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Socioeconomic circumstances, health behaviours and functional limitations in older persons in four Central and Eastern European populations

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Abstract

Objectives: to investigate functional limitations and their association with socioeconomic factors in four Central and Eastern European populations.

Methods: a cross-sectional study of random population samples in Novosibirsk (Russia), Krakow (Poland), Kaunas (Lithuania) and six Czech towns participating in the HAPIEE study. Functional limitations (classified into tertiles of the

SF-36 physical functioning subscale), socioeconomic circumstances and health behaviours were available for 34,431 subjects aged 45–69 years.

Results: the proportion of subjects in the worst tertile of the functional limitations score ($\leq 80\%$ of the maximum score) ranged from 21% of the men in Kaunas to 48% in Krakow women. In multivariate ordered logistic regression, functional limitations were strongly inversely associated with education and positively with material deprivation and with being economically inactive. Functional limitations were more common in male smokers and less common in alcohol drinkers. Socioeconomic characteristics explained some of the differences in functional limitations between populations. Health behaviours explained some of the differences between social groups in both genders and between populations in women.

Conclusion: unexpectedly, functional limitations were not most common in the sample from Russia, the country with the highest mortality rates. All socioeconomic measures were strongly associated with functional limitations and made some contribution towards explaining differences in limitations between populations.

Keywords: *disability, physical functioning, socioeconomic factors, Eastern Europe, older people*

Introduction

The proportion of older persons in most European populations increases; since health declines with age, impaired physical functioning becomes a major public health problem [1]. Among elderly people, functional limitation is the most common factor which leads to disability and further dependence on the other members of the society. Persons with functional limitations often require special care and assistance by both family and qualified personnel, which increases the burden to home budgets, health and social care systems.

Physical functioning and functional capacity reflect objective health status and are important for well-being and the quality of life. Low self-reported physical functioning is associated with low personal autonomy at the individual level and with a range of health indicators, including mortality, use of health services and cardiac and non-cardiovascular death [2–4]. The limitation of functioning is not an inevitable consequence of ageing; some people remain in good functional status even in old age [5]. Identification of factors influencing the risk of functional problems is important for the design of interventions to delay the decline in physical functioning [1, 5].

Although the self-reported measurement of physical functioning is less reliable than objective tests [6], it is far more practical than performance-based methods in large samples, and it has been widely used in population studies. Previous studies found that the prevalence of functional limitations differ between populations [2, 7–10], and cross-sectional studies suggest that the prevalence may be higher and the rate of decline in physical functioning by age may be faster in Central and Eastern Europe than in Western Europe [11, 12]. Death rates are very high in some parts of the region; for example, in 2006 the male all-cause mortality at all ages was about twice higher in Russia than in the Czech Republic (and about three times higher than in the ‘old’ EU); for male mortality at ages over 65 years, the ratios were 1.5 compared with Czechs and 2.1 compared with the old EU (data from the WHO Health for All database). If

the population levels of mortality and non-fatal measures of health status correlate, one would expect higher levels of functional limitations in Russians than in Czechs or Poles.

Given the lack of information on the functional status of older persons in Eastern Europe, we addressed the question of functional limitations in a large population-based study in four post-communist countries. Our objective was to compare the levels of functional limitations in these populations, and to investigate the role of socioeconomic factors in predicting functional limitations within populations and in explaining the differences between populations.

Methods

Study populations and subjects

We used data from the baseline survey for the HAPIEE (Health, Alcohol and Psychosocial factors In Eastern Europe) study, a study conducted in Novosibirsk (a major industrial centre of West Siberia, Russia), Krakow (a major urban centre, Poland), six typical Czech middle-sized towns (Havirov/Karvina, Hradec Kralove, Jihlava, Kromeriz, Liberec and Usti nad Labem) and Kaunas (an important city, Lithuania) [13]. The study investigated samples of men and women aged 45–69 at baseline, stratified by gender and age, randomly selected from population registers (Krakow, Kaunas and Czech towns) and electoral lists (Novosibirsk). In total, 36,030 persons participated in the study (the response rates were 61% in the Czech towns and Krakow, 55% in Novosibirsk and 67% in Kaunas, overall 61%). The study was approved by the ethics committees at University College London and by all participating centres. All participants gave their written informed consent.

