Age and Ageing Advance Access published November 18, 2009

Age and Ageing 2009; 1–4

Research Letter

Coronary heart disease risk factors and regional deprivation in England: does age matter?

SIR—The potential influence of regional deprivation in the development of coronary heart disease (CHD) has rarely been addressed among the older population in England. Most studies on geographical variations have focused on mortality [1, 2] rather than morbidity or concentrated only on particular areas [3–5]. Inequalities in CHD by geographical regions or area of residence are well recognised [6–8]. Given that the risk of CHD increases with age [9, 10] and that the relationship between socioeconomic factors and health varies among different age groups [11, 12], we separately examined the associations of regional deprivation with CHD risk factors accounting for individual measures of social position and health behaviours in late middle age (52–65 years) and older (>65 years). The following biological CHD risk factors were used: body mass index (BMI), waist–hip ratio (WHR), systolic blood pressure, high-density lipoprotein (HDL) cholesterol and triglycerides.

Methods

We used data from Wave-2 of the English Longitudinal Study of Ageing (ELSA), which, biennially, follows people who were aged 50 years and older and living in private households in England in 2002 [13]. Wave-2, which comprised an interview and a nurse visit, took place in 2004–05. Technical details and some primary analyses have been published elsewhere [13, 14]. The sample size for analysis was 4,774 participants. Ethical approval for the data collection was obtained from the London Multi Research Ethics Committee (ref: 04/2/006).

All biological measures were taken during the nurse visit. The mean of three sitting blood pressure measurements taken at 1-min intervals was determined. Triglycerides, total and HDL cholesterol from serum samples were measured by an autoanalyser.

Smoking and physical activity were self-reported. Respondents were classified as never, current and ex-smokers. Four levels of leisure physical activity were created: active (vigorous activity more than once per week), moderate (vigorous activity one to four times a month or moderate activity more than once a week), low (moderate activity one to four times a month or mild activity at least once a week) and sedentary (mild activity less than once per week).

Three measures of individual social position were used: occupational class, wealth and educational level. The most recent occupation was categorised as follows using the National Statistics Socioeconomic Classification: managerial and professional , intermediate , and routine and manual occupations. Wealth was calculated from detailed information on monetary and physical assets and divided into quintiles [13]. For educational level, the highest qualification attained was categorised into three groups: low (basic/primary/foreign education), middle (up to A level) and high (higher education including vocational qualification below degree level).

Social position at regional level

Regions, as specified by the Office for National Statistics, were used to code residence at the time of interview (nine regions in England). The deprivation index was calculated by principal component analysis and comprised of the following regional economic indicators [15]: gross average weekly household income, average household weekly expenditure, share of UK employment, percentage of working age people with higher education, gross value added per head and average house price. Regions were then grouped by tertiles of index scores.

Statistical methods

For respondents with complete information on all variables, we estimated associations of CHD risk factors with regional deprivation first adjusted for sex and age (model 1), then further adjusted for individual social position factors and for health behaviours (model 2). In all the models, sandwich estimator of variance was specified to account for the clustering within regions. Interaction between age and regional deprivation was significant for all CHD outcomes according to the log-likelihood ratio test ($P<0.05$).

Results

For those aged 52–65 years, there were trends of higher BMI and triglyceride levels with increasing regional deprivation ($P=0.02$ and 0.01, respectively; Table 1). However, WHR, systolic blood pressure and HDL cholesterol did not vary by regional deprivation ($P>0.05$). In people aged >65 years, a trend favouring the least deprived regions was found for all the biological CHD risk factors ($P<0.01$).

Associations between CHD risk factors and regional deprivation were largely lacking for the younger age group with the exception of triglyceride levels (Table 2). For the older age group, a regional deprivation gradient in all the CHD risk factors was observed in both models. Adding in

