Henrik Brønnum-Hansen[1], Otto Andersen[2], Mette Kjøller[1], Niels Kristian Rasmussen[1]

Originalartikel | Original article

[1] *National Institute of Public Health, Copenhagen*

[2] *Statistics Denmark, Copenhagen*

Social gradient in life expectancy and health expectancy in Denmark

Summary

Objectives: Health status of a population can be evaluated by health expectancy expressed as average lifetime in various states of health. The purpose of the study was to compare health expectancy in population groups at high, medium and low educational levels.

Methods: Health interview data were combined with life table figures using Sullivan's method.

Results: Life expectancy was 4.3 years longer for 30-year-old men with a high educational level than for those with a low level. At age 30, the proportion of expected lifetime in self-rated good health was 67.7 %, 76.1 % and 82.3 % for men with a low, medium and high educational level, respectively. Among women, life expectancy differed by 2.7 years between low and high educational level, and the proportion of expected lifetime in self-rated good health was 62.5 % at the low and 80.5 % at the high educational level.

Conclusions: Educational level and life expectancy are clearly related. The social gradient in terms of health expectancy is even greater than that in terms of life expectancy.

Keywords: Life expectancy – Health expectancy – Social inequality – Education.

Life expectancy has frequently been used as an indicator of public health; another indicator, health expectancy, was introduced in the 1970s. Life expectancy is a quantitative measure of expected average length of life, while health expectancy represents the average lifetime in good health. Health policy focus on health expectancy has increased, particularly in countries characterised by an aging population because a longer life and a healthier life do not necessarily go together. The indicator has been promoted internationally by the World Health Organisation through the "Health for All" programs and in Denmark by the Danish Government Programme on Public Health and Health Promotion (2000). Health expectancy combines morbidity and mortality in a single indicator and can be used to describe differences in health status between population groups, for instance between groups with different social status. As reported earlier (Lynch & Kaplan 1997; Mackenbach et al. 1997) social status is a strong determinant of population health, the average health status of people with low social status being poorer than that of people with high social status, no matter how health status is measured or how the social structure is described.

According to Juel et al. (2000) life expectancy in Denmark since the middle of the 1970s has increased more slowly than in other industrialised countries. During the period 1975–2000, life expectancy in Denmark increased from 71.1 to 74.5 years for men and from 76.8 to 79.2 years for women and this increase occurred mainly from the mid 1990s. Expected lifetime in good health improved only slightly for men between 1987 and 1994, whereas it deteriorated for women as shown by Brønnum-Hansen (1998). Ingerslev et al. (1994) and Andersen et al. (2001) demonstrated that in Denmark, social differences in mortality are considerable and social differences in self-reported health and morbidity in Denmark was documented by Lissau et al. (2001).

Brønnum-Hansen (2000) reported differences in health expectancy between socio-economic groups in Denmark in the late 1980s, which was a period of recession and high unemployment rates. The socio-economic differences in health expectancy were more pronounced than in life expectancy. Similar conclusions were reached in Austria (Doblhammer & Kytir 1998), Canada (Wilkins & Adams 1983), England and Wales (Bebbington 1993; Melzer et al. 2000), France (Cambois et al. 2001), the Netherlands (van den Bos & van der Maas 1993; van de Water et al. 1996), New Zealand

Soz.- Präventivmed. 49 (2004) 36–41
0303-8408/04/010036–6
DOI 10.1007/s000038-003-3003-9

