RESEARCH REPORT

Socioeconomic inequalities in mobility decline in chronic disease groups (asthma/COPD, heart disease, diabetes mellitus, low back pain): only a minor role for disease severity and comorbidity

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Objective: This study examined the association between socioeconomic status and mobility decline and whether this could be explained by disease severity and comorbidity in four different chronic disease groups (asthma/COPD, heart disease, diabetes mellitus, and low back pain). It is not clear, whether the adverse course of physical functioning in persons with a low socioeconomic status can be explained by a higher prevalence of more severe disease or comorbidity in these persons.
Design: Dutch GLOBE study: prospective cohort study
Setting: Region of Eindhoven (south east of the Netherlands)
Participants: 1384 persons suffering from at least one of the four chronic diseases were selected. The number of respondents in each group was: asthma/COPD 465, heart disease 788, diabetes mellitus 137, and low back pain 707. There were 580 respondents who suffered from more than one condition.
Main results: Odds ratios of mobility decline between 1991 and 1997, adjusted for age, sex, marital status, and baseline mobility, were significantly higher in low socioeconomic groups in comparison with high socioeconomic groups. Only very little of this association could be explained by the higher disease severity and comorbidity in these patients. Findings were similar in patients with asthma/COPD, heart disease, diabetes mellitus, and chronic low back pain.
Conclusion: These findings indicate that to reduce physical disabilities and particularly the socioeconomic differences therein, it may not be sufficient to solely intervene upon the risks of severe disease and comorbidities.

There is substantial evidence that physical functioning, such as mobility, develops more unfavourably in persons with a low socioeconomic status.[1–4] The same effects are also found in chronically ill persons.[5–8] Chronically ill persons, who have a low level of education, belong to a low occupational class, or have a low household income, develop more disabilities than chronically ill persons with a high socioeconomic status.[7] Less clear, however, is whether the adverse course of physical functioning in persons with a low socioeconomic status can be explained by a higher prevalence of more severe disease or comorbidity in these persons. A recent study showed that diseases severity is associated with physical disabilities.[7] Another study shows that people with a low socioeconomic position report a greater disease severity than people with a high socioeconomic position.[9 10] Low socioeconomic status is also positively related to comorbidity, which is also likely to increase disabilities.[11] It is not clear whether previous studies in chronic disease patients have sufficiently controlled for a potentially higher disease severity and comorbidity in low socioeconomic status groups. This is relevant for determining the extent to which any low socioeconomic status—restricted mobility association is confounded by disease severity and/or comorbidity. Furthermore, to reduce physical disabilities and particularly the socioeconomic differences therein, it is important to know whether it is sufficient to reduce severe disease and comorbidities in chronically ill persons with a low socioeconomic status or whether other socially patterned factors should be tackled as well.

Using longitudinal data this study examines the association between socioeconomic status and mobility decline and whether this could be explained by disease severity and comorbidity in four different chronic disease groups (asthma/chronic obstructive pulmonary disease (COPD), heart disease, diabetes mellitus, and low back pain). These four diseases were chosen because they are fairly common, cover a wide range of possible consequences of disease for daily functioning,[12] and represent varying body systems—that is, respiratory (asthma/COPD), cardiovascular (heart disease), metabolic (diabetes mellitus), and musculoskeletal (low back pain).

METHODS

Study population

Data were obtained from the GLOBE (a Dutch acronym for "Health and Living Conditions of the Population of Eindhoven and surroundings) study, a longitudinal study that started in 1991 in the south east of the Netherlands, aimed at explaining socioeconomic inequalities in health.[13] It is based on a cohort of 15 to 74 year old, non-institutionalised people of Dutch nationality. In 1991 the study started with a baseline measurement consisting of a postal survey and an oral interview. A sample of 27 070 inhabitants of 18 municipalities received a postal questionnaire; the sample was drawn from population registers stratified by age and postal code (45–74 years old and people from the highest and lowest socioeconomic groups were over-represented). The response rate of the postal survey was 70.1% resulting in a

Table 1 Baseline mobility (median, first, and third quartile) and mobility decline, for different socioeconomic status indicators and for every disease group

