40)	2.27 (0.87–5.92)
Rheumatoid arthritis	3.91 (1.53–9.98)	1.40 (0.55–3.58)	3.42 (0.92–12.71)
Stroke	1.73 (0.86–3.46)	1.21 (0.63–2.29)	1.63 (0.68–3.92)
Parkinson's disease	3.33 (0.63–17.60)	12.25 (2.46–61.07)	6.33 (0.80–49.77)
Dementia	4.32 (2.51–7.45)	3.72 (2.31–6.00)	11.40 (5.52–23.54)
Vision	1.19 (0.77–1.85)	1.23 (0.86–1.76)	2.50 (1.41–4.46)

Logistic regression adjusting for age, gender, dementia, rheumatoid arthritis, Parkinson's disease, stroke and vision. Odds ratios with 95% confidence intervals.

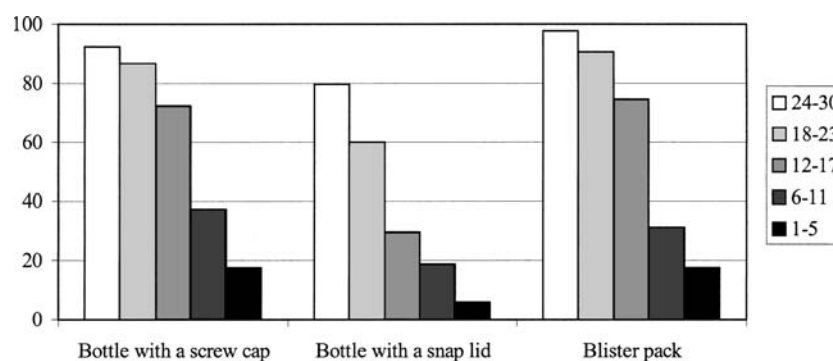


Figure 1 The proportion of elderly (%) who were able to open different kind of medicine containers, correlated to cognitive function as measured by MMSE (n = 600).

Table 4 The percentage of elderly (%) receiving help with their medication, among those who were unable to open one or more of the containers

	n	Percentage that received help	P
Total	224	47.8	
Gender			NS
Male	30	66.7	
Female	194	44.8	
Age groups			*
81–84	50	36.0	
85–89	79	44.3	
90+	95	56.8	
Housing level			***
Own home	147	27.2	
Sheltered accommodation	34	70.6	
Institution	43	100.0	

Statistical analyses were made using chi-square test. * $P < 0.05$, *** $P < 0.001$.

impaired hand function, such as osteoarthritis or general weakness.

Many physical conditions are known to affect hand function, and thereby possibly the ability to open medicine containers. For rheumatoid arthritis this has been known for many years. Glerup and Dengsö¹³ showed that many of the containers for rheumatic

drugs were unacceptable to persons with rheumatoid arthritis. A study by Agnholt and associates¹² reported a similar finding: the time it took for the rheumatic patients to open the container was 40–180% longer than for a reference group of healthy controls. Studies by Verheggen Laming et al.¹⁵ and Lisberg and coworkers¹⁴ investigated how many of the patients with rheumatoid arthritis were able to open containers with rheumatic drugs; both studies showed that suppository packages were very difficult to open.

Today, many containers for anti-rheumatic drugs are designed to be easy to handle. However, the impact of other conditions that may affect the ability to use the hands have not attracted similar attention. In the present study we found that in addition to rheumatoid arthritis, Parkinson's disease and dementia were associated with a decreased ability to open medicine containers. We found no significant association with stroke. However, it is possible that many of the more severe cases of stroke were in the group that did not perform the test.