Measurements

Data used in these analyses were collected by a structured questionnaire that covered health; demographic, socioeconomic and psychosocial factors; health behaviours and nutrition. The questionnaire was translated from English into each language and back translated into English, to ensure the

accuracy of local versions. Subjects in Krakow and the Czech towns completed the questionnaire during a nurse visit to their home (85% of them subsequently attended an examination in a clinic); all Novosibirsk and Kaunas participants completed the questionnaire during a visit to a clinic.

Functional limitations were evaluated by a 10-question scale from the Short Form 36 (SF36) Health Survey tool [14, 15]. The questions assessed limitations in vigorous and moderate individual activities, lifting and carrying, bending, kneeling and stooping, walking, climbing stairs, bathing and dressing. Answers to each question were scored as 0 (limited a lot), 1 (limited a little) and 2 (not limited) and summed up. The final score ranged from 0 to 20 points, and was additionally multiplied by 5, resulting in a final score ranging from 0 (maximum limitations) to 100 (no limitations).

Several socioeconomic characteristics were used as covariates. The marital status was dichotomised into married/cohabiting and 'not married' (combining single, divorced, separated or widowed categories). The educational level was categorized into four groups (primary or less, vocational, secondary and university), ensuring that categories were comparable between countries. The material deprivation level was assessed by three questions about the frequency of difficulties in (i) paying bills, (ii) buying food and (iii) clothes necessary for the subject and/or his family. The answers were recorded on a 5-point scale (coded from 0 to 4); the total deprivation score was calculated as the sum of the three questions, and categorized into three groups: low (0), medium (1–6) and high (7–12). Economic activity was based on the employment status, which was categorized into five categories: employed, owner of a company or self-employed, housewife or farmer or employed pensioner, not employed pensioner and unemployed. Participants were categorised as current smokers or non-smokers (combining past and never smokers). The frequency of alcohol consumption was classified into four categories (never, less than once a month, about one to three times a month and at least once a week). Additional adjustment for binge drinking did not contribute to the fit of the model and was omitted from the statistical models.

Statistical methods

Only participants with non-missing data on all variables of interest were used in the analyses ($n = 34,431$). Because the distribution of the final score was highly skewed, it was classified into approximate tertiles (cut-off points 90 and 80% of the maximum score). We used ordinal (ordered) logistic regression, using physical limitation tertile as outcome, to analyse the associations between socioeconomic circumstances, life style and prevalence of functional limitations. Odds ratios from ordinal logistic regression can be interpreted as weighted means of the odds of lower functioning (tertile 1 versus tertiles 2–3 and tertiles 1–2 versus tertile 3) associated with a given category of an independent variable. The proportional odds assumption was fulfilled, confirming that the associations with independent variables were continuous across functional limitation tertiles.

Additional analyses using different tertiles or binary cut-offs of functional limitations yielded similar results.

The multivariable analyses were conducted in several steps, separately by sex. First, odds ratios of functional limitations by different levels of socioeconomic variables, adjusted for age and attending examination in a clinic (since visiting a clinic was associated with fewer functional limitations), were estimated separately for each population. Next, since the associations were similar between populations, data from the four populations were pooled and odds ratios of functional limitations by socioeconomic factors were estimated. We used three levels of adjustment: (i) adjusted for age, population and attending examination in a clinic (Model 1); (ii) adjusted for age, population, attending examination in a clinic and socioeconomic status indicators (Model 2) and (iii) adjusted for age, population, attending examination in a clinic, socioeconomic status indicators and health behaviours (Model 3). Finally, we analysed the extent to which the differences in the prevalence of functional limitations between populations (country of residence) can be explained by socioeconomic and behavioural variables. All statistical analyses were conducted using Stata 11 (StataCorp LP, TX, USA).

Results

Table 1 shows the characteristics of the study sample by sex and population. The proportion of subjects in the worst tertile of the functioning score was higher in women than in men and, in both sexes, it was highest in Krakow.