Table 1. Mean (standard deviations) of CHD risk factors by regional deprivation

	Regions				*P* for trend
	All regions	Least deprived	Intermediate deprived	Most deprived	
52–65 years (*n*=2,532)					
Body mass index	28.01 (4.72)	27.63 (4.72)	28.09 (4.69)	28.19 (4.72)	0.02
Waist–hip ratio	0.887 (0.083)	0.886 (0.084)	0.890 (0.082)	0.886 (0.084)	0.80
Systolic blood pressure (mmHg)	131.21 (16.99)	130.54 (17.24)	130.91 (17.77)	131.92 (17.00)	0.09
HDL cholesterol (mmol/l)	1.54 (0.38)	1.55 (0.39)	1.55 (0.39)	1.53 (0.36)	0.20
Triglycerides (mmol/l)	1.81 (1.13)	1.73 (1.09)	1.80 (1.13)	1.87 (1.16)	0.01
Over 65 years (*n*=2,242)					
Body mass index	27.44 (4.45)	27.05 (4.46)	27.34 (4.18)	27.81 (4.66)	0.001
Waist–hip ratio	0.898 (0.083)	0.889 (0.080)	0.903 (0.084)	0.902 (0.085)	0.004
Systolic blood pressure (mmHg)	139.26 (19.51)	137.03 (19.31)	139.27 (19.80)	140.76 (19.23)	≤0.001
HDL cholesterol (mmol/l)	1.51 (0.39)	1.57 (0.40)	1.50 (0.37)	1.48 (0.38)	≤0.001
Triglycerides (mmol/l)	1.72 (0.95)	1.60 (0.87)	1.71 (0.96)	1.79 (0.98)	≤0.001

individual-level social position and health behaviours only modestly attenuated the parameters.

Discussion

At older ages, regional deprivation was positively associated with higher BMI, raised WHR, higher systolic blood pressure, lower HDL cholesterol and higher triglyceride levels independently of individual-level social position and health behaviours. However, associations between biological risk factors and regional deprivation were largely lacking for the younger age group with the exception of triglyceride levels. Thus, our findings suggest that the region of residence may be more important for older people's risk of cardiovascular disease than their younger counterparts. These findings may have important policy considerations in terms of the environments in which people live.

Pickett *et al.* found that, in nearly all of 25 multi-level studies reviewed, there was an association between at least one 'neighbourhood' social factor and one or more health

Table 2. Age and sex-adjusted associations of CHD risk factors with regional deprivation (regression coefficients β with 95% confidence intervals) in ELSA Wave-2[a]

	Regional deprivation tertile	52–65 years (*n*=2,532)		Over 65 years (*n*=2,242)	
		Model 1[b] β (95% CI)	Model 2[c] β (95% CI)	Model 1[b] β (95% CI)	Model 2[c] β (95% CI)
Body mass index	Least deprived	0	0	0	0
	Intermediate deprived	0.46* (0.00, 0.92)	0.53* (0.08, 0.99)	0.30** (0.19, 0.40)	0.24** (0.10, 0.38)
	Most deprived	0.57** (0.25, 0.89)	0.42 (−0.03, 0.86)	0.77** (0.33, 1.22)	0.60* (0.12, 1.09)
	P for trend	0.01	0.16	0.005	0.03
Waist–hip ratio	Least deprived	0	0	0	0
	Intermediate deprived	0.004* (0.001, 0.008)	0.005* (0.003, 0.008)	0.008** (0.004, 0.012)	0.007** (0.005, 0.010)
	Most deprived	0.001 (−0.003, 0.006)	−0.001 (−0.004, 0.002)	0.010** (0.003, 0.017)	0.008* (0.001, 0.015)
	P for trend	0.89	0.47	0.021	0.074
Systolic blood pressure (mmHg)	Least deprived	0	0	0	0
	Intermediate deprived	0.41 (−1.44, 2.25)	0.42 (−1.29, 2.13)	2.28 (−0.28, 4.83)	2.15 (−0.37, 4.66)
	Most deprived	1.43 (−0.00, 2.86)	1.18 (−0.06, 2.42)	3.77* (1.10, 6.43)	3.55* (1.91, 6.20)
	P for trend	0.54	0.06	0.011	0.015
HDL cholesterol (mmol/l)	Least deprived	0	0	0	0
	Intermediate deprived	−0.01 (−0.07, 0.05)	−0.01 (−0.07, 0.05)	−0.07** (−0.10, −0.04)	−0.06** (−0.10, −0.03)
	Most deprived	−0.03 (−0.10, 0.05)	−0.01 (−0.09, 0.06)	−0.08** (−0.12, −0.04)	−0.07** (−0.10, −0.03)
	P for trend	0.42	0.67	0.008	0.016
Triglycerides (mmol/l)	Least deprived	0	0	0	0
	Intermediate deprived	0.08 (−0.02, 0.18)	0.09 (−0.01, 0.19)	0.11** (0.08, 0.14)	0.10** (0.05, 0.15)
	Most deprived	0.14** (0.07, 0.22)	0.12** (0.04, 0.20)	0.19** (0.11, 0.27)	0.15** (0.07, 0.25)
	P for trend	0.002	0.006	0.001	0.005

CI, confidence interval; *$P<0.05$; **$P<0.001$.