Cognitive function, as measured by MMSE, was strongly correlated to the ability to open all three kinds of medicine containers. We also observed a decreased ability with impaired vision, although only for the snap lid bottle. Atkin et al.⁸ also correlated the ability to open medicine containers to MMSE and to vision, and found a significant relationship. Nikolaus and colleagues¹⁰ reported a similar result, although in their study only 10% failed to open and take out one tablet from one or more containers. Edelberg et al. used an instrument to test medication management;

a low total score on this test was related to poor cognition as measured with MMSE⁹. Ruscin and Semla reported similar results in their study of medication management. Included in their test was reading and interpreting medication labels, opening safety-capped vials, removing tablets from vials and identifying different colors. All the different tasks as well as the total test were related to cognition and to physical function¹¹.

In the present study we found that less than half of those people who were unable to open one or more of the containers received help with their medication. Help is usually available in sheltered accommodation and institutions and therefore the inability to open medicine containers does not have practical consequences for the patient. However, among people living in own home, representing over 80 % of the studied population, only 27 % reportedly received help.

Our study has some limitations. First, we lack information on the ability to open medicine containers for 79 of the subjects (11.6% of the total cohort). When comparing these missing persons with the rest of the cohort we found that they received a larger proportion of drugs, performed significantly worse on MMSE and were significantly older. Also they were more likely to live in sheltered accommodations or institutions and to receive help with their medication. We can therefore assume that they would have performed poorly in our tests and that our result is an underestimation or the proportion having problems opening their medicine containers. However, as more of them received help with their medication, the underestimation of the clinical problem may not be as great.

Another limitation concerns the medicine containers used for the test. We selected three types of medicine containers that are common on the market today. However, we do not know how representative they are for the types of medicine containers commonly used by older people. People who handle their medication may be familiar with their own containers and may therefore open them more easily. Therefore – although remarkably few of those who could not open the containers reported that they received help with their medication – we do not know to what extent this may have influenced their drug adherence. Future studies should be designed to examine whether older people can open their own medicine containers.

Our data is from 1994 to 1996. We chose this earlier wave (2nd follow-up, 1994–1996) of the Kungsholmen project because it included the data of ability to open containers in a large population of very old people, which could not be obtained in the later two follow-ups (1997–1998 and 1999–2000). There are reasons to believe that our results are relevant today. The containers tested in this study were commonly used for dispensing drugs at the time of the study. Today, two of these containers are still in use, without any changes. The third container has been changed slightly. The most frequently used drug among elderly people today is dispensed in this type of container – a larger version of the snap-lid bottle. Also, recent data from a Swedish survey of elderly people from 2002 showed similar results. Of those persons 81 years and older who could be interviewed directly, 18% could

not open a bottle with a snap lid (M. Parker 2003, Personal communication).

Today, we see an increase in the use of systems whereby tablets are dispensed in unitdoses. That is, all the tablets to be taken at a particular time are packaged together for the individual user. This means that the patient only needs to remember to take the tablets at the correct time. She does not need to remember dosage, nor does she need to open several containers, only the plastic package of the unit dose. Use of this system is on the increase in Sweden. However, it is used mainly in institutions and sheltered accommodations to facilitate the dispensing of tablets otherwise handled by nurses. Also, little is known about the difficulties elderly people may have opening the plastic packages these unit doses are dispensed in.

We did not include childproof containers as a separate item. Drugs are not packaged at Swedish pharmacies. Instead, labels with individual patient information are put directly on the manufacturers' containers in the pharmacy. Every pharmaceutical company has its own containers and most do not use childproof containers.

The pharmacist has a unique opportunity to ask questions concerning medication issues. The patients who have difficulties opening their containers could be easily identified in the consultation. Potential problems can often be solved by switching to another brand or, after consultation with the prescribing physician, by changing the prescription to something that is available in containers that are easier to open.

Conclusion

Effective drug therapy requires correct handling of the drug, including being able to open the medicine container. Our study shows that many elderly people have difficulties opening medicine containers. We also show that somatic, neurological and cognitive disorders may affect the ability to open medicine containers. One should be more aware of this, both in terms of container design and in the pharmacy. Moreover, our results indicate that, many elderly people who have difficulties opening medicine containers live in their own homes and do not receive any help with their medication.

