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ORIGINAL INVESTIGATION

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Complex health problems in the oldest old in Sweden 1992–2002

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Abstract Most studies on health trends in the elderly population focus on specific conditions, studied one at a time. However, health problems are often interrelated and exist simultaneously in late life. Individuals with health problems in several domains present special challenges to care services. To estimate future needs for care it may be relevant to study trends of complex health problems as well as single health items. This study identified serious problems in three domains (diseases/symptoms, mobility, cognition/communication) in two representative samples of the Swedish population aged 77 and older (1992: $n = 537$; 2002: $n = 561$). People with serious problems in two or three domains were considered to have complex health problems. Changes between 1992 and 2002 in the prevalence of persons having serious problems in no, one and two/three domains were analyzed with logistic regressions. When examining each domain separately all three showed a significant increase of serious problems. For diseases/symptoms the increase remained significant after controlling for different age and gender distributions in the two surveys. Results showed a significant increase in the prevalence of having problems in one domain, as well as having problems in two or three domains (complex problems). Results persisted when adjusting for different distributions in age, gender and education between 1992 and 2002. Results suggest a worsening of health during the 10-year period and an increase of complex problems. This emphasizes the necessity of cooperation and collaboration between different kinds of medical and social services for elderly people.

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Introduction

Overall survival is increasing, as is the prevalence of chronic conditions that can be medically managed, but that may lead to reductions in life quality as well as needs for medical or social services (Longino and Murphy 1995). A natural consequence of this is that more people live to an old age with chronic conditions (Rosen and Haglund 2001). Several cross-sectional studies have shown that the end of life is dominated by sustained patterns of multiple functional declines (Lunney et al. 2002; Romoren and Blekeseaune 2003). If the prevalence of chronic conditions has increased over time, it is likely that the number of people who have several conditions simultaneously will also increase. If the proportion of the population with multiple chronic conditions and disabilities increases over time, this would have important implications for future policy and resource allocation.

Swedish studies of people who need help from several different care providers have demonstrated the difficulties of coordinating medical and social services (Gurner and Thorslund 2001, 2003). The threshold to institutions has risen in the past decades, with the result that more very frail persons live at home and need medical and rehabilitative services as well as household services (Larsson et al. 2005). At the same time, there have been signs that health in the elderly population has been deteriorating (Parker et al. 2005). People with extensive needs for health and social services represent a special challenge in a care system that is divided in several disciplines and administered by several authorities. Even if all providers have good quality care, the communication and collaboration between different care providers has not always been adequate. Despite numerous services, the total result for the individual is often less than satisfactory.

Research on population health trends over time has mostly focused on specific conditions, studied one at a time, e.g., diabetes, hypertension, stroke, dementia. However, these conditions are interrelated and often exist simultaneously in late life (The Canadian Study of Health and Aging Working Group 2001). With regard to planning the eldercare and medical care system, trends in health indicators that cover several dimensions of health may be an important complement to single variables, which may follow different trends over time. Single variables may not give a comprehensive picture of health status and the necessary integration of medical and social services. Attention to complex health profiles is increasing (Bortz 2002; Fried et al. 2004; Rockwood et al. 2000) but most studies have been cross-sectional at one point of time.

Against this background, this study investigated whether the proportion of people with complex needs has increased over time. We identified serious problems in three domains of health (diseases/symptoms, mobility, cognition/communication) in two representative samples of the Swedish population aged 77+. We then compared the prevalence of having serious problems in no, one or several domains in 1992 with 2002.

Previous research has operationalized several concepts of complexity in health problems in various ways without leading to a consensus, e.g., the concepts of co-morbidity/multi-morbidity, disability and frailty (Markle-Reid and Browne 2003). In clinical research, the importance of multi-morbidity—when two or more diseases are present simultaneously—is now well established (Fillenbaum et al. 2000; Guralnik 1996). Although there is controversy concerning how to measure disability, there is general consensus that it refers to difficulties or dependency in carrying out tasks, often measured by self-reports of limitations in activities of daily living (ADLs). "Frailty" is often used to describe a medical syndrome to identify persons at risk for negative outcomes (death, disability, dependence) and who might benefit from interventions (Fried et al. 2001; Hogan et al. 2003). For example, one study operationalized a phenotype of the clinically frail older adults, based on the presence of three or more core elements: weakness, poor endurance, weight loss, low physical activity and slow gait speed (Fried et al. 2001). Puts et al. (2005a, b) expanded this definition to include psychological markers and introduced a dynamic definition based on change in frailty markers between two time points. Their measure of frailty was associated with negative outcomes independently of disability and chronic disease, thereby demonstrating a unique contribution to risk (Puts et al. 2005a, b, c).

