ORIGINAL ARTICLE

Deprivation, smoking, and quality of life in asthma

J B Austin, S Selvaraj, D Godden, G Russell

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Correspondence to: Dr J B Austin, Highland and Islands Health Research Institute, University of Aberdeen, The Green House, Inverness IV2 3ED, UK; jane.austin@hpcot.scot.nhs.uk

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Aims: To explore associations of deprivation and smoking, with prevalence of asthma, wheeze, and quality of life.

Methods: Survey, using International Study of Asthma and Allergies in Childhood (ISAAC) methodology, of children aged 13–14 years attending Scottish schools previously surveyed in 1995.

Results: 4665/5247 (89%) pupils completed questionnaires. 3656/4665 (78.4%) had missed school for any reason in the last 12 months, 587 (12.6%) because of asthma or wheeze. Compared to children with 1–3 wheeze attacks per year, those with >12 attacks in the last year were more likely to have missed school, twice as likely to have missed physical education in the last month, to report interference with home activities, or to have visited accident and emergency departments, and three times more likely to have been hospitalised. Deprivation was not independently associated with self-reported asthma or wheeze, but was associated with school absence, either for any reason or specifically for asthma or wheeze, but not with use of services such as accident and emergency visits, doctor visits, or hospital admissions. Active smoking was associated with wheezy symptoms, and active and passive smoking with use of medical services. These associations were independent of wheeze severity, treatment taken, and other associated atopic conditions. Smoking also had an impact on school absence and home and school activities.

Conclusions: Deprivation does not affect the prevalence of asthma or wheeze. Exposure to cigarette smoke was associated with the increased use of services. Deprivation and smoking have independent adverse effects on the quality of life in subjects with asthma or wheeze.

The prevalence of asthma has increased in the western world in the last four decades^{1–2} but is now stabilising,³ or decreasing.⁴ There has been a downward trend in acute asthma episodes since 1993 in England and Wales,⁵ and results of serial prevalence surveys of adolescents show a decrease in reported wheeze in both England and Scotland.⁶ Despite most affected children having mild asthma,⁷ the social and economic impact on the family is significant.^{8–9} The child's quality of life can be profoundly affected by sleep disturbance, limitations in physical activity, and poor self-esteem.^{9–11}

While studies from North America,¹² Europe,¹³ and Scotland¹⁴ suggest that deprivation is associated with asthma, particularly if symptoms are severe,^{13–14} a recent Scottish study showed no such effect, although the population studied was predominantly rural and relatively affluent.⁴ Erickson *et al* found that household income correlated positively with health related quality of life.¹⁵ Thus, the interrelations between environmental influences and disease are complex, and the recent International Study of Asthma and Allergies in Childhood (ISAAC)⁶ provided an opportunity to explore, at a national level, associations of deprivation and smoking with prevalence of wheeze, asthma, and quality of life.

METHODS

This study adopted the ISAAC protocol, including the self-completed questionnaire previously used in Scotland in 1995.^{7–16} The questionnaire included items on symptoms, diagnosis, and treatment of asthma, eczema, and hay fever. In order to assign deprivation ranks, pupils were asked for the first five digits of their postcode. Deprivation scores and ranks were derived from the Scottish Index of Multiple Deprivation (SIMD),^{17–18} which assigns a deprivation score

and rank, based on a number of domains, to each ward, a ward being a small geographical area within local authority boundaries as defined by central government. For ease of interpretation we divided the ranks into quartiles, where 1 represents the most affluent group and 4 the most deprived group. Because for reasons of confidentiality we did not collect the last letter of the postcode, there were occasions when these spanned more than one ward; under these circumstances, a median rank was assigned. Additional questions concerning quality of life were also included, based on those used in a study of Croydon children¹⁹ and used in a previous study in the Highlands of Scotland.⁴

The sampling frame used in the 1995 prevalence study included mixed sex state secondary schools with over 100 pupils in each school year for every region, including Orkney, Shetland, and the Western Isles, together with the metropolitan areas of Edinburgh and Glasgow. One school from each region/island was selected randomly from the sampling frame. The same 14 schools that participated in 1995 were selected. All pupils in years 2 and 3 (aged 13–14) were invited to participate in the study. Information letters and consent slips were distributed to pupils by the schools prior to the fieldwork. Questionnaires were completed in the schools under the supervision of trained researchers between January and March 2002.