		Baseline mobility					Baseline mobility					Baseline mobility		
Education*	Number	median	1st–3rd quartile	Mobility decline (%)	Occupation†	Number	median	1st–3rd quartile	Mobility decline %	Income‡	Number	median	1st–3rd quartile	Mobility decline (%)
Asthma/COPD	456				Asthma/COPD	380				Asthma/COPD	389			
High	66	0.00	0.00 to 10.63	22.7	1	134	0.00	0.00 to 11.20	24.6	High	128	0.00	0.00 to 11.20	22.7
Medium	163	0.00	0.00 to11.20	27.6	2	105	0.00	0.00 to 11.20	29.5	Medium	132	0.00	0.00 to 11.20	37.9
Low	227	10.79	0.00 to 21.99	42.3	3	14	15.85	0.00 to 31.44	42.9	Low	129	11.20	0.00 to 26.91	45.7
					4	127	11.20	0.00 to 21.99	42.5					
p value		<0.01		<0.01	p value		<0.01		0.01	p value		<0.01		<0.01
Heart disease	770				Heart disease	687				Heart disease	670			
High	99	0.00	0.00 to 9.30	20.2	1	229	0.00	0.00 to 11.20	27.5	High	220	0.00	0.00 to 11.20	25.9
Medium	256	0.00	0.00 to 11.20	34.0	2	189	0.00	0.00 to 11.20	39.2	Medium	221	0.00	0.00 to 20.50	38.9
Low	415	10.57	0.00 to 23.89	41.2	3	28	20.50	0.00 to 31.07	42.9	Low	229	11.20	0.00 to 31.07	40.2
					4	241	10.57	0.00 to 31.07	40.9					
p value		<0.01		<0.01	p value		<0.01		0.02	p value		<0.01		<0.01
Diabetes	130				Diabetes	123				Diabetes	105			
High	13	0.00	0.00 to 5.60	23.1	1	34	0.00	0.00 to 0.00	29.4	High	33	0.00	0.00 to 10.89	24.2
Medium	41	0.00	0.00 to 11.20	26.8	2	38	0.00	0.00 to 20.41	39.5	Medium	36	0.00	0.00 to 11.20	38.9
Low	76	0.00	0.00 to 20.40	43.4	3	5	20.50	0.00 to 38.23	40.0	Low	36	0.00	0.00 to 23.26	50.0
					4	46	0.00	0.00 to 25.57	41.3					
p value		0.72		0.12	p value		0.05		0.73	p value		0.50		0.09
Low back pain	696				Low back pain	631				Low back pain	602			
High	93	10.57	0.00 to 11.20	33.3	1	204	11.20	0.00 to 21.77	32.4	High	210	11.20	0.00 to 21.77	31.4
Medium	245	11.20	0.00 to 21.77	38.8	2	178	11.20	0.00 to 21.77	40.4	Medium	207	11.20	0.00 to 21.99	35.3
Low	358	11.20	0.00 to 32.56	37.4	3	23	21.99	11.20 to 32.56	34.8	Low	185	21.36	0.00 to 35.23	40.5
					4	226	11.42	0.00 to 32.56	38.9					
p value		<0.01		0.65	p value		<0.01		0.36	p value		<0.01		0.17

*Education: high (university, higher vocational), medium (higher secondary, intermediate vocational), low (lower secondary, lower vocational). †Occupation: 1 (higher) grade professionals, 2 routine non-manual workers or high skilled manual workers, 3 self employed, 4 low skilled and unskilled manual workers. ‡Equivalent income in euros: high (>947.04), medium (657.53–947.04), low (<657.53).

Table 2 Odds ratios (OR) and 95% confidence intervals (95% CI) for severity and comorbidity by socio-economic status; separately for different chronic disease groups, adjusted for age, sex, and marital status*