Some researchers have a more biological perspective; they use the term frailty to describe individuals with low reserve capacity and the body's decreased ability to manage complex physiologic stress (Lipsitz 2002).

However, there is a broad overlap between frailty and both disability and multimorbidity. Modified by social, economic and behavioral factors, as well as access to medical care, both multimorbidity and frailty are underlying causes for disability and other adverse health outcomes, including mortality and need for long-term care. Disability may, in turn, exacerbate frailty and multimorbidity (Fried et al. 2004).

Several studies have investigated cross-sectional prevalence rates of frailty or disability at one point of time. Estimations of prevalence rates vary from 6 to 40% and depend highly on how the term was operationalized, age groups studied, as well as whether institutionalized persons and cognitively impaired persons are included. Most studies find higher prevalence rates for women and older age groups (Brayne et al. 2001; Fried et al. 2004; The Canadian Study of Health and Aging Working Group 2001).

Besides cross-sectional estimations of prevalence rates of frailty or disability at one point of time, few population surveys allow the study of change in complex health problems over time. Empirical investigations of health trends in the elderly population have predominantly investigated single health items. Most of these studies concern disability and point toward improvements during the 1980s and early 1990s, e.g., in the USA (Crimmins 2004; Freedman et al. 2002), Sweden (Ahacic et al. 2000, 2003; Lagergren and Batljan 2000; Rosen and Haglund 2005; Steen 2002; Wilhelmson et al. 2002) and Finland (Malmberg et al. 2002). With respect to symptoms and diseases there is no uniform trend. Doblhammer and Kytir (2001) reported that both healthy life-expectancy and the ratio of healthy years to life expectancy increased in Austria between 1978 and 1998. By contrast, results from the USA showed an increasing prevalence of most diseases (Crimmins 2004). Swedish studies also indicated worsening health and function during the 1990s when examining self-reported health items and tests of function (Parker et al. 2005) as well as longstanding illnesses (Rosen and Haglund 2005). There are indications that the trend of health improvement in the elderly population during the 1970s and 1980s does not apply to the 1990s (Lagergren 2004; Larsson and Thorslund 2005).

The study presented here covers physical, functional and cognitive domains that are important for the individual in maintaining well-being and relevant for planning medical care and social services. Our concept of complex health problems is based on population data and includes those persons who have serious problems in two or three of these domains. Complexity is often implicit in frailty and multi-morbidity. Therefore, our definition cuts across concepts of multi-morbidity, disability and frailty. We use the term "complex health problems" to emphasize the implications for the necessary coordination of different kinds of services involved for persons with serious problems in several health domains. In general, symptoms/diseases concern the health care system, mobility problems are mainly handled by social services and/or informal caregivers and persons with serious cognition/communication problems often need help from all three kinds of care providers. Elderly

people with serious problems in several domains (complex health problems) most likely need a mix of services from multiple providers.

Our aim was to describe changes in prevalence rates of persons with serious problems in the three above named domains over time. Changes between 1992 and 2002 of having serious problems in no, one or several domains were analyzed in two representative samples of the Swedish population aged 77 years and older. Institutionalized, cognitively impaired and proxy interviewed persons were included.

Methods

Sample

The Swedish Panel Study of the living conditions of the oldest old (SWEOLD I and II) consists of two surveys from 1992 and 2002 representative of the population aged 77 years or older (1992: $n = 537$; 2002: $n = 561$; approximately 1‰ of the population in this age group) (Lundberg and Thorslund 1996). Table 1 describes the sample characteristics. Prevalence rates over time may be sensitive to a number of methodological features, e.g., question wording, sample frame, the mode of interview and non-response (Freedman et al. 2004). In our study identical items were available for 1992 and 2002. Institutionalized persons were included, and proxy and telephone interviews were carried out when necessary. While non-response was somewhat greater in 2002, distribution of interview mode (direct, proxy, telephone) changed only marginally between the two studies. The percentage of persons living in institutions (13 and 15%) reflects the national average. Age and gender distribution is also reflective of national figures for the two survey years.