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Conflicts of interest

No conflicts of interest.

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References

- 1 Österlind PO, Bucht G. Drug consumption during the last decade among persons born in 1902 in Umea, Sweden: a longitudinal population study. *Drugs Aging* 1991; 1: 477-86.
- 2 Chrischilles EA, Foley DJ, Wallace RB, Lemke JH, Semla TP, Hanlon JT et al. Use of medications by persons 65 and over: data from the established populations for epidemiologic studies of the elderly. *J Gerontol* 1992; 47(5): M137-44.
- 3 Sherman FT, Warach JD, Libow LS. Child-resistant containers for the elderly. *J Am Med Assoc* 1979; 241(10): 1001-2.
- 4 Darnell JC, Murray MD, Martz BL, Weinberger M. Medication use by ambulatory elderly. An in-home survey. *J Am Geriatr Soc* 1986; 34(1): 1-4.
- 5 Jahnigen DW. Problems with pill packaging. *J Am Geriatr Soc* 1988; 36: 279-80.
- 6 Keram S, Williams ME. Quantifying the ease or difficulty older persons experience in opening medication containers. *J Am Geriatr Soc* 1988; 36(3): 198-201.
- 7 Robbins LJ, Jahnigen DW. Child-resistant packaging and the geriatric patient. *J Am Geriatr Soc* 1984; 32(6): 450-2.
- 8 Atkin PA, Finnegan TP, Ogle SJ, Shenfield GM. Functional ability of patients to manage medication packaging: a survey of geriatric inpatients. *Age Ageing* 1994; 23: 113-6.
- 9 Edelberg HK, Shallenberger E, Wei JY. Medication management capacity in highly functioning community-living older adults: detection of early deficits. *J Am Geriatr Soc* 1999; 47(5): 592-6.
- 10 Nikolaus T, Kruse W, Bach M, Specht-Leible N, Oster P, Schlierf G. Elderly patients' problems with medication. An in-hospital and follow-up study. *Eur J Clin Pharmacol* 1996; 49: 255-9.
- 11 Ruscin JM, Semla TP. Assessment of medication management skills in older outpatients. *Ann Pharmacother* 1996; 30(10): 1083-8.
- 12 Agnholt J, Bendixen K, Fossgreen J. Medicinemballageoplukning af patienter med reumatoid arthritis. *Ugeskr Laeger* 1983; 145(29): 2216-9.
- 13 Glerup E, Dengsö H. Åbning of medicinemballage. *Ugeskr Laeger* 1990; 152(28): 2047-50.
- 14 Lisberg RB, Higham C, Jayson MIV. Problems for rheumatic patients in opening dispensed drug containers. *Br J Rheumatol* 1983; 22145: 95-8.
- 15 Verheggen-Laming BNE, Phiferons H, Mulder EFM, Van Der Meij NT, Van Harten RPW, Dijkmans BAC. Comparison of packages for suppositories by patients with reumatoid arthritis. *Scand J Rheumatol* 1988; 17: 161-5.
- 16 Fratiglioni L, Grut M, Forsell Y, Viitanen M, Grafström M, Holmen K et al. Prevalence of Alzheimer's disease and other dementias in an elderly urban population: relationship with age, sex and education. *Neurology* 1991; 41: 1886-92.
- 17 Fratiglioni L, Viitanen M, Bäckman L, Sandman P-O, Winblad B. Occurrence of dementia in advanced age: the study design of the Kungsholmen project. *Neuroepidemiology* 1992; 11(SUP-PL 1): 29-36.
- 18 Fratiglioni L, Viitanen M, Strauss Evon, Tontodonati V, Herlitz A, Winblad B. Very old women at highest risk of dementia and Alzheimer's disease: incidence data from the Kungsholmen Project, Stockholm. *Neurology* 1997; 48: 132-8.
- 19 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.
- 20 American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 3rd ed., revised (DSM III-R). Washington, DC 1987.