(Davis et al. 2000), Spain (Gutiérrez-Fisac et al. 2000) and the USA (Guralnik et al. 1993; Land et al. 1994; Crimmins et al. 1996; Crimmins & Saito 2001). However, it is difficult to make detailed comparisons between countries, as health status indicators vary according to the health survey questions asked, the answer categories and the formulation of answers. Although ongoing attempts to harmonize self-reported health measurements will improve comparability between countries, comparisons will remain difficult because of cultural differences as reported by Jylhä et al. (1998) and Cambois & Robine (1996) and because of differences in the definition of social status by education, occupation or income. Even when, for instance, education is chosen, the classification is not exactly the same. Differences in health expectancy according to education have been studied in Finland and Norway by Valkonen et al. (1997) and Sihvonen et al. (1998), in Austria by Doblhammer & Kytir (1998), in the Netherlands by van de Water et al. (1996), and in the USA by Guralnik et al. (1993), Land et al. (1994), Crimmins et al. (1996) and Crimmins & Saito (2001), and education was included in an ecological study in Spain reported by Gutiérrez-Fisac et al. (2000).

Social inequality is usually measured by occupational position, income or educational level. The social variables are strongly related, but while occupation may change during a person's lifetime education does not change much as people grow older. For instance, the occupation and income of a person are sensitive to market fluctuations and the person's health and when the retirement age is reached socio-economic status changes to pensioner while educational level remains unchanged. Since the previous Danish study of socioeconomic differences in health expectancy a new health interview survey has been conducted in 2000 the size of which was expanded compared to previous surveys. Also more data at Statistics Denmark have been processed. Thus, the upper age limit of available data on education has increased by 10 years so these data are now available up to the age of 75. And whereas register data at Statistics Denmark on former occupation for retired persons are missing, data of education are preserved. Because national registers in Denmark can be linked at the individual level on the basis of a unique personal identification code assigned to all Danish citizens life tables for various educational groups can be calculated directly.

The purpose of the study was to estimate life expectancy and health expectancy in Denmark at the end of the 20th century. The analysis focused on the distribution of life expectancy, expected lifetime in self-rated good health and lifetime without long-standing illness in various social groups defined by educational level.

Material and methods

For the Danish Health Interview Survey 2000, a sample of 22 486 individuals aged 16 or more was drawn from the Danish Civil Registration System. The sample was stratified to ensure sufficient data for each county of Denmark. In order to eliminate seasonal variation, the interviews were conducted in three rounds, in February, May and September 2000, the samples comprising 6557, 6797 and 9132, respectively. Carefully trained professionals from the Danish National Institute of Social Research interviewed 16690 persons (74.2% of the sample). 22.4% refused to participate, 1.3% did not participate because of illness or handicap and 1.2% were not found at home. The non-response rate was the same among men and women, but increased with increasing age for women while it was almost independent of age for men. Further, non-response was highest among people living in the metropolitan area, and comparisons according to marital status showed the lowest non-response rate among married men and widowers. Details and results of the survey have been reported recently by Davidsen & Kjøller (2002) and the National Institute of Public Health (2002).

Self-rated health was measured by answers to the question: "How do you rate your present state of health in general?" The five original response categories (really good, good, fair, poor and very poor) were dichotomised into "good" and "fair or poor". Long-standing illness was measured by answers to the question "Do you suffer from any long-standing illness, long-standing after-effect of injury, any disability, or other long-standing condition?" Questions about schooling, vocational training and further education were also asked.

The core of Statistics Denmark national registers on education and occupation are the census of 1970. Since 1980 educational data have been reported through the Ministry of Education and are updated annually. Life tables for the period 1996–2000 were constructed for various educational groups in Denmark by linking Statistics Denmark registers on vital status and education for all Danish inhabitants. Because the 1970 census did not include educational data for persons older than 50 information on education was not available for people over 75 in 1995. Therefore, the mortality rates for all educational groups were assumed to be equal after that age.

Educational level was defined on the basis of the Danish Educational Nomenclature, which is an adaptation of UNESCO's International Standard Classification of Education. We combined data on schooling, vocational training and further education and defined three levels of education: low, i.e., persons with a maximum of 10 years of schooling and no more than semi-skilled training, basic vocational training or business school (first year); medium, i.e., persons with either

a maximum of 10 years of schooling and further vocational or other training or with post-secondary schooling but no higher education; and high, i.e., persons with any type of higher education. This information was available from the Health Interview Survey and from the Statistics Denmark register except for people over 75. In the Health Interview Survey, educational level for Danes over 30 was unclassifiable or not stated for only five persons. Data from the Statistics Denmark register on educational status were unclassified or missing for about 2.5 % of the 30- to 74-year-olds. Health expectancy was estimated for 30-year-olds by assuming that most people had finished their education by that age.