Population-specific odds ratios of functional limitations by covariates are given in Supplementary data available in *Age and Ageing* online, Tables S1 and S2. Odds ratios of functional limitations by socioeconomic characteristics at different levels of adjustment in the pooled data are shown in Table 2. In the simplest model (Model 1), there are pronounced effects on functional limitations by education, material deprivation and economic activity in both genders. The odds ratios of functional limitations were higher among abstainers from alcohol and in male smokers (not shown in tables). After including all socioeconomic indicators simultaneously (Model 2), the odds ratios were considerably attenuated, compared with Model 1, but most retained high statistical significance. Deprivation and being unemployed had the largest effects on functioning. Additional adjustment for smoking and drinking frequency (Model 3) made only minor impact on the odds ratios, compared with Model 2.

Table 3 examined the differences in functional limitations between study populations. After controlling for age and visiting a clinic (Model 1), Kaunas men had a lower odds of functional limitations than other populations; among women, the lowest odds was seen in Czech towns. Inclusion of socioeconomic indicators into the model increased the differences between men in Czech towns and in Novosibirsk but reduced the difference with Kaunas and Krakow; in women, the odds ratios for Novosibirsk and Krakow were reduced but the odds ratios for Kaunas

Table 1. Descriptive characteristics of the study sample (%)

	Men				Women			
	Czech towns (<i>n</i> = 3,774)	Novosibirsk (<i>n</i> = 4,262)	Krakov (<i>n</i> = 5,063)	Kaunas (<i>n</i> = 2,779)	Czech towns (<i>n</i> = 4,298)	Novosibirsk (<i>n</i> = 5,088)	Krakov (<i>n</i> = 5,332)	Kaunas (<i>n</i> = 3,327)
Physical functioning tertile								
Highest (best)	47.9	55.7	47.4	58.4	37.9	28.2	29.9	32.4
Middle	25.9	21.1	21.4	20.9	27.8	24.3	22.8	25.0
Lowest (worst)	26.2	23.2	31.1	20.7	34.4	47.5	48.2	42.6
Age group								
45–49	16.1	15.9	17.5	13.3	18.4	18.0	19.7	13.6
50–54	19.1	19.6	19.7	14.5	20.7	19.1	21.4	16.5
55–59	19.5	21.5	21.4	21.7	18.1	21.3	20.7	20.2
60–64	22.0	19.2	20.4	24.2	23.6	18.8	19.4	25.5
65–69	23.2	23.8	21.0	26.3	19.2	22.8	18.8	24.2
Marital status								
Married or cohabiting	84.4	87.8	86.7	85.5	68.5	59.4	66.5	59.1
Not married	15.6	12.2	13.3	14.5	31.5	40.6	33.5	40.9
Health status								
Very good and good	40.0	15.7	40.1	34.1	41.0	5.8	31.8	21.9
Average	48.5	67.3	46.1	54.6	48.4	67.0	52.3	61.3
Poor and very poor	11.5	17.0	13.8	11.3	10.6	27.2	15.9	16.8
Education level								
Primary	5.8	11.4	9.5	4.6	17.8	9.7	13.7	3.8
Vocational	43.5	35.0	27.6	9.9	30.4	33.5	15.2	7.3
Secondary	32.1	21.8	32.7	51.4	41.4	30.5	44.1	55.1
University	18.6	31.8	30.2	34.1	10.4	26.3	27.0	33.8
Deprivation level								
Low	54.6	37.5	52.7	76.6	45.7	20.0	42.8	63.5
Medium	41.2	43.6	37.6	22.1	48.0	51.8	43.2	32.9
High	4.2	18.9	9.7	1.3	6.3	28.2	14.0	3.6
Economic activity								
Employed	38.0	37.5	31.8	45.3	35.9	29.2	29.5	39.1
Owner of a company/self-employed	12.2	2.6	9.0	4.9	4.6	1.1	3.6	1.8
Housewife/farmer/working pensioner	8.5	21.2	7.9	21.9	8.7	18.2	8.6	18.5
Non-working pensioner	38.2	33.1	45.3	23.1	48.2	48.7	53.9	36.2
Unemployed	3.1	5.6	6.0	4.8	2.6	2.8	4.4	4.4
Smoking								
No	73.4	51.3	66.3	36.8	78.8	90.6	74.3	81.3
Yes	26.6	48.7	33.7	63.2	21.2	9.4	25.7	18.7
Alcohol drinking								
Never	6.6	13.4	21.6	5.5	17.9	17.9	46.0	7.1
Less than once a month	17.0	17.7	19.3	20.3	32.9	55.5	27.3	49.1
About one to three times a month	17.7	24.2	23.2	33.6	24.0	18.9	16.6	32.2
At least once a week	58.7	44.7	35.9	40.6	25.2	7.8	10.1	11.6

increased substantially (Model 2). Additional adjustment for smoking and drinking (Model 3) did not materially change the results in men, but attenuated the odds ratios in women.