	Severe disease‡		Severe comorbidity§			Severe disease‡		Severe comorbidity§			Severe disease†		Severe comorbidity§	
Education†	**OR**	**95% CI**	**OR**	**95% CI**	**Occupation†**	**OR**	**95% CI**	**OR**	**95% CI**	**Income†**	**OR**	**95% CI**	**OR**	**95% CI**
Asthma/COPD					Asthma/COPD					Asthma/COPD				
High	1.00		1.00		1	1.00		1.00		High	1.00		1.00	
Medium	1.45	0.78 to 2.69	1.06	0.58 to 1.94	2	**1.72**	1.00 to 2.96	1.16	0.67 to 2.00	medium	1.35	0.81 to 2.24	1.05	0.63 to 1.76
Low	**1.92**	1.04 to 3.55	**1.94**	1.05 to 3.57	3	2.85	0.91 to 8.90	1.49	0.46 to 4.87	Low	**1.78**	1.07 to 2.99	**1.84**	1.07 to 3.19
					4	**2.79**	1.65 to 4.73	**2.37**	1.35 to 4.15					
Heart disease					Heart disease					Heart disease				
High	1.00		1.00		1	1.00		1.00		High	1.00		1.00	
Medium	1.69	0.71 to 4.02	1.13	0.69 to 1.83	2	1.51	0.82 to 2.78	0.98	0.66 to 1.46	medium	1.30	0.73 to 2.33	**1.62**	1.10 to 2.39
Low	2.00	0.87 to 4.60	**1.74**	1.09 to 2.78	3	1.61	0.50 to 5.18	1.61	0.72 to 3.59	Low	1.49	0.84 to 2.65	**1.86**	1.26 to 2.75
					4	**1.86**	1.06 to 3.27	**1.85**	1.27 to 2.70					
Diabetes					Diabetes					Diabetes				
High	1.00		1.00		1	1.00		1.00		High	1.00		1.00	
Medium	1.86	0.42 to 8.23	0.79	0.21 to 2.98	2	1.22	0.47 to 3.19	0.99	0.38 to 2.57	medium	2.29	0.77 to 6.79	0.76	0.27 to 2.18
Low	2.63	0.61 to 11.26	1.47	0.41 to 5.35	3	5.98	0.59 to 60.56	1.31	0.19 to 9.29	Low	**3.94**	1.30 to 11.92	1.22	0.42 to 3.54
					4	0.99	0.37 to 2.65	0.81	0.31 to 2.13					
Low back pain					Low back pain					Low back pain				
High	1.00		1.00		1	1.00		1.00		High	1.00		1.00	
Medium	1.07	0.61 to 1.87	1.11	0.67 to 1.82	2	1.06	0.66 to 1.68	1.15	0.75 to 1.77	medium	1.16	0.75 to 1.82	1.11	0.74 to 1.67
Low	1.10	0.64 to 1.88	**1.80**	1.11 to 2.92	3	1.86	0.72 to 4.77	0.81	0.33 to 2.01	Low	1.36	0.86 to 2.14	**1.71**	1.11 to 2.63
					4	1.12	0.72 to 1.73	1.26	0.85 to 1.89					

Significant odds ratios at $p<0.05$ are in bold. *All p values of the Hosmer and Lemeshow for goodness of fit of logistic regression are >0.05, indicating that the model's estimates fit the data at an acceptable level. All analyses were carried out with the same number of respondents in each group: asthma/COPD 465, heart disease 788, diabetes mellitus 137, and low back pain 707. †See notes in table 1 for education, occupation, and income. ‡Severe disease, 1: most severe category and 0: less severe categories. §Severe comorbidity, 1: any severe comorbid condition and 0: no severe comorbid condition.

Table 3 Odds ratios (OR) and 95% confidence intervals (95% CI) for decline in mobility by disease severity and comorbidity; separately for different chronic disease groups, adjusted for age, sex, marital status, and baseline mobility*

		Mobility decline	
		OR	95% CI
Asthma/COPD			
Severity	grade 1	1.00	
	grade 2	1.01	0.51 to 2.01
	grade 3†	1.72	0.97 to 3.08
	other forms of asthma/COPD	0.78	0.38 to 1.59
Severe comorbid diseases		**1.66**	1.24 to 2.22
Less severe comorbid diseases		1.10	0.93 to 1.30
Heart disease			
Severity	non-specific symptoms	1.00	
	angina pectoris without heart failure	1.29	0.88 to 1.88
	heart failure without angina pectoris	0.81	0.47 to 1.41
	angina pectoris with heart failure†	**1.62**	1.00 to 2.62
	other forms of heart disease	0.77	0.44 to 1.36
Severe comorbid diseases		**1.38**	1.10 to 1.72
Less severe comorbid diseases		**1.25**	1.10 to 1.42
Diabetes			
Severity	without complications	1.00	
	with complications†	**4.98**	2.02 to 12.29
Severe comorbid diseases		0.95	0.56 to 1.63
Less severe comorbid diseases		1.01	0.71 to 1.44
Low back pain			
Severity	no radiation, less than 3 months	1.00	
	with radiation, less than 3 months	0.95	0.60 to 1.50
	no radiation, at least 3 months	1.02	0.61 to 1.72
	with radiation, at least 3 months†	1.54	0.97 to 2.46
	Other forms of back complaints	0.91	0.36 to 2.31
Severe comorbid diseases		**1.27**	1.06 to 1.52
Less severe comorbid diseases		0.98	0.97 to 0.99