Health expectancy per educational group was calculated by Sullivan's method (1971), combining life tables and prevalence rates of health status. The expected number of years lived in the age intervals 30–34, 35–39, …, 70–74, ≥ 75 were calculated on the basis of the life table figures and multiplied by age-specific proportions of healthy people taken from the health survey data. Health expectancy for 30-year-olds was then calculated by adding these years for all age groups and dividing the sum by the number of survivors at age 30. By relating health expectancy to life expectancy, a measure of the proportion of lifetime in good health was established. The variance in health status prevalence rates was estimated with weights to compensate for the stratification in the health survey sample and confidence intervals were calculated from the formulae suggested by the International Network on Health Expectancy and reported by Jagger et al. (2001).

Results

Table 1 shows life expectancy, expected lifetime in self-rated good, fair or poor health and the proportion of expected lifetime in self-rated good health at age 30. The life expectancy of a 30-year-old man was 45.2 years, 34.2 of which were expected to be spent in good health and 10.9 in fair or poor health (see row "All" in Table 1, which also includes individuals for whom data on education were unclassifiable or missing). The life expectancy of a man with a high educational level was 47.8 years, with 39.3 years in good health and 8.5 in fair or poor health, while that of a man with a low educational level was reduced to 43.5 years, 29.5 of which were expected to be spent in good health and 14.0 in fair or poor health. Substantial differences in life expectancy and health expectancy between educational groups were also seen for women.

Women live longer than men and could expect both more years in self-rated good health and more years in fair or poor health than men (Tab. 1). The proportion of expected lifetime in good health was higher for men than for women and from the confidence intervals in Table 1 it appears that this difference between the sexes was statistically significant for people at low or medium educational levels but was less pronounced for people at a high educational level.

A 30-year-old man could expect 25.0 years without long-standing illness, corresponding to 55.3 % of the rest of his life (Tab. 2). The gain in life expectancy due to higher education consisted mainly of years without long-standing illness, as the differences between educational groups in expected lifetime spent with long-standing illness were modest. Thus, lifetime with long-standing illness varied from 19 to 21 years. For women, the differences between educational groups in expected lifetime with and without long-standing illness were less pronounced than for men (Tab. 2).

Table 1 Life expectancy, expected lifetime in self-rated good, fair or poor health and proportion of expected lifetime in self-rated good health at age 30 in Denmark, 2000, by educational level

Level of education	Life expectancy	Expected lifetime in self-rated good health		Expected lifetime in self-rated fair or poor health		Proportion of expected lifetime in self-rated good health	
	years	years	(95 % CI)	years	(95 % CI)	%	(95 % CI)
Men							
High	47.8	39.3	(38.3–40.3)	8.5	(7.4– 9.5)	82.3	(80.2–84.4)
Medium	45.5	34.7	(34.0–35.3)	10.9	(10.2–11.6)	76.1	(74.6–77.6)
Low	43.5	29.5	(28.4–30.5)	14.0	(13.0–15.0)	67.7	(65.4–70.1)
All[a]	45.2	34.2	(33.7–34.7)	10.9	(10.5–11.4)	75.8	(74.7–76.8)
Women							
High	51.3	41.3	(40.0–42.5)	10.0	(8.7–11.3)	80.5	(78.0–83.0)
Medium	50.4	35.5	(34.6–36.5)	14.8	(13.9–15.8)	70.5	(68.6–72.4)
Low	48.6	30.4	(29.3–31.4)	18.2	(17.2–19.3)	62.5	(60.4–64.6)
All[a]	49.6	35.4	(34.8–35.9)	14.2	(13.7–14.8)	71.3	(70.2–72.4)