All data were double entered independently into an Access database. Data were analysed in accordance with ISAAC policy.¹⁶ We included “missing” or inapplicable responses in denominators for univariate analyses, but excluded them from subsequent bivariate analyses. SIMD ranks were

Abbreviations: ISAAC, International Study of Asthma and Allergies in Childhood; SIMD, Scottish Index of Multiple Deprivation

Table 1 Diagnosis, symptoms, use of services, and quality of life factor (%) by deprivation

	Deprivation quartile				p value
	1	2	3	4	
Diagnosis/symptoms	n = 1085	n = 1162	n = 1054	n = 997	
Asthma reported	23.6	25.0	24.8	25.1	0.635
Eczema reported	26.3	29.3	24.1	19.6	0.008
Hay fever reported	34.3	34.5	33.3	34.4	0.928
Wheeze in last 12 months	26.1	26.8	31.1	27.1	0.406
Intermittent itchy flexural rash in last 12 months	11.6	13.2	11.8	11.2	0.734
Rhinoconjunctivitis in last 12 months	15.5	13.0	15.9	17.3	0.220
Sleep disturbance	1.9	3.1	4.8	4.4	0.004
Speech limitation	5.6	6.0	7.3	7.9	0.072
Severe wheeze (4+ attacks)	7.0	6.2	6.4	5.5	0.321
Treatment in last 12 months for wheeze/asthma	18.2	18.5	19.7	19.7	0.286
Use of services in last 12 months*	n = 509	n = 566	n = 543	n = 471	
Doctor visit	7.7	9.4	11.8	13.0	0.007
Hospital admissions	5.7	4.6	8.1	7.0	0.090
Visit to A&E	6.9	7.1	10.9	10.8	0.011
Impact on activity*					
Missed school for any reason in last 12 months	79.2	83.0	85.8	86.4	0.003
Missed school because of asthma and wheeze in last 12 months	18.9	23.3	23.4	30.8	0.001
Interfered ever with PE	30.3	31.4	33.7	32.9	0.140
Interfered with home activities	7.1	7.8	10.1	7.6	0.312

*Data related to children reporting asthma or lifetime wheeze.

divided into four categories for analysis purposes based on quartiles of population SIMD ranks. We performed Student's *t* test to examine the linear trend of prevalence of symptoms, use of services, and quality of life factors across deprivation quartiles. Logistic regression analysis was used to assess the effect of deprivation on severity of wheeze and quality of life factors, simultaneously adjusting for smoking status, gender, and co-morbid conditions. Factors significant at univariate analysis with *p* values below 0.2 were considered in the multiple logistic regression analysis. Results are presented as percentages and odds ratios with 95% confidence intervals (CI). Since cluster sampling had a significant impact on the results, all the statistical analyses took into account of the additional variance arising from this study design. Probability values below 0.05 were considered as statistically significant. Stata version 8.0 was used for all analyses.

The study was approved by Multicentre Research Ethics Committee, and by relevant local research ethics committees. Participation was entirely voluntary.

RESULTS

All 14 (100%) schools participated, and 4665/ 5247 (89%) pupils completed questionnaires. Response rates by school varied from 83% to 94%. Subjects were aged between 12 and 15 years, the majority (95.6%) being aged 13–14 years; 2291 (49.1%) were male; and 103 (2.2%) were born outside the UK. Postcode information was complete for 4104 (88%) cases. A further 194 (4%) cases were assigned SIMD ranks if at least the first part of the postcode information was complete. Postcode information in the remaining 8% of questionnaires was either missing or insufficient to calculate deprivation ranks. The distribution of SIMD ranks among our sample was comparable to that of the Scottish population.^{17 18}

Asthma was reported by 1141 (24.5%) subjects and wheeze in the last 12 months by 1295 (27.8%). The majority of subjects experiencing wheeze reported 1–3 attacks in the last 12 months.