Significant odds ratios at $p<0.05$ are in bold. *See corresponding notes in table 2. †Most severe disease category.

study population of 18 973 respondents. A sub-sample of 3968 persons drawn from respondents to the postal survey was approached for an oral interview. Participants completed an interview and a self administered questionnaire; the response was 72.2% (n = 2867). In this sub-sample, people who reported one or more of the following chronic diseases were over-represented: asthma/COPD, heart disease, diabetes mellitus, and severe low back pain. For the analyses presented in this paper, respondents suffering from at least one of the four chronic diseases were selected, resulting in 2015 respondents in 1991. Response at follow up in 1997 was 69.8% of the 2015 respondents in 1991, resulting in 1407 respondents. For 23 participants outcome data were missing, leaving 1384 participants for the present analyses. The

Table 4 Odds ratios (OR) and 95% confidence intervals (95% CI) for decline in physical functioning by socioeconomic status; separately for different chronic disease groups*

		Asthma/COPD		Heart disease		Diabetes		Low back pain	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Education†									
model 1‡	High	1.00		1.00		1.00		1.00	
	Medium	1.18	0.58 to 2.38	**1.88**	1.06 to 3.32	0.98	0.19 to 4.99	1.04	0.62 to 1.76
	Low	1.90	0.95 to 3.79	**2.40**	1.38 to 4.16	1.77	0.38 to 8.33	1.03	0.62 to 1.72
model 2§	High	1.00		1.00		1.00		1.00	
	Medium	1.07	0.52 to 2.20	1.75	0.98 to 3.12	0.76	0.14 to 4.26	1.02	0.60 to 1.74
	Low	1.73	0.85 to 3.53	**2.37**	1.35 to 4.14	1.18	0.87 to 1.02	1.01	0.60 to 1.70
Occupation†									
model 1‡	1	1.00		1.00		1.00		1.00	
	2	1.21	0.67 to 2.17	**1.73**	1.13 to 2.65	1.65	0.55 to 4.95	1.34	0.87 to 2.08
	3	2.37	0.75 to 7.50	**2.30**	1.00 to 5.28	0.97	0.11 to 8.61	1.58	0.61 to 4.07
	4	**2.21**	1.27 to 3.86	**1.91**	1.28 to 2.86	1.15	0.38 to 3.44	**1.60**	1.05 to 2.43
model 2§	1	1.00		1.00		1.00		1.00	
	2	1.11	0.60 to 2.03	**1.67**	1.09 to 2.57	1.77	0.52 to 5.96	1.35	0.86 to 2.10
	3	2.02	0.62 to 6.65	2.21	0.95 to 5.16	0.65	0.07 to 6.42	1.61	0.62 to 4.19
	4	**1.79**	1.00 to 3.20	**1.80**	1.19 to 2.71	1.45	0.42 to 5.04	**1.59**	1.04 to 2.45
Income†									
model 1‡	High	1.00		1.00		1.00		1.00	
	Medium	**1.81**	1.02 to 3.20	**1.72**	1.13 to 2.61	1.53	0.48 to 4.81	1.26	0.82 to 1.92
	Low	**2.83**	1.58 to 5.09	**1.97**	1.29 to 3.02	2.28	0.70 to 7.37	**1.81**	1.16 to 2.83
model 2§	High	1.00		1.00		1.00		1.00	
	Medium	**1.82**	1.01 to 3.26	**1.69**	1.10 to 2.59	1.22	0.35 to 4.18	1.23	0.80 to 1.89
	Low	**2.60**	1.43 to 4.74	**1.94**	1.25 to 2.99	1.76	0.51 to 6.06	**1.69**	1.07 to 2.67

Significant odds ratios at $p<0.05$ are in bold. *See corresponding note in table 2. †See notes in table 1. ‡Model 1: adjusted for sex, age, marital status, and baseline mobility. §Model 2: adjusted for sex, age, marital status, baseline mobility, comorbidity and baseline severity.

