Trends and educational disparities in functional capacity among people aged 65–84 years

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Background This study examined 10 year trends in functional capacity by gender, age, and education among elderly Finns aged 65–84 years, focusing on difficulties in basic activities of daily living (BADL). Educational disparities and their trends in the prevalence of these difficulties were also assessed.

Methods Data were derived from nationally representative monitoring surveys conducted biennially from 1993 to 2003 by the National Public Health Institute (KTL). A total of 5740 men and 5746 women were included in the study (response rate 80%). Activities of daily living (ADL) measures were used to assess levels of functional capacity. Education was divided into two groups: low (0–8 years) and high (9+ years). Age-adjusted trends and logistic regression analyses were computed.

Results A clear downward trend in BADL difficulties was observed in all age groups in both genders. 80–84 year olds had clearly poorer functional ability than 65–69 year olds, even when adjusted for chronic diseases. Despite the overall improvement in functional capacity in both educational groups, low educational status persistently predicted poorer functional capacity. When chronic diseases and survey period were controlled for, the educational disparities attenuated slightly but remained significant.

Conclusions The number of Finnish elderly with BADL difficulties has declined markedly over the past 10 years. However, persistent educational disparities continue to present a challenge to public health initiatives for reducing inequalities in health.

Keywords functional capacity, education, elderly people, trends

A large body of research from various countries indicates that functional capacity among elderly people is improving.1–11 This evidence is encouraging from the policy perspective but also for the independent living and quality of life of elderly people. The positive trend in functional capacity highlights the issue of possible disparities in functional capacity trends between population sub-groups. It is well known that the younger elderly have better functional capacity than their older counterparts.9,12–19 Socioeconomic position according to occupation-based social class, education, or income is another useful dimension to investigate as it is related to health in the general population: the lower the socioeconomic position the worse the health.20–22 Most studies of health inequality have concentrated on working age people. Only recently have health inequalities in later life been addressed in public health research, with studies using different indicators of socioeconomic position, including education, revealing that higher position is associated with better functional capacity.6,18–20,25–29
Data on variations in positive trends in functional capacity according to sociodemographic characteristics such as socioeconomic status would support policy initiatives for preventive health care approaches. However, studies examining trends by population sub-groups are limited and their results somewhat contradictory.3

In order to achieve further improvements in functional capacity of the elderly and to reduce socioeconomic disparities, we need to identify factors underlying the progress that has occurred so far and the differentials. Chronic diseases are among the most important candidates for such factors.10,30

Ability to perform activities of daily living (ADL) is a commonly used measure for determining a person’s functional status. Abilities to perform basic activities of daily living (BADL) (i.e. dressing, bathing, eating), a sub-category of ADL, are necessary together with instrumental activities of daily living (IADL) (i.e. housekeeping, shopping, meal preparation) for independent living. In addition to research on the established framework that examines whether an individual has difficulty in any activities of daily living (ADL), it is also important to analyse trends in age and socioeconomic patterns of BADL abilities, which covers more severe impairments in functional capacity.

The specific aims of this study were (i) to investigate 10 year trends in functional capacity by gender and age among elderly Finns aged 65–84 years, focusing on BADL; (ii) to examine educational disparities in the prevalence of these difficulties as well as in their trends; and (iii) to assess the role of chronic diseases as possible factors underlying recent trends in functional limitations and educational disparities in their prevalence.

Methods
Subjects and data collection
The study was based on nationwide data derived from consecutive biennial nationwide surveys on health behaviour among elderly people conducted by the Department of Epidemiology and Health Promotion of the National Public Health Institute since 1985 (except 1991 when data were not collected).31 The primary purpose of this monitoring system is to obtain information about state of health, functional capacity, lifestyles, and coping with everyday life demands among Finns (including institutionalized people) aged 65–84 years. The postal surveys have involved stratified random samples of 300 men and women in 5 year age groups. Until 1989 the age range was 65–79 years, thereafter 65–84. Thus the first three rounds of data gathering have addressed a total sample of 1800 the later ones of 2400 persons. Altogether, there have been 15 950 respondents since 1985. A question about education has been included in the survey since 1993, and, therefore, 1993–2003 data were used for this study. There was a total of 11 486 respondents aged 65–84 years old in 1993–2003: 5740 men and 5746 women (80% average response rate over the period).