A total of 3656/4665 (78.4%) had missed school for any reason in the last 12 months, of whom 587 (12.6%) missed

Table 2 Factors associated with diagnosis, and symptoms; findings from multiple logistic regression

	Reported asthma		Current wheeze	
SIMD				
Q1	–	–	1.00	
Q2	–	–	1.12	(0.86 to 1.48)
Q3	–	–	1.29	(1.05 to 1.58)
Q4	–	–	1.01	(0.75 to 1.35)
Active smoking				
Never smoker	1.00	–	1.00	–
Ex-smoker	1.05	(0.90 to 1.22)	1.42	(1.17 to 1.72)
Current	0.83	(0.68 to 1.01)	2.94	(1.62 to 2.32)
Gender				
Male	1.00	–	–	–
Female	0.80	(0.69 to 0.93)	–	–
Hay fever				
No	1.00	–	1.00	–
Yes	1.68	(1.51 to 1.87)	2.66	(2.27 to 3.12)

Data are odds ratios (95% CI).

Associations are significant when CI does not include 1.

– indicates that the factor did not reach significance for inclusion in the final model.

school because of asthma or wheeze. Of the 2262 subjects reporting lifetime wheeze or asthma, 744 (32.9%) reported interference with physical education (PE) and 186 (8.2%) reported interference with home activities. A total of 240 (10.6%) had a required a doctor visit, 208 (9.2%) had attended an accident and emergency department (A&E), and 148 (6.5%) had had hospital admissions in the last 12 months.

Subjects with more frequent wheeze reported a greater impact on their quality of life. Compared to children with 1–3 attacks of wheeze in the last 12 months, those reporting more than 12 attacks were likely to miss school more often and for longer, were twice as likely to have missed PE in the last month, to report interference with home activities, or to have visited A&E, and three times more likely to have been admitted to hospital (full data are provided in table A which is available on the *ADC* website).

There was no association between deprivation and self-reported asthma or hay fever, though eczema was commoner in children from more affluent areas (table 1). With the exception of sleep disturbance, no associations between deprivation and measures of severity, such as speech limitation or frequency of attacks of wheeze were noted. Subjects in deprived areas reported greater use of services and impact on activities, and this was statistically significant for doctor visits, attending A&E departments, and missing school.

Associations between a range of factors and diagnosis, symptoms, use of medical services, and impact on activities were explored in multiple logistic regressions analyses. Table 2 shows associations with diagnosis and symptoms. Self-reported asthma was associated with symptoms of hay fever, but not with active or passive smoking. Females were less likely to report asthma. In contrast, current wheeze was associated with previous or current smoking, and with symptoms of hay fever.

Table 3 shows associations with use of services. Visits to the doctor were associated with current smoking, passive smoke exposure, severity of wheeze, and treatment. Hospital admissions were associated with wheeze severity and treatment, while visits to A&E were associated with current smoking, wheeze severity, and treatment. Deprivation was no longer associated with use of services when adjusted for smoking, wheeze severity, and treatment.

School absence for any reason was associated with deprivation, previous smoking, passive smoking, wheeze severity, treatment, and female gender. School absence for asthma/wheeze showed similar associations, except that the association with smoking by the individual was not significant, while that with concurrent hay fever was significant. Interference with PE was associated with current smoking, wheeze severity, treatment, female gender, eczema, and hay fever, while interference with home activities was associated with passive smoking, severity, treatment, female gender and hay fever (full data are provided in table B which is available on the *ADC* website).

DISCUSSION

This representative national sample of young Scottish teenagers was part of an international survey using ISAAC methodology, which has been used extensively worldwide.²⁰ The additional quality of life questions were based on those used by Anderson and colleagues.¹⁹ The questionnaire used is considered to be a reliable instrument for determining asthma symptoms in the last 12 months.²¹

Deprivation was not independently associated with self-reported asthma or wheezy symptoms, but was associated with school absence for any reason or specifically for asthma or wheeze. Active smoking was associated with wheezy symptoms, while active and passive smoking had significant associations with use of medical services, independent of wheeze severity, treatment taken, and other atopic problems.