[a] Including individuals for whom data on education were unclassifiable or missing
CI: confidence interval

Table 2 Life expectancy, expected lifetime with and without long-standing illness and proportion of expected lifetime without long-standing illness at age 30 in Denmark, 2000, by educational level

Level of education	Life expectancy	Expected lifetime without long-standing illness		Expected lifetime with long-standing illness		Proportion of expected lifetime without long-standing illness	
	years	years	(95 % CI)	years	(95 % CI)	%	(95 % CI)
Men							
High	47.8	29.2	(27.9–30.4)	18.6	(17.4–19.9)	61.0	(58.4–63.6)
Medium	45.5	25.0	(24.2–25.7)	20.6	(19.8–21.4)	54.8	(53.1–56.6)
Low	43.5	22.1	(21.0–23.2)	21.4	(20.3–22.5)	50.8	(48.2–53.3)
All[a]	45.2	25.0	(24.4–25.5)	20.2	(19.6–20.7)	55.3	(54.1–56.6)
Women							
High	51.3	28.1	(26.6–29.5)	23.2	(21.7–24.6)	54.8	(51.9–57.6)
Medium	50.4	27.0	(26.0–28.0)	23.3	(22.3–24.4)	53.6	(51.6–55.7)
Low	48.6	23.8	(22.7–24.9)	24.8	(23.7–25.9)	48.9	(46.7–51.2)
All[a]	49.6	26.5	(25.9–27.1)	23.1	(22.5–23.7)	53.4	(52.2–54.6)

[a] Including individuals for whom data on education were unclassifiable or missing
CI: confidence interval

Discussion

We found a clear social gradient in life expectancy and an even steeper gradient with respect to expected lifetime in self-rated good health. Thus, expected life years in self-rated good health increased and expected years spent in self-rated fair or poor health decreased with increasing educational level. A gradient was also seen for expected lifetime without long-standing illness, although the expected years spent with long-standing illness did not differ much between educational groups.

Our study has the strength that the life tables by educational level are based on data for all inhabitants of Denmark younger than 75 established from national registers by linkage at the individual level through the unique personal identification number. As sex- and age-specific death rates were calculated exactly within each educational level also life tables could be constructed exactly apart from figures for the elderly, because Statistics Denmark has no information about educational level for people over 75. This lack did not introduce a serious bias into this study as it is related to the systematic data collection procedure at Statistics Denmark and not a matter of non-response. The assumption that the mortality rates after age 75 were equal for all educational groups could not have influenced the results noticeably. Only for about 2.5 % of the 30- to 74-year-olds education was not classifiable or data on educational level were missing from the Statistics Denmark register. Because the survey and register data were not linked at the individual level, however, it was not possible to determine differential response rates among educational groups. Studies of the health status of respondents and non-respondents show some inconsistency, but most of them show that individuals in poor health are more likely to be non-respondents as reported by others (van den Akker et al. 1998; Osler & Schroll 1992; Vestbo & Rasmussen 1992). This selection bias would tend to result in underestimates of differences in health expectancy between educational groups if non-respondents with a high educational level were healthier than non-respondents with a low educational level.

Some of our results are comparable to those found in other Nordic countries in the late 1980s. A study of Sihvonen and colleagues (1998) estimated the difference in expected lifetime in fair or poor health of people aged 25–75 with low and high levels of education to be 9.6 and 11.3 years for men and 11.4 and 13.3 years for women in Finland and Norway, respectively. These figures are higher than our estimates, partial life expectancy in fair or poor health of people aged 25–75 being 5.7 and 9.1 years longer for men and women with a low educational level than for those with a high educational level (data not shown). In Austria in 1991, 30-year-old men at higher and lower educational levels could expect to live 41.6 years and 39.2 years more, respectively, before the age of 75 and partial life expectancy (restricted to the age interval 30–75) in self-rated good or fair health was 39.8 years for men at a high educational level and 35.6 years for men at a low educational level according to Doblhammer & Kytir (1998). Similar results were found for women, although the differences between educational groups were slightly less marked than for men. In the Dutch study of health expectancy in 1990 reported by van de Water et al. (1996), the difference in expected lifetime in self-rated good health between men at the highest and the lowest educational level was 12.6 years.