Functional capacity
All the measures used in this study were presented identically in every year of data collection from 1993 to 2003. Functional capacity was examined using five different ADL items: use of stairs and walking outside (mobility items); bathing, dressing, and eating (BADL items) (IADL items were not available for this study). Ability to perform these activities was assessed using the following alternatives: ‘I can’t do this even with assistance’; ‘yes, if someone assists me’; ‘yes, I can perform it alone but it is difficult’; ‘yes, alone without difficulty’. The first three responses were combined as indicating difficulties in functional capacity. An ADL variable was composed comprising three categories as follows: (i) no limitation in any of the five items; (ii) limitation in one or two mobility items but none of the BADL items; and (iii) limitation in at least one BADL item. Almost all respondents (99.3%) with a limitation in BADL were also limited in mobility.

Period, age, and education
In order to study secular trends in functional capacity, study years were combined into blocks of two consecutive survey years (1993 and 1995; 1997 and 1999; 2001 and 2003) to increase the number of observations for the periods. Response rates for these periods were 83, 77, and 79%, respectively. The basic demographic variables used in this study were gender, age, and education. Participants were divided into four 5 year age groups (65–69, 70–74, 75–79, 80–84). Information about education was based on the question: ‘How many years in all have you attended school or studied full time? Elementary school is included’. Reported years of education were divided into two groups: the lower educational group included those who had studied none to 8 years (at least elementary but not secondary school), and the higher group included those who had studied 9 years or more (at least secondary school).

Other independent variables
In addition to gender, age, and education, four additional variables were formed. Based on the question: ‘In the past year, have you been diagnosed with or treated for the following illnesses by a doctor’, three dichotomous variables were constructed to indicate whether the subject had a cardiovascular disease or diabetes (CVD/DM) (high blood pressure/hypertension, myocardial infarction, angina pectoris/coronary disease, heart failure, diabetes), a musculoskeletal disease (MSD) (rheumatoid arthritis, other arthritic illness, degenerative disk disease/other back illness), or chronic bronchitis/emphysema. Furthermore, we included depressive symptoms with the question: ‘In the past month (30 days) have you had the following symptoms or ailments’, followed by a list including depression. Disease variables and symptom variable were dichotomized as: 0 = no disease/depressive symptom present, 1 = one or more diseases, or depressive symptom present.

Statistical methods
We first described the distribution of functional capacity during the first and the last period by gender and age group using the three-category ADL variable. To form comparable survey periods, direct age adjustment based on the general population of Finland was performed (year 2003 was the reference population). A logistic regression model was then computed to evaluate differences in functional ability between subgroups. Age-adjusted odds ratios plus 95% CIs for each independent variable separately were first calculated. Then all independent variables (age, education, survey period, chronic diseases, and depressive symptom) were included simultaneously into the model. In addition, interactions of the
Results

The characteristics of the sample by survey period are shown in Table 1. Finland’s education structure has evolved rapidly. While in the early 1990s only ~20% of older people had 9 years or more of education, by the early 2000s the corresponding figure for men was 32% and for women 37%.

BADL difficulties decreased over time (Figure 1). This development was statistically significant in all age groups except 70- to 74-year-old men when the first and last survey periods were compared (Table 2). According to the age-adjusted figures the positive trend of BADL difficulties was similar in both genders: the prevalence among men declined from 16% in the early 1990s to 10% in the early 2000s, and among women from 18 to 10%.

The prevalence of BADL difficulties decreased significantly in both educational groups between the first and last survey periods (Figure 2 and Table 2). However, the educational disparities in BADL difficulties persisted among men and women throughout the survey period (Figure 2): those with none to 8 years of education had a clearly higher prevalence of BADL difficulties than those with 9 years or more.