Key points

- In different chronic disease groups (asthma/COPD, heart disease, diabetes mellitus, low back pain), people with a low socioeconomic status had an increased risk of mobility decline in comparison with people with a high socioeconomic status.
- Disease severity and comorbidity contributed only very little to socioeconomic status differentials in mobility decline.

Policy implications

To reduce physical disabilities and particularly the socioeconomic differences therein, it may not be sufficient to solely intervene upon the risks of severe disease and comorbidities.

number of respondents in each group was: asthma/COPD 465, heart disease 788, diabetes mellitus 137, and low back pain 707. There were 580 respondents who suffered from more than one condition.

Data

Physical mobility was measured with the Nottingham health profile (NHP). The NHP is a self administered questionnaire designed to measure perceived health problems.[14] The part that measures physical mobility consists of eight statements that reflect problems with mobility (see appendix). Respondents had to answer ''yes'' or ''no'' to each of these statements. Because the statements vary in severity, they have been weighted by means of Thurstone's method of paired comparisons.[15] The minimum score is 0 and the maximum score is 100, which represents a situation where the respondent answers affirmatively to all the statements. The higher the score, the greater the mobility problems are. To determine whether there was a decline or not between 1991 and 1997, a reliable change index was computed using the Edwards-Nunnally method of determining improvement rates. This method takes into account the measurement reliability of the NHP mobility scale.[16] Decline conform the Edwards-Nunnally method was defined as a 1991–1997 difference score greater than 6.

We used three indicators of socioeconomic status: level of education, equivalent income, and occupational class. Three categories of level of education were created: high (university, higher vocational training); medium (higher secondary, intermediate vocational training); low (lower secondary, lower vocational training). Occupational class was measured according to Erikson, Goldthorpe and Portocarero (EGP) classification[17] that originally consisted of 11 categories. In this study four categories were created: (1) (higher) grade professionals; (2) routine non-manual workers and high skilled manual workers; (3) self employed; (4) low skilled and unskilled manual workers. Net equivalent income per month was measured by adding all income components of all household members adjusted for household size. Three categories of equivalent income, in euros, were distinguished: high (>947); medium (658–947); low (<658). Education data were missing for 28 participants, this was 171 for occupation and 215 for income.

Disease specific questionnaires on asthma/COPD,[18] heart disease,[19 20] diabetes mellitus,[21] and low back pain[22 23] were used to determine the severity of the chronic disease.[7 8] Four categories for asthma/COPD were distinguished: (1,2,3) three categories indicating increasing severity of asthma/COPD (grade 1 to grade 3); (4) other forms of asthma.[18] For heart disease, five categories were distinguished: (1) non-specific symptoms; (2) angina pectoris without heart failure; (3) heart failure without angina pectoris; (4) angina pectoris with heart failure; (5) other forms of heart disease.[19 20] Two categories of diabetes mellitus were distinguished: (1) diabetes without complications; (2) diabetes with at least one complication.[21] Finally, five categories of low back pain were distinguished: (1) low back pain, no radiation, less than three months; (2) low back pain, with radiation, less than three months; (3) low back pain, no radiation, at least three months; (4) low back pain, with radiation, at least three months; (5) other forms of back complaints.[22 23]

Comorbidity was defined as the number of other diseases that respondents reported. Comorbidity was measured with two variables. The first variable reflects the number of additional severe comorbid diseases that people had (asthma/COPD, coronary, stroke, stomach ulcer, kidney disease, diabetes mellitus, arthritis, rheumatoid arthritis, disease of nervous system, cancer). The second variable indicates the number of less severe comorbid diseases (intestinal disorders, high blood pressure, gall stones, kidney stones, prostate complaints, back pain, joint problems, migraine, depression, chronic skin disease, prolapse, varicose veins, and accidental injury).