Discussion

This large population-based study in Central and Eastern Europe found pronounced social gradients in functional limitations consistent with previous findings elsewhere. Interestingly, socioeconomic characteristics explained some of the variation in functional limitations between populations but two major health behaviours, smoking and drinking, did not seem to mediate the effects of socioeconomic characteristics, and their contribution to explaining some of the differences in functional limitations between study populations was limited to women.

Several limitations of this study need to be considered when interpreting the results. First, the cross-sectional design makes it difficult to assess the direction of the relationships between variables, and reverse causality is possible. For example, material deprivation can plausibly both lead to functional limitations and be a result of impaired functioning. This problem is even more apparent in the case in health behaviours: participants may abstain from drinking because of ill health, rather than the opposite.

Secondly, all variables were self-reported. This may introduce two problems. First, a reporting bias within populations, by which reporting of the outcome is not independent of the exposure. For example, people with pronounced functional limitations may over-report material deprivation. The second issue is the comparability between populations. Different populations may have different

Table 2. Odds ratios (95% CIs) from ordinal logistic regression of reporting lower physical functioning at different levels of adjustment

	Model 1		Model 2		Model 3	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Men						
Marital status						
Married or cohabiting	1.00	<0.001	1.00	0.545	1.00	0.893
Not married	1.22 (1.12–1.33)		1.03 (0.94–1.12)		1.01 (0.92–1.10)	
Education						
Primary	1.00		1.00		1.00	
Vocational	0.74 (0.67–0.84)	<0.001	0.90 (0.79–1.01)	0.073	0.91 (0.81–1.03)	0.127
Secondary	0.56 (0.50–0.63)	<0.001	0.74 (0.66–0.84)	<0.001	0.76 (0.67–0.86)	<0.001
University	0.38 (0.34–0.43)	<0.001	0.60 (0.53–0.68)	<0.001	0.64 (0.56–0.73)	<0.001
Deprivation						
Low	1.00		1.00		1.00	
Medium	1.87 (1.75–1.99)	<0.001	1.68 (1.57–1.80)	<0.001	1.67 (1.56–1.79)	<0.001
High	3.43 (3.07–3.83)	<0.001	2.53 (2.25–2.83)	<0.001	2.50 (2.23–2.81)	<0.001
Economic activity						
Employed	1.00		1.00		1.00	
Owner of a company/self-employed	0.96 (0.85–1.10)	0.579	1.05 (0.92–1.20)	0.454	1.07 (0.94–1.22)	0.308
Housewife/farmer/employed pensioner	1.63 (1.46–1.82)	<0.001	1.59 (1.42–1.77)	<0.001	1.59 (1.42–1.78)	<0.001
Not employed pensioner	3.85 (3.50–4.23)	<0.001	3.20 (2.91–3.53)	<0.001	3.09 (2.80–3.40)	<0.001
Unemployed	2.52 (2.19–2.91)	<0.001	1.99 (1.71–2.30)	<0.001	1.98 (1.71–2.30)	<0.001
Women						
Marital status						
Married/cohabiting	1.00	0.163	1.00	0.027	1.00	
Not married	1.04 (0.98–1.10)		0.82 (0.69–0.98)		0.96 (0.90–1.02)	0.183
Education						
Primary	1.00		1.00	<0.001	1.00	
Vocational	0.74 (0.67–0.83)	<0.001	0.82 (0.73–0.91)	<0.001	0.84 (0.75–0.95)	0.002
Secondary	0.55 (0.50–0.61)	<0.001	0.65 (0.59–0.72)	<0.001	0.69 (0.62–0.76)	<0.001
University	0.39 (0.35–0.44)	<0.001	0.55 (0.49–0.61)	<0.001	0.59 (0.52–0.66)	<0.001
Deprivation						
Low	1.00		1.00		1.00	
Medium	1.73 (1.62–1.84)	<0.001	1.60 (1.50–1.70)	<0.001	1.61 (1.51–1.72)	<0.001
High	3.33 (3.02–3.66)	<0.001	2.73 (2.47–3.01)	<0.001	2.73 (2.47–3.01)	<0.001
Economic activity						
Employed	1.00		1.00		1.00	
Owner of a company/self-employed	0.75 (0.64–0.89)	0.001	0.82 (0.69–0.98)	0.027	0.82 (0.69–0.98)	0.030
Housewife/farmer/employed pensioner	1.47 (1.33–1.63)	<0.001	1.41 (1.27–1.56)	<0.001	1.41 (1.27–1.56)	<0.001
Not employed pensioner	2.89 (2.64–3.17)	<0.001	2.39 (2.18–2.63)	<0.001	2.32 (2.11–2.55)	<0.001
Unemployed	2.50 (2.14–2.92)	<0.001	1.95 (1.67–2.29)	<0.001	1.89 (1.61–2.21)	<0.001