Table 1 SWEOLD sample characteristics 1992 and 2002

	1992		2002	
	Percent	*n*	Percent	*n*
Response pattern				
Response	95.4	537	88.5	561
Non-response	4.6	26	11.5	73
Type of interview				
Direct visit interviews	81.8	439	79.9	448
Direct telephone interviews	6.3	34	7.3	41
Proxy interviews	11.9	64	12.8	72
Living situation				
In institutions	12.8	69	14.6	82
In community	87.2	468	85.4	479
Age group				
77–79	25.5	137	20.0	112
80–84	43.4	233	42.1	236
85+	31.1	167	38.0	213
Mean/median age	83.0/82.0	537	83.7/83.0	561
Gender				
Males	39.5	212	40.6	228
Females	60.5	325	59.4	333
Education				
Only grade school (6–8 years)	76.9	413	68.4	384
Beyond grade school	22.5	121	30.7	172
Mean/median years of education	7.4/7.0	534	8.0/7.0	556

Variables

Measures were selected to represent a variety of health and function-related domains. Moreover, in order to make nationally representative estimates for the population aged 77 or older, we only used those measures available for all respondents, even proxy-interviewed and persons living in institutions. This excluded tests of function (with the exception of the cognition test, see below) and subjective evaluations of health. In addition, we selected measures that are less vulnerable to environmental change (e.g., housing standard, assistive technology) and changes in expectations, e.g., we studied changes in mobility instead of the widely used ADL.

Outcome measures

Diseases/symptoms The question was asked "Have you had any of the following diseases or symptoms during the last 12 months?" followed by a list of both diseases and symptoms (Table 2). "No" was coded as 0, "Yes, mild problems" was coded as 1 and "Yes, severe problems" was coded as 3.

Body mass index (BMI) under 16 was coded as severe underweight (3), between 16 and under 22 as mild underweight (1) and 22 or more as not underweight (0) (Andersen 2003).

The summed diseases/symptoms domain ranges from 0 to 42 and a cut-off for "serious health problems" was determined at the highest quintile. The cut-off for the 1992 sample was 9, meaning that persons belonging to the highest quintile had, e.g., at least three severe diseases/symptoms or two severe and three mild. The same cut-off was used for the 2002 sample.

Mobility Mobility was a domain consisting of four items. Respondents were asked if they could walk 100 m fairly briskly without difficulties, walk up stairs, rise from a chair without difficulty and stand without support. Possible responses were "Yes" (0) and "No" (1). Persons having at least three limitations were considered having serious mobility problems, comprising 23.6% of the total sample.

Cognition/communication The survey included items from the Folstein Mini-Mental State Examination (Folstein et al. 1975). Due to interview time constraints, items were selected for a total of 18 of the 30 original points. From the total possible score of 18, a cut-off point was determined using data from a larger Swedish study HARMONY (Gatz et al. 2005; Palmer et al. 2002). In HARMONY, identically scored MMSE items were examined against clinical dementia diagnosis and the cutoff <12 best distinguished demented from non-demented. In our studies, of the 898 respondents who

Table 2 Prevalence rates for mild and severe health problems in 1992 and 2002 and odds ratios for differences between years