The age-adjusted total figures revealed that difficulties only in mobility increased among women and remained somewhat the same among men. The prevalence with no ADL limitations increased from 1993–1995 to 2001–2003, especially in men and particularly among those aged 65–69 and 75–79. Among women the trend was rather even. Although differences in BADL difficulties by age and education were clear, these disparities remained the same over time in terms of interaction test (age: men $P = 0.513$, women $P = 0.439$; education: men $P = 0.328$, women $P = 0.242$) (not shown in tables).

Difficulties in mobility in both educational groups remained at the same level over time among men but increased among women. Educational disparities only in mobility limitation were seen solely among women (Figure 2).

BADL limitations increased with age (Table 3). According to the regression model, 80–84 year olds (men: $OR = 6.12$, 95% CI 4.75–7.87, women: $OR = 8.18$, 95% CI 6.28–10.67) had clearly poorer functional ability than 65–69 year olds in terms of BADL difficulties. After controlling for multiple factors (education, survey period, area of living, chronic diseases, and depressive symptom) age disparities in functional ability attenuated only slightly.

Although improved functional ability occurred among men and women of both educational groups (Table 2), educational disparities persisted. In 2001–2003, those with 9 or more years of education (men: $OR = 0.50$, 95% CI 0.40–0.62, women: $OR = 0.45$, 95% CI 0.36–0.56) had better functional ability than those with 8 years or less of education (Table 3). After controlling for multiple factors in Model 2 (age, survey period, chronic diseases, and depressive symptom), the educational disparities attenuated slightly but remained statistically significant.

BADL difficulties decreased statistically significantly over time (Table 3). All the disease/symptom variables were significantly associated with BADL difficulties. The strongest association was found between a depressive symptom and BADL difficulty (simultaneously adjusted OR for men was 4.09, for women 2.88). However, adjusting for possible changes in self-reported chronic diseases did not have a marked influence on the decline in BADL difficulties.

Discussion

The main findings of the present study were: (i) The proportion of elderly people in Finland with BADL difficulty decreased markedly between the early 1990s and early 2000s. This improvement covered all age groups, but age disparities remained somewhat similar. The oldest men and women clearly had the poorest functional capacity. (ii) Educational disparities in BADL restrictions persisted over the period: the higher the level of education the better the functional capacity. This association remained after adjusting for several factors including diseases. (iii) Depression was strongly related to BADL. Self-reported diseases were associated with functional impairments. However, controlling for this had little influence on the minor secular changes of educational disparities in functional capacity.

The high response rate throughout the study period indicates good external validity of this biennially collected nationwide
This study provides a truly nationally representative picture of trends in functional capacity. According to Freedman et al., data on trends in disparities by education are limited, and the few studies conducted have produced somewhat mixed results. Our report thus complements this important field.

Self-reporting based on postal surveys might produce only a rather general picture of the issues studied. Further bias may arise from inaccurate and incomplete reporting. As institutionalized elderly were underrepresented in this data, the results might be slightly more positive than in the entire population of Finnish elderly. Whether other non-respondents differ in their level of functional capacity is unexplored. A high number of non-respondents may bias results concerning functional capacity and other health outcomes. In the present study, however, the prevalence of non-response was rather low and stable over time periods (17–23% by survey periods), so any differences in functional capacity between respondents and non-respondents among elderly people in Finland can be assumed not to have greatly biased these trend results.

ADL measures have been found to associate with more objective performance tests. Despite the rather limited number of ADLs in our study, the items used can be considered crucial as far as independent functioning is concerned. Any comparison of results between different studies should take into account the variety of settings and instruments that have been used to assess functional capacity. Nevertheless, the general trends of improving functional capacity previously observed are in line with the present study. Our results also accord with earlier findings concerning age and education. Controlling for chronic diseases slightly attenuated the educational disparities, although large differences remained unexplained by these factors. This finding may suggest that several important explanatory factors generating educational disparities were not considered here, such as environmental and behavioural influences, among others.

The finding suggesting only slight improvement of functional capacity among women as defined by no difficulties in ADL overall does not address possible changes in different categories of ADL difficulties. A more detailed examination revealed that over the study period a shift occurred from multiple ADL difficulties to difficulties only in mobility. This emphasizes the importance of opening up the ADL parameters and studying different categories of functional impairment.