[a]Analysed for respondents with complete data for own social position and health-related behaviours. The clustering within regions is accounted by specifying sandwich estimator of variance.

[b]Model 1: age and sex-adjusted associations of CHD risk factors with regional deprivation.

[c]Model 2: also adjusted for social position variables at individual level, smoking and physical activity.

outcomes after adjusting for individual socioeconomic position—these were often modest [16]. We also had modest results for our younger age group but more substantial ones for the older age group. The 25 studies were predominantly looking at smaller geographical areas and younger age groups, only one specifically covering 45–64 years old. Recent studies continue to show associations between neighbourhood socioeconomic status and health indicators [17, 18].

The geographical differences within the UK in health-related behaviours [3, 4, 6, 19, 20] may be one pathway between regional-level socioeconomic circumstances and CHD risk factors. Although the health behaviours, as measured in the present study, did not affect the deprivation parameters, the measures may be insufficiently precise to avoid some residual confounding.

Having found that living in a deprived region had the most negative health effects at older ages, consider that one reason for this could be an increased dependence on locally provided facilities and services. In our sample, almost 95% of people aged >65 were retired, and our results were similar when we categorised by retirement status rather than age. Length of residence in the area may be another factor. For example, in one study neighbourhood, effects were stronger for those who had lived in an area for at least 10 years [21]; the extent of internal migration may be less among the oldest and hence current level of deprivation at regional level may capture more of their lifetime circumstances.

We used regions although this precluded multi-level modelling because there are substantial economic differences at this level and regional development authorities have been given a key role in economic development. Particularly in historically deprived areas, we surmise that there is a regional identity associated with lifestyle and culture.

The regional deprivation index used a range of regional economic factors that we believed relevant to people's opportunities for healthy lifestyles and avoidance of chronic stress. Furthermore, by simultaneously using three measures of individual social position in the model, we aimed to minimise residual socioeconomic confounding. However, social position factors may capture the status of the older group less well than that of the younger (e.g. educational expectations changed considerably during the 20th century and some participants stopped work many years ago), so part of the explanation for our findings may be greater residual confounding among the older age group.

To our knowledge, this is the first national study in England examining the effects of regional deprivation on CHD risk factors among older people. Additionally, we examined regional deprivation variations in CHD risk factors in two age groups: late middle age, before usual onset of overt disease and in older adults. There are limitations to this study. First, we could not yet examine changes in CHD risk factors over time. Second, there are factors that we did not have in our models such as migration and time since retirement, which could impact on CHD health. Third, ELSA initially omitted people living in institutions and so may underestimate socioeconomic differences in health.

We conclude that there is an impact of socioeconomic factors at regional level on biological risk factors for cardiovascular disease among people >65 years old. However, regional deprivation was not associated with most of the CHD risk factors at late middle age (52–65 years).

Key points

- Among people aged between 52 and 65 years, regional deprivation was not strongly related to CHD risk factors.
- At older ages (>65 years), regional deprivation was positively associated with higher BMI, raised WHR, higher systolic blood pressure, lower HDL cholesterol and higher triglyceride levels independent of the individual-level social position and health behaviours.
- Region of residence may be more important for older people's cardiovascular disease than their younger counterparts.

Acknowledgements

The data were made available through the UK Data Archive. ELSA was developed by a team of researchers based at the National Centre for Social Research, University College London and the Institute of Fiscal Studies. The data were collected by the National Centre for Social Research. The funding is provided by the National Institute on Aging in the USA and a consortium of UK government departments coordinated by the Office for National Statistics. The developers and funders of ELSA and the Archive do not bear any responsibility for the analyses or interpretations presented here.

Conflicts of interest

None.

Faiza Tabassum*, Elizabeth Breeze, Meena Kumari
Department of Epidemiology and Public Health, University College London, 1-19 Torrington Place, London WC1E 6BT, UK
Email: f.tabassum@ucl.ac.uk
**To whom correspondence should be addressed*

References

1. Ben-Shlomo Y, White IR, Marmot M. Does the variation in the socioeconomic characteristics of an area affect mortality? Br Med J 1996; 312: 1013–4.
2. Smith GD, Hart C, Watt G, Hole D, Hawthorne V. Individual social class, area-based deprivation, cardiovascular disease risk factors, and mortality: the Renfrew and Paisley Study. J Epidemiol Community Health 1998; 52: 399–405.