Statistical analysis

All analyses, using SPSS version 10.1, were carried out separately for each chronic disease group and every socioeconomic status indicator. To determine if there were differences in baseline mobility between socioeconomic groups, a Kruskal-Wallis test was used. A non-parametric test was used because the NHP score did not have a normal distribution; many respondents were free of mobility problems. The χ^2 test was used to determine whether there were differences in the percentage of people with a decline in mobility between socioeconomic groups. Logistic regression models were fitted to study the association between socioeconomic status and disease severity and comorbidity. Disease severity and comorbidity were the dependent variables in these models and were therefore dichotomised. Disease severity was dichotomised as the most severe category compared with the other ones and comorbidity as any comorbid diseases compared with no comorbid disease. These analyses were adjusted for age (continuous variable), sex, and marital status (never married, married, divorced, widowed). Logistic regression models were also fitted to study the association between disease severity and comorbidity on the one hand and mobility decline, as the dependent variable, on the other hand, adjusting for age sex, martial status, and baseline mobility (continuous variable). Finally, the main logistic regression analyses were carried out where the dependent variable was the decline in mobility between 1991 and 1997. The determinant of interest was socioeconomic status, where the highest socioeconomic group was always the reference category. Two logistic regression models were fitted, the first model adjusted for baseline mobility, age, sex, and marital status. Model 2 contained all variables of the first model as well as severity of the chronic disease and comorbidity. The goodness of fit of the logistic regression models was tested using the Hosmer and Lemeshow test, which tells us something about predicted versus observed classifications. The significance of all logistic regression models was greater than 0.05, which means that the model's estimates fit the data at an acceptable level. After removing outliers from the dataset for the logistic regression analyses, using the Student test residuals and Cook's distance, results were very similar or the same.

RESULTS

Table 1 presents the number of people at baseline, the median mobility score at baseline, and the percentage of people with a decline in mobility for every socioeconomic status indicator and for every disease group. At baseline, people in a low socioeconomic group had more mobility problems than people in the high socioeconomic groups. This was statistically significant for every socioeconomic status indicator in the asthma/COPD group, the heart disease group, and the group with low back pain. In the diabetes group, there were no statistically significant differences between socioeconomic groups. The percentage of people with a decline in mobility problems generally was also highest in the low socioeconomic groups. For example, in the asthma/COPD group 42.3% of the people with a low educational level had a decline in mobility between 1991 and 1997 in comparison with 22.7% with a high educational level. These higher percentages were not significant for the diabetes group and the low back pain group.

Table 2 presents the results of the association between socioeconomic status on the one hand and disease severity and severe comorbid diseases on the other hand. Risks of having a severe chronic disease and more severe comorbid diseases generally were higher for lower socioeconomic groups, although the heightened risks were not always statistically significant. For example, odds ratios of disease severity in low education groups were 1.92 (95% CI: 1.04 to 3.55) for asthma/COPD, 2.00 (95% CI: 0.87 to 4.60) for heart disease, 2.63 (95% CI: 0.61 to 11.26) for diabetes, and 1.10 (95% CI: 0.64 to 1.88) for low back pain. Odds ratios of severe comorbid diseases in low education groups were 1.94 (95% CI: 1.05 to 3.57) for asthma/COPD, 1.74 (95% CI: 1.09 to 2.78) for heart disease, 1.47 (95% CI: 0.41 to 5.35) for diabetes, and 1.80 (95% CI: 1.11 to 2.92) for low back pain. The associations between socioeconomic status and less severe comorbid diseases were highly similar (not tabulated).

Table 3 shows the association between disease severity, comorbidity, and mobility decline. A more severe disease increased the risk of getting more mobility problems. The strongest association was found in the most severe category for each disease; asthma/COPD grade 3 (OR: 1.72; 95% CI: 0.97 to 3.08), angina pectoris and heart failure (OR: 1.62; 95% CI: 1.00 to 2.62), diabetes with complications (OR: 4.98; 95% CI: 2.02 to 12.29), low back pain with radiation and at least three months (OR: 1.54; 95% CI: 0.97 to 2.46). Having additional severe comorbid diseases also increased the risk of getting more mobility problems. These results were statistically significant in all disease groups except in the diabetes group. There was only an association with less severe comorbid diseases in the heart disease group (OR: 1.25; 95% CI: 1.10 to 1.42).