	1992 $n = 537$ (%)	2002 $n = 561$ (%)	OR not adjusted	OR adjusted for age, gender	95% CI
Diseases/symptoms					
General fatigue/sleeplessness					
Mild	36.3	43.5	1.35*	1.37*	1.07–1.75
Severe	15.8	22.1	1.51**	1.45*	1.07–1.98
Dizziness					
Mild	28.9	31.0	1.11	1.08	0.83–1.40
Severe	4.8	8.0	1.71*	1.69*	1.03–2.79
Leg ulcers					
Mild	1.5	5.2	3.61**	3.59**	1.62–7.94
Severe	1.3	2.0	1.51	1.40	0.54–3.68
Diabetes					
Mild	7.1	6.8	0.95	0.95	0.59–1.51
Severe	2.8	3.2	1.15	1.18	0.59–2.38
Stomachache					
Mild	13.3	17.5	1.37+	1.38	0.99–1.93
Severe	5.4	5.2	0.96	0.93	0.55–1.59
Myocardial infarction/other heart problems					
Mild	17.0	16.0	0.92	0.88	0.64–1.22
Severe	4.3	7.8	1.90*	1.93*	1.14–3.24
Stroke					
Mild	0.7	3.7	5.18**	4.81**	1.63–14.17
Severe	2.8	2.3	0.83	0.76	0.36–1.63
Breathlessness					
Mild	24.0	26.9	1.17	1.16	0.88–1.53
Severe	6.5	7.3	1.13	1.13	0.70–1.80
Chest pain					
Mild	18.8	15.5	0.79	0.78	0.57–1.07
Severe	6.9	8.6	1.26	1.27	0.81–1.98
Hypertension					
Mild	19.2	20.5	1.09	1.11	0.82–1.49
Severe	3.0	6.4	2.23**	2.39**	1.29–4.39
Joint pain					
Mild	25.3	34.4	1.55***	1.53***	1.18–1.99
Severe	15.8	22.8	1.57**	1.62**	1.19–2.21
Back pain					
Mild	27.0	28.5	1.08	1.08	0.83–1.41
Severe	15.5	23.9	1.72***	1.77***	1.30–2.40
Shoulder pain					
Mild	24.2	30.8	1.40*	1.42*	1.09–1.86
Severe	10.2	12.3	1.23	1.26	0.86–1.84
Low BMI					
Mild	23.5	24.6	1.06	1.02	0.77–1.35
Severe	0.9	0.4	0.38	0.31	0.06–1.63
Multiple diseases/symptoms[a]	20.7	31.7	1.78***	1.78***	1.35–2.35
Mobility limitations					
Cannot walk 100 m fairly briskly without problems	39.9	50.3	1.53***	1.46**	1.13–1.87
Cannot stand without support	12.4	15.9	1.33	1.20	0.84–1.71
Cannot rise from a chair without difficulty	24.4	33.5	1.56**	1.47**	1.11–1.93
Cannot walk up stairs	39.3	43.8	1.20	1.13	0.88–1.45
Serious mobility limitations[b]	20.6	26.9	1.42*	1.30+	0.97–1.74
Cognition/communication					
Cognitive test	11.5	16.9	1.56*	1.48*	1.05–2.10
Did not do cognitive test	2.8	2.7	0.96	0.96	0.46–1.98
Proxy interview	11.9	12.8	1.09	0.96	0.66–1.39
Poor cognition/communication[c]	26.3	32.4	1.35*	1.25	0.95–1.64

$^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

[a] "No" was coded as 0, "Yes, mild problems" was coded as 1 and "Yes, severe problems" was coded as 3. The summed diseases/symptoms domain ranged from 0 to 42. A cut-off (9) for "multiple diseases/symptoms" was determined at the highest quintile for the 1992 sample and the same cut-off was used for the 2002 sample. Persons belonging to the highest quintile had, for example, at least three severe health problems or two severe and three mild

[b] Persons not able to perform at least three of the four activities were coded as having serious mobility problems. Due to missing mobility data, three cases in 1992 and seven in 2002 were excluded

[c] Persons who scored < 12 on the cognitive test, who did not do the test or were not be able to be interviewed directly were considered to have poor cognition/communication

Table 3 Serious problems by combinations of domains

	1992 $n = 534$ (%)	2002 $n = 554$ (%)	OR	OR adjusted for age and gender	95% CI
No severe problems	55.8	42.4	0.59***	0.60***	0.46–0.76
Serious problems in one domain	25.1	31.4	1.35*	1.34*	1.03–1.75
Only poor cognition/communication	11.0	11.7	1.06	1.03	0.71–1.50
Only multiple diseases/symptoms	10.1	14.8	1.53*	1.59*	1.10–2.29
Only serious mobility limitations	3.9	4.9	1.24	1.17	0.65–2.11
Serious problems in 2–3 domains	19.0	26.2	1.49**	1.37*	1.02–1.85
Poor cognition + multiple diseases/symptoms	2.4	4.2	1.72	1.70	0.85–3.41
Poor cognition + serious mobility limitations	8.4	9.2	1.09	0.94	0.61–1.45
Multiple diseases/symptoms + severe mobility limitations	4.1	5.8	1.42	1.40	0.80–2.45
Poor cognition + multiple diseases/symptoms + serious mobility limitations	4.1	7.0	1.75*	1.57	0.91–2.71
Total	100	100			