3. Ellaway A, Anderson A, Macintyre S. Does area of residence affect body size and shape? Int J Obes Relat Metab Disord 1997; 21: 304–8.
4. Crombie IK, Smith WC, Tavendale R, Tunstall-Pedoe H. Geographical clustering of risk factors and lifestyle for coronary heart disease in the Scottish Heart Health Study. Br Heart J 1990; 64: 199–203.
5. Aslanyan S, Weir CJ, Lees KR, Reid JL, McInnes GT. Effect of area-based deprivation on the severity, subtype, and outcome of ischemic stroke. Stroke 2003; 34: 2623–8.
6. Morris RW, Whincup PH, Lampe FC, Walker M, Wannamethee SG, Shaper AG. Geographic variation in incidence of coronary heart disease in Britain: the contribution of established risk factors. Heart 2001; 86: 277–83.
7. Riva M, Gauvin L, Barnett TA. Toward the next generation of research into small area effects on health: a synthesis of multilevel investigations published since July 1998. J Epidemiol Community Health 2007; 61: 853–61.
8. Morris RW, Wannamethee G, Lennon LT, Thomas MC, Whincup PH. Do socioeconomic characteristics of neighbourhood of residence independently influence incidence of coronary heart disease and all-cause mortality in older British men? Eur J Cardiovasc Prev Rehabil 2008; 15: 19–25.
9. Jousilahti P, Vartiainen E, Tuomilehto J, Puska P. Sex, age, cardiovascular risk factors, and coronary heart disease: a prospective follow-up study of 14 786 middle-aged men and women in Finland. Circulation 1999; 99: 1165–72.
10. Rich-Edwards JW, Manson JE, Hennekens CH, Buring JE. The primary prevention of coronary heart disease in women. N Engl J Med 1995; 332: 1758–66.
11. Huisman M, Kunst AE, Mackenbach JP. Socioeconomic inequalities in morbidity among the elderly; a European overview. Soc Sci Med 2003; 57: 861–73.
12. Chandola T, Ferrie J, Sacker A, Marmot M. Social inequalities in self reported health in early old age: follow-up of prospective cohort study. Br Med J 2007; 334: 990.
13. Banks J, Breeze E, Lessof C, Nazroo J. Retirement, health and relationships of the older population in England: The 2004 English Longitudinal Study of Ageing (wave 2). *London Institute for Fiscal Studies*. 2006. 383p.
14. Scholes S, Taylor R, Cheshire H, Cox K, Lessof C. *Technical report (wave 2): retirement, health and relationships of the older population in England: the 2004 English Longitudinal Study of Ageing*. London: National Centre for Social Research. 107pp.
15. *Regional Economic Indicators December 2007*. *Southwest Observatory*. 2007Available from: URL:http://www.southwestid.org.uk/download/4149492c178cd31a01178cfbd1250002/Regional_-December_%202007.pdf.
16. Pickett KE, Pearl M. Multilevel analysis of neighbourhood socioeconomic context and health outcomes: a critical review. J Epidemiol Community Health 2001; 55: 111–22.
17. Lang IA, Llewellyn DJ, Langa KM, Wallace RB, Huppert FA, Melzer D. Neighbourhood deprivation, individual socioeconomic status, and cognitive function in older people: analyses from the English Longitudinal Study of Ageing. J Am Geriatr Soc 2008; 56: 191–8.
18. Basta NE, Matthews FE, Chatfield MD, Brayne C. CFAS M.R.C. Community-level socio-economic status and cognitive and functional impairment in the older population. Eur J Public Health 2008; 18: 48–54.
19. Lawlor DA, Bedford C, Taylor M, Ebrahim S. Geographical variation in cardiovascular disease, risk factors, and their control in older women: British Women's Heart and Health Study. J Epidemiol Community Health 2003; 57: 134–40.
20. Ellaway A, Macintyre S. Does where you live predict health related behaviours?: a case study in Glasgow. Health Bull (Edinb) 1996; 54: 443–6.
21. Stafford M, Gimeno D, Marmot MG. Neighbourhood characteristics and trajectories of health functioning: a multilevel prospective analysis. Eur J Public Health 2008; 18: 604–10.

doi: 10.1093/ageing/afp205