Generally, odds ratios of mobility decline, adjusted for age, sex, marital status, and baseline mobility, were significantly higher in low socioeconomic groups in comparison with high socioeconomic groups (table 4, model 1). Low income showed particularly heightened risks of mobility decline; odds ratios were 2.83 (95% CI: 1.58 to 5.09), 1.97 (95% CI: 1.29 to 3.02), 2.28 (95% CI: 0.70 to 7.37), and 1.81 (95% CI: 1.16 to 2.83) for asthma/COPD, heart disease, diabetes, and low back pain, respectively. In the diabetes group, odds of mobility decline for low socioeconomic status were not significantly different from the odds for high socioeconomic status. Furthermore, low educational level did not affect mobility decline in the group with low back pain. Controlling for comorbidity and disease severity had only little effect on the odds ratios of mobility decline for low socioeconomic status (table 4, model 2). Almost all significant odds ratios of model 1 remained statistically significant in model 2. In model 1, 12 odds ratios were statistically significant. After controlling for disease severity and comorbidity, 10 odds ratios were still statistically significant. Odds ratios also decreased only little between model 1 and 2. Interaction terms between socioeconomic status and age, and socioeconomic status and sex were not statistically significant, which confirmed that the association between socioeconomic status and mobility decline was similar for all ages and men and women.

DISCUSSION

In different chronic disease groups (asthma/COPD, heart disease, diabetes mellitus, low back pain), people with a low socioeconomic status generally had an increased risk of mobility decline in comparison with people with a high socioeconomic status. Low socioeconomic status was also associated with more severe chronic diseases and more severe comorbid diseases. Both disease severity and comorbidity were also related to mobility. Despite these associations disease severity and comorbidity contributed only very little to the socioeconomic differentials in mobility decline. This was found across all disease groups and all three socioeconomic status indicators. Strongest associations were found with equivalent income as socioeconomic status indicator. Odds ratios in the lowest income groups ranged from 1.69 to 2.60 in the fully adjusted model (table 4, model 2). Strongest associations between socioeconomic status and mobility decline were found in the heart disease group. The contribution of disease severity and comorbidity in the heart disease group was not different from the other chronic diseases. Effects were less pronounced in the diabetes group, but this was probably partly because of the small number of people in the diabetes group. These findings imply that in chronically ill patients, low socioeconomic status is related to decreasing mobility and that the higher prevalence of severe disease and comorbidities in lower socioeconomic status groups can hardly explain this association.

Because of the longitudinal character of our study, we may conclude that there probably is a causal relation between socioeconomic status and mobility decline. However, because only baseline data on severity and comorbidity were analysed, the association between socioeconomic status on the one hand and disease severity and comorbidity on the other hand might have resulted from reverse causation or health related mobility.[24–26] For example, people having a more severe disease might have ended up in a lower socioeconomic group.[26] It is likely that this selection effect has a larger effect on income and perhaps occupation than on educational level, as the latter indicator is less sensitive to change during adulthood. In this study, the same results were found across all socioeconomic status indicators, including education. Furthermore, there is substantial evidence that low socioeconomic status predicts the incidence of all kinds of diseases,[27] more severe diseases,[9 10] and higher risks of comorbidity.[11] Whether based on causation or selection, our findings show that the higher prevalence of severe disease and comorbidities in lower social classes can hardly explain the heightened odds of mobility restrictions in these groups.

Our findings imply that there are other factors that explain the association between low socioeconomic status and mobility decline. These factors may be related to behavioural factors or psychosocial factors. Low socioeconomic status is related to many adverse behavioural factors, such as smoking, excessive alcohol consumption, and decreasing physical activity that on their turn are related to poor health outcomes.[3 28 29] There is also evidence that psychosocial factors, such as control belief and stress, play an important part in functional outcomes,[30] and also in the association between socioeconomic status and poor functional outcomes.[31 32] Income, being the strongest predictor of mobility, suggests that the direct availability of financial resources

might also be important.[33] A lack of material resources held by people and the availability of public resources might be important in explaining socioeconomic differences in health. Life course factors such as lifetime exposures to adverse occupational and social circumstances may also play a part.