Prevalence rates for 1992 and 2002 and odds ratios for differences between years. Due to missing mobility data, three cases in 1992 and seven in 2002 were excluded
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

were directly interviewed, 13.1% scored lower than the cut-off and 2.2% did not do the test. For the indirect interviews, we studied interviewer notes and comments from relatives or care personnel concerning the reason for proxy interview. The vast majority of proxy interviewed persons were too sick or weak to participate; common comments were "confused", "demented" and/or "suffering from aphasia". Therefore, respondents who scored below cut-off in the test or did not do the test or were not able to be interviewed directly were coded as having serious cognitive and/or communication problems.

People with serious problems in two or three of the domains were considered to have complex health problems.

Gender and age were recorded for each person. Education was based on years of schooling. This was dichotomized for Table 1 into grade school or above; in the Table 4 analysis it is entered as a continuous variable.

Analysis

Prevalence rates are presented for both time points (as shown in Tables 1–3). In order to adjust for differences in the age and gender distribution between 1992 and 2002, results from binary logistic regressions are presented (as shown in Tables 2–3). Ordered logistic regression was used to analyze the impact of possible confounders, i.e., the point of measurement, age, gender and education on the number of domains with serious limitations (as shown in Table 4). Ordered logistic regressions allow the use of a dependent variable with several categories when there is no assumption about linearity, e.g., the intervals between categories are not necessarily equal.

Results

The first two columns of Table 2 present 1992 and 2002 prevalence rates for all variables separately. Columns 3 and 4 contain odds-ratios from logistic regressions. The third column shows whether the difference between 1992 and 2002 is significant for each variable. The fourth column adjusts for the different age and gender distributions in the two samples.

In all three domains serious problems increased significantly between 1992 and 2002. The increase was highest for the domain of multiple diseases/symptoms, from 21 to 32%. Nine of the 12 items increased, both symptoms (e.g., pain, fatigue/sleeplessness) and diseases (e.g., severe myocardial infarction/other heart prob-

Table 4 Factors related to the number of domains with serious problems (0–3 domains)

	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Year 2002	1.65 ***	1.31–2.06	1.59 ***	1.26–2.01	1.71***	1.35–2.17
Age			1.13 ***	1.10–1.16	1.13***	1.10–1.16
Gender			1.68 ***	1.33–2.14	1.64***	1.29–2.09
Years of education					0.89***	0.85–0.94

Odds ratios for having serious problems in additional domains ($n = 1088$). Due to missing mobility data three cases in 1992 and seven in 2002 were excluded
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

lems). Serious mobility problems were about as common in 1992 as multiple diseases/symptoms but the increase was somewhat lower during the 10-year period (from 21 to 27%). About one-fourth of the persons had poor cognition/communication skills in 1992, compared to almost one-third in 2002.

When controlling for the different age and gender distributions in the two surveys only the increase of multiple diseases/symptoms remained significant. The increase of serious mobility limitations remained significant on a 10%-level.

Table 3 illustrates the proportion of persons having serious problems in no, one and two or three domains as well as prevalence rates of all eight different combinations. The most striking development is that the proportion of persons reporting no serious limitations decreased drastically from 56 to 42%. On the other hand, the proportion of persons with serious problems in one domain increased from 25 to 31% and the proportion of elderly people with serious problems in 2–3 domains increased from 19 to 26%. These trends persisted when controlling for different age and gender distributions.

When examining different combinations of domains with serious problems, "only poor cognition/communication" and "only multiple diseases/symptoms" were most common at both time points. Among all seven possible combinations "multiple diseases/symptoms" was the only one that increased significantly, even when controlling for age and gender distributions. The most vulnerable subset of the population reporting serious limitations in all three domains also increased in absolute terms, from 4 to 7% of the population aged 77+. However, the increase was not significant when considering the higher mean age of the sample in 2002. Prevalence rates for all other combinations showed a slight non-significant increase.