An interesting overall finding in the present study was that although BADL difficulties declined, total disability remained about the same. Statistics from Finland indicate that difficulties in using stairs have not improved at the same pace as difficulties in walking outside and difficulties in BADL. It may well be that improvements in infrastructure (e.g. better pedestrian pathways) and in basic home facilities have contributed to the positive trends in ADL, whereas the use of stairs has continued to require the same amount of physical effort despite other developments.

Health care traditionally deals with health-related problems after they have already emerged. The expanding ageing population and the challenge of maintaining access to health care becomes increasingly important. A comprehensive understanding of trends in functional capacity is crucial for planning and evaluating health care strategies.

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<td></td>
<td>Difficulty in BADL</td>
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<td></td>
<td>Men</td>
<td>Women</td>
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<tr>
<td>Age group</td>
<td>OR; 95 % CI</td>
<td>OR; 95 % CI</td>
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<tr>
<td>65–69</td>
<td>0.45; 0.26–0.77</td>
<td>0.50; 0.28–0.88</td>
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<td>70–74</td>
<td>0.67; 0.44–1.08</td>
<td>0.35; 0.21–0.57</td>
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<td>75–79</td>
<td>0.49; 0.35–0.69</td>
<td>0.56; 0.39–0.80</td>
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<td>80–84</td>
<td>0.68; 0.51–0.91</td>
<td>0.54; 0.40–0.74</td>
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<td>65–84a</td>
<td>0.59; 0.49–0.71</td>
<td>0.50; 0.41–0.61</td>
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<td>Education</td>
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<td>0–8 yearsa</td>
<td>0.66; 0.54–0.82</td>
<td>0.57; 0.45–0.71</td>
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<td>9+ yearsa</td>
<td>0.45; 0.28–0.72</td>
<td>0.39; 0.24–0.64</td>
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a Age adjusted.
Odds ratio (OR) with 95% confidence interval (CI).
services require that preventive approaches to functional capacity issues and health in general receive more urgent priority than ever before.

This study provides useful data for health and welfare policy as difficulties in functional capacity are known to predict higher use of hospital services.35–38

Figure 2  Age-adjusted distribution of BADL and mobility difficulties by education in 1993–1995 and 2001–2003 for men and women (%)

Table 3  Associations of BADL difficulties with sociodemographic and disease/symptom variables for men and women

<table>
<thead>
<tr>
<th>Age</th>
<th>Model 1a</th>
<th>Model 2b</th>
<th>Model 1a</th>
<th>Model 2b</th>
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<tr>
<td>65–69</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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<tr>
<td>70–74</td>
<td>1.58 (1.19–2.10)</td>
<td>1.40 (1.04–1.89)</td>
<td>1.84 (1.37–2.48)</td>
<td>1.77 (1.29–2.43)</td>
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<tr>
<td>75–79</td>
<td>3.60 (2.77–4.66)</td>
<td>2.99 (2.28–3.93)</td>
<td>3.75 (2.84–4.95)</td>
<td>3.14 (2.34–4.21)</td>
</tr>
<tr>
<td>80–84</td>
<td>6.12 (4.75–7.87)</td>
<td>5.41 (4.15–7.05)</td>
<td>8.18 (6.28–10.67)</td>
<td>6.80 (5.12–9.02)</td>
</tr>
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Survey period

| 1993–1995 | 1.00     | 1.00     | 1.00     | 1.00     |
| 1997–1999 | 0.70 (0.58–0.84) | 0.73 (0.60–0.88) | 0.71 (0.59–0.85) | 0.74 (0.60–0.90) |
| 2001–2003 | 0.58 (0.48–0.70) | 0.63 (0.52–0.77) | 0.50 (0.41–0.60) | 0.55 (0.45–0.68) |

Education

| 0–8 years | 1.00     | 1.00     | 1.00     | 1.00     |
| 9+ years  | 0.50 (0.40–0.62) | 0.55 (0.44–0.69) | 0.45 (0.36–0.56) | 0.52 (0.41–0.65) |