Some limitations of the study have to be considered. Firstly, this study was entirely based on self reports. Despite this limitation, we were able to control for disease severity, using disease specific questionnaires and comorbidity. However, we only adjusted for disease severity and comorbidity at baseline. Assuming that disease severity and comorbidity increase more in low socioeconomic groups than in high socioeconomic groups over time, the contribution of severity and comorbidity may have been underestimated. Secondly, our study consists of persons younger than 75 years only. For the present research question, this should be considered a limitation, because generalisability is thus restricted to persons younger than 75. Socioeconomic differences in mobility decline and the role of medical factors therein may be different in persons older than 74. Thirdly, we did not have information about the time of onset of disease. It remains unknown whether the time of onset of disease differs between socioeconomic status groups and the extent to which this affects mobility decline. Fourthly, baseline NHP data were collected during an oral interview, while NHP data in 1997 with a postal questionnaire. It is possible that people were more likely to admit health problems in the postal survey, therefore we could have overestimated the number of people with a mobility decline. However, it remains unclear whether this affected the association between socioeconomic status and mobility decline. Fifthly, baseline response was 72.2%; and was lower in low socioeconomic groups. Attrition attributable to mortality and non-response was also higher in low socioeconomic groups.[8] Response at follow up in 1997 was 69.8%. Participants who were lost to follow up also had significantly worse NHP scores at baseline ($p<0.01$) in comparison with persons who remained in the study. Furthermore, these persons had more severe chronic diseases and more severe comorbid diseases ($p<0.01$). The association between socioeconomic status and mobility decline might therefore be underestimated in this study. Whether the relative contribution of disease severity and comorbidity is equally underestimated remains unknown. Finally, occupation data and income data were missing for 171 and 215, respectively. These persons more often had a lower educational level compared with persons with full data. This may also have led to an underestimation of the effect of occupation and income on mobility decline.

In summary, there is a strong relation between socioeconomic status and mobility decline among chronically ill persons. Only little of this relation could be explained by disease severity and comorbidity. Findings were similar in patients with asthma/COPD, heart disease, diabetes mellitus, and chronic low back pain. Further research is necessary to discover if behavioural, material, and/or psychosocial factors additionally contribute to the association between socioeconomic status and mobility decline among the chronically ill. Our findings are also important for policies aimed at reducing functional limitations in people with chronic diseases, particularly in people from lower socioeconomic status group. They imply that reducing the risk of severe disease and comorbidities may not be sufficient to reduce physical disabilities and particularly the socioeconomic differences therein.

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APPENDIX

MOBILITY PART OF THE NOTTINGHAM HEALTH PROFILE

1. I can only walk indoors
2. I find it hard to bend
3. I'm unable to walk at all
4. I have trouble getting up and down stairs or steps
5. I find it hard to reach for things
6. I find it hard to dress myself
7. I find it hard to stand for long
8. I need help to walk outside

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ECHO

Is there a north-south divide in social class inequalities in health in Great Britain? Cross sectional study using data from the 2001 census

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Please visit the *Journal of Epidemiology and Community Health* website [www.jech.com] for a link to the full text of this article.

Objective: To examine individual social class inequalities in self rated general health within and between the constituent countries of Great Britain and the regions of England.

Design: Cross sectional study using data from the 2001 national census.

Setting: Great Britain.

Participants: Adults aged between 25 and 64 in Great Britain and enumerated in the 2001 population census (n = 25.6 million).

Main outcome measures: European age standardised rates of self rated general health, for men and women classified by the government social class scheme.

Results: In each of the seven social classes, Wales and the North East and North West regions of England had high rates of poor health. There were large social class inequalities in self rated health, with rates of poor health generally increasing from class 1 (higher professional occupations) to class 7 (routine occupations). The size of the health divide varied between regions: the largest rate ratios for routine versus higher professional classes were for Scotland (2.9 for men; 2.8 for women) and London (2.9 for men; 2.4 for women). Women had higher rates of poor health compared to men in the same social class, except in class 6 (semi-routine occupations).

Conclusions: A northwest-southeast divide in social class inequalities existed in Great Britain at the start of the 21st century, with each of the seven social classes having higher rates of poor health in Wales, the North East and North West regions of England than elsewhere. The widest health gap between social classes, however, was in Scotland and London, adding another dimension to the policy debate on resource allocation and targets to tackle the health divide.

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