In Table 4 the odds ratios show the odds of being in one category rather than in a "lower" category, i.e., to have serious problems in two or three domains rather than in one and to have serious problems in one domain rather than in none. In the first model, only differences over time were analyzed. Compared to 1992, the odds in 2002 of having serious problems in additional domains were 65% higher. Models 2 and 3 examine if the odds of having serious problems in additional domains in 2002 was influenced by other variables known to be related to health. Age and gender distributions were slightly different in the two waves. However, the results remained significant and rather stable when adding age and gender in model 2. Education is often correlated to health and education levels rose between 1992 and 2002. Adding years of education in model 3 did not change the results.

Controlled for the other three variables, women had 64% higher odds of having additional severe problems compared to men. For every year of age the odds of having additional serious problems increased by 13%. In contrast, for every additional year of education the odds decreased by 11%.

Discussion

Trends in complex health problems are of interest both in absolute terms as well as relative to distributions in gender, age and education. From an epidemiological perspective, it is of interest whether changes in complex health problems over time are independent of changes in the gender, age and educational composition of the population. That is, to what extent are changes due to actual health change rather than compositional changes? From an administrative perspective, nationally representative estimations of raw prevalence rates of complex health problems in the elderly population provide key information for planning appropriate services.

However, most studies considering complexity in health problems have only addressed prevalence rates at one point of time. Studies revealing population health trends, on the other hand, have predominantly examined single items.

The aim of this study was to examine change in complex health problems among the oldest old between 1992 and 2002. Using nationally representative data that included cognitively impaired and institutionalized persons we constructed a measure that reflects serious problems in three domains important for the individual in maintaining well-being and relevant for planning medical care and social services: diseases/symptoms, mobility limitations and cognition/communication problems.

Our results showed that the largest change between 1992 and 2002 was the decrease of elderly people who had no serious problems in any of the three domains. Correspondingly, the proportion of persons with serious problems in one and two to three domains (complex problems) increased significantly. The results remained rather stable when adjusting for age and gender, meaning that complex health problems among the oldest old increased significantly between 1992 and 2002, both with and without considering slightly different age and gender distributions at the two survey waves. Additionally, consistent with previous studies on factors affecting health among elderly people, our results indicated independent significant effects of gender, age and education on the odds of having complex health problems (Crimmins and Saito 2001; Leveille et al. 2000; Melzer et al. 2000; Parker et al. 1994; Thorslund and Lundberg 1994).

When examining the three analyzed domains separately, the proportion of persons who were classified as having serious problems increased significantly between 1992 and 2002 for each of the three domains. The greatest increase occurred in multiple diseases/symptoms. This was the only domain for which the increase in serious problems remained significant when accounting for different age and gender distributions in 1992 and 2002. There was no specific symptom/disease that explained the increase of serious problems in this domain. Rosen and Haglund (2005) also reported increasing

prevalence of longstanding illness among Swedish people aged 64–84 years, an increase that was more pronounced for those with several longstanding illnesses.

Studies considering health problems in the elderly population are often based on samples that do not comprise the entire elderly population. Many studies rely on clinical or administrative data. Clinical studies are often based on single diagnoses. Research using administrative data reflects services rendered, which may differ from the actual needs of services.

Studies also often exclude groups of persons who are most likely to have complex health problems, such as persons who are too sick to participate in an interview, those who are institutionalized and/or cognitively impaired (Brayne et al. 2001; Fried et al. 2001). Compared to many surveys from larger countries the SWEOLD samples are small (Freedman et al. 2002). However, in order to ensure highly representative samples of the Swedish population aged 77 years and older, SWEOLD includes institutionalized, cognitively impaired persons and proxy interviews. Even if the institutionalized population is small its inclusion is important as thresholds for access to institutions change over time, thereby influencing prevalence rates of health problems among those living in the community.