CVD/DM

| No        | 1.00     | 1.00     | 1.00     | 1.00     |
| Yes       | 1.72 (1.46–2.02) | 1.56 (1.32–1.86) | 1.88 (1.58–2.24) | 1.70 (1.41–2.05) |

MSD

| No        | 1.00     | 1.00     | 1.00     | 1.00     |
| Yes       | 1.63 (1.40–1.91) | 1.39 (1.18–1.65) | 2.06 (1.75–2.41) | 1.81 (1.52–2.15) |

Chronic bronchitis/emphysema

| No        | 1.00     | 1.00     | 1.00     | 1.00     |
| Yes       | 2.14 (1.72–2.66) | 1.63 (1.28–2.06) | 1.79 (1.34–2.39) | 1.43 (1.04–1.95) |

Depressive symptom

| No        | 1.00     | 1.00     | 1.00     | 1.00     |
| Yes       | 4.52 (3.70–5.53) | 4.09 (3.31–5.04) | 3.48 (2.88–4.21) | 2.88 (2.35–3.52) |

Logistic regression with odds ratios (OR) and their 95% confidence interval (CI).

a  Model 1. Age adjusted.
b  Model 2. Simultaneously adjusted with the variables in the model.

The rapid decline in the prevalence of difficulties in BADL is important information for those implementing health policy actions. If this positive trend continues the future elderly will most certainly enjoy higher levels of independence than has ever occurred before. However, the residual educational disparities in functional capacity continue to present a challenge...
to public health approaches aimed at reducing inequalities in health. Furthermore, challenges such as increasing obesity figures of the population might pose a threat to the future disability trends.

**KEY MESSAGES**

- The proportion of elderly people in Finland with BADL difficulty decreased markedly between the early 1990s and early 2000s.
- This improvement covered all age groups, but age disparities remained somewhat similar. The oldest men and women clearly had the poorest functional capacity.
- Educational disparities in BADL restrictions persisted over the period: the higher the level of education the better the functional capacity.

**References**

Commentary: Dissecting disability
trends—concepts, measures, and explanations

Vicki A Freedman1* and Linda G Martin2

A fundamental question at the intersection of the epidemiology and demography of aging is whether mortality declines in late life are accompanied by a compression or expansion of morbidity and disability. The answer has both theoretical implications and practical consequences for many nations now facing population aging.

Sulander and colleagues3 find that the proportion of older people in Finland with difficulty in basic activities of daily living (BADLs; bathing, dressing, or eating) decreased between the early 1990s and early 2000s. Difficulty with only mobility (not with BADLs) increased for women and was flat for men. And educational gaps in BADLs persisted over the period. These findings join studies from the US and other industrialized countries in suggesting that disability may be declining in late life while socioeconomic disparities are persisting or growing.1

What are the challenges in interpreting this accumulating evidence and advancing our understanding of the implications of lengthening life? We believe three topics will continue to confront researchers in this line of inquiry: (i) linking measures of disability to clear concepts; (ii) ensuring validity of comparisons based on survey data; and (iii) moving beyond disparities to understand causal mechanisms.

Linking clear concepts to measures of disability

Over the last few decades, the world’s understanding of disability has evolved from a classic medical model, which attributes disability to underlying chronic conditions and impairments, to one that recognizes disability as a gap between functional ability (e.g. reaching, bending, walking) and the demands of the environment.2,3 Nevertheless, in practice the term disability and its measurement have been applied inconsistently. Even one of the most widely used scales to measure personal-care disability in old age, the Index of Activities of Daily Living,4 has many incarnations, not all of which measure the same concepts. Some surveys ask whether respondents have difficulty (generally but not always with accommodations, e.g. help or equipment); others ask about the need for help or inability to complete the activity without help; still others ask about the use of accommodations, that is, whether individuals get help or use special equipment. These wording differences are not only important conceptually but may yield quite different prevalence levels and trends.3

The Sulander paper combines individuals who cannot do activities even with assistance with individuals reporting they can carry out an activity with assistance and those who report