The Danish study reported by Brønnum-Hansen (2000) on differences in health expectancy by occupational group in the late 1980s demonstrated a clear social gradient and a striking difference between economically active and inactive people. The group of economically inactive comprised

11 % men and 26 % women between 30 and 65. Despite the recession and high unemployment rates in the late 1980s a significant proportion of the group of economically inactive people consisted of disability pensioners, social welfare recipients and others who almost by definition had a poor health. Lissau et al. (2001) reported that women in general and people at a low educational level experienced a higher risk of being marginalized to the group of economically inactive because of health problems than men and people at a high educational level. Thus, health expectancy in the economically active groups may in general be favoured because unhealthy people are marginalized. In particular health expectancy among the occupational groups characterised by a high educational level is favoured. Despite the differences in variables chosen in the previous and the present studies the common conclusion can be drawn that social inequality is more marked as regards health expectancy than life expectancy.

Acknowledgements
The study was funded by The Danish Ministry of Health grant for research and analysis.

Zusammenfassung

Soziales Gefälle in der Lebenserwartung und der gesundheitlichen Erwartung in Dänemark

Fragestellung: Der Gesundheitszustand einer Bevölkerung kann anhand der gesundheitlichen Erwartung beurteilt werden, ausgedrückt als durchschnittliche Lebensdauer bei unterschiedlicher Gesundheit. Zweck der Studie war die gesundheitliche Erwartung von Bevölkerungsgruppen mit niedrigem, mittlerem und hohem Bildungsniveau zu vergleichen.

Methoden: Daten einer Gesundheitserhebung wurden unter Anwendung von Sullivan's Methode mit Zahlen von Sterbetafeln kombiniert.

Ergebnisse: Die Lebenserwartung war für 30-jährige Männer mit hohem Bildungsniveau um 4.3 Jahre länger als für jene mit niedrigem Bildungsniveau. Im Alter von 30 Jahren betrug der Anteil der Lebenserwartung bei als persönlich gut eingeschätzter Gesundheit 67,7 % für Männer mit niedrigen, 76,1 % für Männer mit mittlerem und 82,3 % für Männer mit hohem Bildungsniveau. Bei den Frauen variierte die Lebenserwartung zwischen niedrigem und hohem Bildungsniveau um 2,7 Jahre. Der Anteil der Lebenserwartung bei als persönlich gut eingeschätzter Gesundheit betrug für Frauen mit niedrigem Bildungsniveau 62.5 % und für Frauen mit hohem Bildungsniveau 80,5 %.

Schlussfolgerung: Es besteht eindeutig eine Beziehung zwischen dem Bildungsniveau und der Lebenserwartung. Das soziale Gefälle ist für die gesundheitlichen Erwartungen sogar noch grösser als jenes für die Lebenserwartung.

Résumé

Gradient social en matière d'espérance de vie et de santé au Danemark

Objectif: L'état de santé d'une population peut être évalué par l'espérance de santé qui est la durée de vie moyenne dans différents états de santé. L'objectif de l'étude était de comparer l'espérance de santé dans des groupes de population de haut, moyen et bas niveau d'éducation.

Méthode: Les données des interrogatoires de santé furent combinées avec des statistiques de survie selon la méthode de Sullivan.