Model 1: adjusted for age, population and attending examination in a clinic.

Model 2: adjusted for age, population, attending examination in a clinic and socioeconomic status (SES) indicators.

Model 3: adjusted for age, population, attending examination in a clinic, socioeconomic status (SES) indicators, smoking, and drinking frequency.

criteria for ‘normality’, and the same level of physical functioning may be interpreted differently in different populations. In the absence of objective measures, we cannot be entirely confident that the reported levels of functional limitations in the participating countries are not influenced by different perceptions. On the other hand, functional limitations based on a number of concrete items are more likely to be a more robust measure than, for example, a single question on self-rated health.

Thirdly, although the study examined random population samples, the selected cities/towns may not be representative of urban populations in the respective countries. For example, large cities have relatively higher education level than smaller towns, and the degree of urbanisation may partly explain the relatively low educational level in the

Czech town (the largest Czech town had a population of about 100,000 people, while Kaunas, Krakow and Novosibirsk are important regional centres). Nevertheless, socioeconomic circumstances differ considerably between these four countries; preliminary data on mortality follow-up, showing 2.2 times higher male and 1.4 times higher female mortality in the Novosibirsk sample than in the Czech subjects (unpublished), suggest that at least some of the important differences between countries are reflected by the differences between the four study samples.

Despite these limitations, this is one of the first, and certainly the largest study so far on the levels and socioeconomic correlates of functional limitations in Central and Eastern Europe. We have previously found a strong population-level correlation between life expectancy and

Table 3. Odds ratios (95% CIs) from ordinal logistic regression of reporting lower physical functioning by population

	Model 1		Model 2		Model 3	
	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Men						
Czech towns	1.00		1.00		1.00	
Novosibirsk	0.79 (0.72–0.86)	<0.001	0.68 (0.62–0.74)	<0.001	0.62 (0.57–0.69)	<0.001
Krakow	1.16 (1.07–1.25)	<0.001	1.04 (0.96–1.14)	0.307	0.98 (0.89–1.07)	0.594
Kaunas	0.64 (0.58–0.70)	<0.001	0.93 (0.84–1.03)	0.169	0.84 (0.75–0.94)	0.002
Women						
Czech towns	1.00		1.00		1.00	
Novosibirsk	1.68 (1.56–1.82)	<0.001	1.40 (1.29–1.53)	<0.001	1.31 (1.20–1.43)	<0.001
Krakow	1.74 (1.62–1.88)	<0.001	1.69 (1.57–1.83)	<0.001	1.52 (1.40–1.65)	<0.001
Kaunas	1.25 (1.15–1.36)	<0.001	1.84 (1.68–2.02)	<0.001	1.81 (1.64–1.99)	<0.001

Model 1: adjusted for age and attending examination in a clinic.

Model 2: adjusted for age, attending examination in a clinic and SES indicators.

Model 3: adjusted for age, attending examination in a clinic, SES indicators, smoking and drinking frequency.

self-rated health in 13 countries of Central and Eastern Europe [16]. Given the mortality gradient across countries and study populations covered by our study, we expected much higher levels of functional limitations in Novosibirsk than in Krakow or Czechs towns. The results in males did not confirm this hypothesis; the lowest odds of functional limitations was in fact found in Novosibirsk.