Other issues of survey design can also introduce bias into prevalence rates of health problems over time (Freedman et al. 2004). SWEOLD design and fieldwork was similar in both the years. Non-response was low, although it increased somewhat during the 10-year period. Interview mode, however, changed only marginally. Identical items were used in both years.

Health trend studies capture change in both actual health as well as other factors related to health. Changes over time in self-reported items may be due to actual change but may also be influenced by changes in reporting and environmental modifications. Increased reporting can be a result of greater awareness of a problem, better diagnoses or that it has become more socially acceptable to report some symptoms or diseases.

Self-reported measures of mobility may be vulnerable to changes in expectations but are probably less vulnerable to environmental modifications than ADL (activities of daily living). A study carried out with the same SWEOLD data confirmed the significant worsening of health between 1992 and 2002 when examining tests of function (peak flow, physical performance, cognition). Tests are less vulnerable to reporting differences, rising expectations and environmental modifications (Parker et al. 2005).

Using trends in ADL limitations or disability as a proxy for health, several studies reported health improvements during the 1980s and 1990s. Previous analyses of SWEOLD data, however, found no significant differences in ADL limitations between 1992 and 2002 (Parker et al. 2005). It is important to understand that health problems do not always lead to disability and limitations in ADL's. A decrease in ADL limitations may reflect environmental improvements rather than improvements in health (Spillman 2004). Several studies have shown that diseases have become less closely linked to disability during the 1990s (Crimmins 2004; Rosen and Haglund 2005).

The health measures used in this study are necessarily crude as they were directed to a nationally representative sample of the population aged 77 years and older including cognitively impaired, institutionalized persons and proxy interviews. Therefore, we have made our definition of complexity rather restrictive, setting high thresholds for the three domains: only the highest quintile of symptoms/diagnoses, inability to perform three of four mobility tasks and having at least mild dementia or being unable to communicate with the interviewer. As a consequence, a very vulnerable subset of the elderly population has been identified. Further analysis on this group (not shown) revealed that a majority of these people also had ADL limitations (80% in 1992; 74% in 2002). Also hearing problems (48% in 1992; 54% in 2002) and vision problems (among direct visit interviews: 28% in 1992; 23% in 2002) were common.

Theories of population aging emphasize the interplay of mortality and morbidity patterns with demographic changes in a population (Myers et al. 2003). Over time, morbidity prevalence changes in relation to demographic change. Sweden has one of the world's oldest populations. Results from this study could reflect the emergence of a very frail old population, as proposed by Robine and Michel (2004). Results could also reflect local conditions, as suggested by Deeg (2004), i.e., a cumulative consequence of the supportive environment and care provided by the Swedish welfare state since the 1960s.

As part of the debate whether subsequent cohorts of elderly people tend to have better health, the concept of dynamic equilibrium has emerged, i.e., longer survival is associated with increased less severe morbidity counterbalanced by a decrease in severe morbidity (Manton 1982). Our results, however, suggest that severe and complex health problems among the oldest old increased in Sweden during the 1990s.

The increase of complex health problems among the oldest old in Sweden since the beginning of the 1990s has major implications for health and social-policy. We have probably not yet reached the full impact of life-saving interventions introduced during the past 15 years (Rosen and Haglund 2005). More and more individuals with chronic complex health problems will survive till old age. Many of them will require medical care and various social services. This indicates, of course, the importance of primary prevention in order to have more healthy elderly survivors in the future (Rosen and Haglund 2005). It is important that elderly people with complex medical needs have access to geriatric expertise (Akner 2004). Equally important is that collaboration between medical care and social service providers improves, especially as the ability to navigate the health care system decreases with poor health (Brayne et al. 2001; Fried et al. 2004). This is a central issue since the threshold to

institutions has risen in the past decades, with the result that more very frail persons live at home and need medical and rehabilitative services as well as household services (Larsson et al. 2005). This trend is also reflected in our data as further analyses (not shown) revealed that the proportion of community-dwelling persons with complex health problems has increased between 1992 and 2002, especially among those living alone.

In conclusion, measures of complexity in health problems are useful to achieve nationally representative descriptions of the living conditions of the oldest old as well as for estimations of future needs for eldercare. The increase in the number and proportion of elderly people with complex health problems and needs emphasizes the necessity of improved models for organized collaboration between different care providers.

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