Résultats: L'espérance de vie était de 4.3 années plus longue pour un homme de 30 ans avec un haut niveau d'éducation comparé à un homme du même âge mais de bas niveau d'éducation. A 30 ans, la proportion d'espérance de vie en bonne santé subjective était de 67.7 %, 76.1 % et 82.3 % pour les hommes avec, respectivement, un bas, un moyen ou un haut niveau d'éducation. Parmi les femmes, l'espérance de vie différait de 2.7 ans entre un niveau d'éducation bas et haut, et la proportion de l'espérance de vie en bonne santé subjective était de 62.5 % et 80.5 % pour, respectivement, les bas et hauts niveaux éducationnels.

Conclusion: Le niveau d'éducation et l'espérance de vie sont clairement associés. Le gradient social en terme d'espérance de santé est même plus fort qu'en terme d'espérance de vie.

References

Andersen O, Laursen L, Petersen JK (2001). Dødelighed og erhverv 1981–1995 [Mortality and occupation 1981–1995]. Copenhagen: Statistics Denmark.

Bebbington AC (1993). Regional and social variations in disability-free life expectancy in Great Britain. In: Robine JM, Mathers CD, Bone MR, Romieu I, eds. Calculation of health expectancies: Harmonization, consensus achieved and future perspectives. Montrouge: John Libbey Eurotext: 175–91.

Boström G, Persson G (2001). Chapter 2. The development and distribution of public health. In: Persson G, Boström G, Diderichsen F, et al., eds. Health in Sweden – the national public health report 2001. Scand J Public Health *29* (Suppl *58*): 17–36.

Brønnum-Hansen H (1998). Trends in health expectancy in Denmark, 1987–1994. Dan Med Bull *45*: 217–21.

Brønnum-Hansen H (2000). Socioeconomic differences in health expectancy in Denmark. Scand J Public Health *28*: 194–9.

Cambois E, Robine JM (1996). An international comparison of trends in disability-free life expectancy. In: Eisen R, Sloan FA, eds. Long-term care: economic issues and policy solutions. Boston: Kluwer Academic Publishers: 11–23.

Cambois E, Robine JM, Hayward MD (2001). Social inequalities in disability-free life expectancy in the French male population, 1980–1991. Demography *38*: 513–24.

Crimmins EM, Hayward MD, Saito Y (1996). Differentials in active life expectancy in the older population of the United States. J Gerontol B Psychol Sci Soc Sci *51* (*3*): S111–20.

Crimmins EM, Saito Y (2001). Trends in healthy life expectancy in the United States, 1970–1990: Gender, racial, and educational differences. Soc Sci Med *52*: 1629–41.

Davidsen M, Kjøller M (2002). The Danish health and morbidity survey – design and analysis. Stat Trans 5: 927–42.

Davis P, Graham P, Pearce N (2000). Health expectancy in New Zealand, 1981–1991: social variations and trends in a period of rapid social and economic change. J Epidemiol Community Health *53*: 519–27.

Doblhammer G, Kytir J (1998). Social inequalities in disability-free and healthy life expectancy in Austria. Wien Klin Wochenschr *110*: 393–6.

Guralnik JM, Land KC, Blazer D, Fillenbaum GG, Branch LG (1993). Educational status and active life expectancy among older blacks and whites. N Engl J Med *329*: 110–6.

Gutiérrez-Fisac JL, Gispert R, Solà J (2000). Factors explaining the geographical differences in disability free life expectancy in Spain. J Epidemiol Community Health *54*: 451–5.

Ingerslev O, Madsen M, Andersen O (1994). Sociale forskelle i dødeligheden i Danmark [Socio-economic differences in mortality in Denmark]. Copenhagen: Life Expectancy Committee, Danish Ministry of Health. (Report; no. 3).

Jagger C, Hauet E, Brouard N (2001). Health expectancy calculation by the Sullivan method: a practical guide: European concerted action on the harmonization of health expectancy calculations in Europe. Leicester; Paris: Euro-Reves. (Revespaper; no. 408).

Juel K, Bjerregaard P, Madsen M (2000). Mortality and life expectancy in Denmark and in other European countries. What is happening to middle-aged Danes? Eur J Public Health *10*: 93–100.