Comparing absolute levels of functional limitations with studies in other populations is problematic because of the differences in methodology. Using different definitions, the prevalence of functional limitations was reported to be between 8 and 20% in the USA [17, 18], around 17% in France [19], 15% or more (depending on method) in the UK [20] and between 11 and 19% in Sweden [10]. Although direct comparisons are difficult, our data suggest relatively high levels of functional limitations in these Central and Eastern European population samples, particularly among women.

The strong effects of socioeconomic factors in our data are consistent with previous studies elsewhere, which have shown that different measurements of physical functioning consistently show associations with various measures of socioeconomic status [5, 21–25]. Central and Eastern Europe follows the same pattern. Although the temporal sequence of the association of functional limitations with material deprivation and economic activity remains unclear, education is not affected by this problem, since the participants had completed their education before entering the study. Education was strongly associated with functional limitations in all populations and in both genders, and is clearly a major determinant of functional status.

Given the important role of smoking and alcohol in the high mortality of Eastern European populations [26–28], we expected that these behaviours act as important mediators of both socioeconomic and societal (i.e. population-level) influences on functional limitations. However, was not the case. This finding is surprising, since functioning and mortality have at least partly overlapping causes, particularly cardiovascular risk factors.

Addressing health inequalities is high on international agenda [29]. Our finding of a pronounced social gradient in functional limitations in these middle-aged population samples in Central and Eastern Europe is important for several reasons. First, functional limitations predict severe disability, and disability in turn is associated with poverty [30]. The large differentials in functioning in middle-aged persons observed in this study may predict future ill health and deprivation. If efforts to improve functional outcomes are to succeed, they need to start at relatively young ages. Secondly, although the relationship between disability and poverty needs more research, especially to determine the most important causal factors [30], poor physical functioning may be a significant element that acts as a mediator in this association. Finally, socioeconomic factors may influence functional limitations via different pathways, both direct and indirect [22]; the modest contribution of smoking and alcohol to the social differentials suggests that interventions restricted to these health behaviours may not significantly reduce social inequalities in the health of older people.

Key points

- Eastern European countries have high mortality rates but little is known about non-fatal health outcomes among older persons.
- There were strong socioeconomic gradients in functional limitations in all four samples.
- Differences in functional limitations between the four populations did not follow differences in mortality rates.
- Differences in functional limitations between the four populations were only partly explained by socioeconomic factors.
- The contribution of health behaviours to the social gradient was small; smoking and alcohol explained some of the differences between populations in women but not in men.

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Conflicts of interest

None declared.

Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

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Secular trends in lung function and its relation to survival in Swedish 75 year olds 1976–2006

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Abstract

Background: several studies have found that lung function correlates with survival in older people. We examined secular trends in lung function and its relation to survival in Swedish 75 year olds.

Method: representative samples from the general population in Gothenburg, Sweden, were examined at the age of 75 in 1976–77 ($n = 743$) and 2005–06 ($n = 765$) with comprehensive somatic and psychiatric examinations. Lung function was measured as peak expiratory flow (PEF).

Results: the mean PEF was higher in 75 year olds examined 2005–06 compared with those examined 1976–77 both among women (339 versus 307 l/min; $P < 0.001$) and men (490 versus 400 l/min, $P < 0.001$). The birth cohort effect was still significant after adjusting for a number of confounders. PEF correlated with survival between age 75 and 78 years among those examined in 1976–77 both in women (OR per 10 l/min increase in PEF = 1.112, 95% CI: 1.047–1.182) and in men (OR = 1.040, 95% CI: 1.015–1.066), but not in those examined 2005–06 (women: OR = 1.071, 95% CI: 0.965–1.188; men: OR = 1.000, 95% CI: 0.957–1.046).

Conclusion: we found better lung function in the later-born cohort of 75 year olds, which was only partially explained by changes in smoking, height and weight, physical activity, socio-economic/educational factors and pulmonary/cardiovascular morbidity. The association between better lung function and short-term survival was strong in 1976–77, but had disappeared in 2005–06. More studies are needed to elucidate the role of lung function for long-term survival and identify other factors that explain the secular trends in lung function.

Keywords: Cohort effect, lung function, aged, mortality, population study, older people