Jylhä M, Guralnik JM, Ferrucci L, Jokela J, Heikkinen E (1998). Is self-rated health comparable across cultures and genders? J Gerontol B Psychol Sci Soc Sci *53* (*3*): S144–52.

Kaprio J, Sarna S, Fogelholm M, Koskenvuo M (1996). Total and occupationally active life expectancies in relation to social class and marital status in men classified as healthy at 20 in Finland. J Epidemiol Community Health *50*: 653–60.

Land KC, Guralnik JM, Blazer DG (1994). Estimating increment-decrement life tables with multiple covariates from panel data: the case of active life expectancy. Demography *31*: 297–319.

Lissau I, Rasmussen NK, Hesse NM, Hesse U (2001). Social differences in illness and health-related exclusion from the labour market in Denmark from 1987 to 1994. Scand J Public Health Suppl *55*: 19–30.

Lynch JW, Kaplan GA (1997). Understanding how inequality in the distribution of income affects health. J Health Psych *2*: 297–314.

Mackenbach JP, Kunst AE, Cavelaars AEJM, Groenhof F, Geurts JJM, the EU Working Group on Socioeconomic Inequalities in Health (1997). Socioeconomic inequalities in morbidity and mortality in western Europe. Lancet *349*: 1655–9.

Melzer D, McWilliams B, Brayne C, Johnson T, Bond J (2000). Socioeconomic status and the expectation of disability in old age: estimates for England. J Epidemiol Community Health *54*: 286–92.

National Institute of Public Health (2002). Sundhed & sygelighed i Danmark 2000 og udviklingen siden 1987 [The Danish Health Interview Survey 2000]. Copenhagen: National Institute of Public Health.

Osler M, Schroll M (1992). Differences between participants and non-participants in a population study on nutrition and health in the elderly. Eur J Clin Nutr *46*: 289–95.

Sihvonen AP, Kunst AE, Lahelma E, Valkonen T, Mackenbach JP (1998). Socioeconomic inequalities in health expectancy in Finland and Norway in the late 1980s. Soc Sci Med *47*: 303–15.

Sullivan DF (1971). A single index of mortality and morbidity. Health Services and Mental Health Administration Health Report *86*: 347–54.

The Danish Government Programme on Public Health and Health Promotion 1999–2008 (2000). Copenhagen: Danish Ministry of Health.

Valkonen T, Sihvonen AP, Lahelma E (1997). Health expectancy by level of education in Finland. Soc Sci Med *44*: 801–8.

van den Akker M, Buntinx F, Metsemakers JF, Knottnerus JA (1998). Morbidity in responders and non-responders in a register-based population survey. Fam Pract *15*: 261–3.

van den Bos GAM, van der Maas PJ (1993). Social inequalities in the basic components of health expectancy: Chronic morbidity, disability and mortality. In: Robine JM, Mathers CD, Bone MR, Romieu I, eds. Calculation of health expectancies: Harmonization, consensus achieved and future perspectives. Montrouge: John Libbey Eurotext: 193–201.

van de Water HPA, Boshuizen HC, Perenboom RJM (1996). Health expectancy in the Netherlands 1983-1990. Eur J Public Health *6*: 21–8.

Vestbo J, Rasmussen FV (1992). Baseline characteristics are not sufficient indicators of non-response bias follow up studies. J Epidemiol Community Health *46*: 617–9.

Wilkins R, Adams OB (1983). Health expectancy in Canada, late 1970s: demographic, regional, and social dimensions. Am J Public Health *73*: 1073–80.

Address for correspondence

Henrik Brønnum-Hansen
National Institute of Public Health
25 Svanemøllevej
DK-2100, Copenhagen
Tel.: +45 39 20 7777
Fax: +45 39 20 8010
E-mail: hbh@niph.dk

Soz.- Präventivmed. 49 (2004) 36–41