Since older indices may not reflect rural deprivation adequately,²² we used the SIMD, a new index thought to have advantages for studies that incorporate both urban and rural settings. It is expressed as a continuous variable, but for this analysis, we expressed the data in quartiles, which provide sufficient sample sizes for robust statistical analysis and ease of interpretation of results.

In keeping with the general literature, the majority of wheezy subjects reported only mild to moderate symptoms.^{7–14} However, the impact on use of services and activities was significant. The number of children missing school or requiring doctor visits was comparable to those found in the Highlands,⁴ but more children required more than two visits (3.5% *v* 1.7%), had been admitted to hospital in the last year (6.5% *v* 0.9%), and had attended accident and emergency departments, (9.2% *v* 3.4%). This may reflect differing

Table 3 Factors associated with use of services; findings from multiple logistic regression

	Doctor visit in last 12 months		Hospital admission in last 12 months		Visit to A&E in last 12 months	
Active smoking						
Never smoker	1.00	–	–	–	1.00	–
Ex-smoker	1.14	(0.82 to 1.57)	–	–	0.97	(0.65 to 1.43)
Current	2.09	(1.43 to 3.04)	–	–	1.50	(1.09 to 2.07)
Passive smoking						
None in the family	1.00	–	1.00	–	1.00	–
Mother only	1.31	(0.74 to 2.30)	1.08	(0.61 to 1.90)	1.60	(0.93 to 2.75)
Father only	1.63	(1.10 to 2.40)	1.23	(0.72 to 2.11)	1.50	(0.95 to 2.37)
Parents	1.48	(1.00 to 2.18)	1.33	(0.71 to 2.51)	1.08	(0.65 to 1.78)
Other	2.09	(1.03 to 4.25)	2.16	(0.79 to 5.95)	1.81	(0.68 to 4.83)
Wheeze severity						
None	1.00	–	1.00	–	1.00	–
1–3 attacks	2.03	(1.34 to 3.06)	1.89	(1.22 to 2.94)	1.97	(1.37 to 2.83)
4 or more attacks	3.26	(2.05 to 5.19)	2.90	(1.99 to 4.23)	3.20	(2.15 to 4.77)
Treatment taken						
Yes	3.21	(2.28 to 4.50)	4.95	(3.10 to 7.90)	2.92	(2.12 to 4.01)
No	1.00	–	1.00	–	1.00	–

Data are odds ratios (95% CI).

Associations are significant when CI does not include 1.

– indicates that the factor did not reach significance for inclusion in the final model.

Not shown in the table are SIMD, gender, hay fever, and eczema, which were included but not significant in the final model.

What is already known on this topic

- Asthma may be associated with school absence and limited physical activity
- There is conflicting literature on the association of deprivation and asthma
- Deprivation has been associated with poorer treatment and more hospital admissions

distances between home and hospital, a view supported by an American study which found that the supply and character of medical care was an important influence on the likelihood of paediatric admissions.²³

Asthma and wheeze, including frequent wheeze, were not associated with deprivation expressed as SIMD. This contrasts with studies from North America, but is consistent with Strachan and colleagues' UK study.^{12–24} Previous studies from Europe and the UK have shown an association between deprivation and severe wheeze, a finding not replicated here.^{13–25} The large UK study by Duran-Tauleria and Rona²⁵ found a lower parent reported prevalence of asthma and wheeze compared with Scottish studies.^{2–26} These authors suggested that variations in deprivation largely account for these regional differences, perhaps due to differences in management.²⁵ However, they used a deprivation index that is considered to have an urban bias. We found no difference in reported treatment related to deprivation.

The age at which children are studied may be important. A study of younger primary school children showed a relation between asthma and deprivation, independent of parental smoking.²⁷ However, among our adolescent study population, there was no association with deprivation. In studies of young people in the West of Scotland, there was relatively little health inequality in adolescence for chronic illness including asthma, other than for severe chronic illness determined from infancy.²⁸ These authors suggest that, in adolescence, "influences associated with the secondary school, the peer group and youth culture cut across influences associated with home background or neighborhood in such a way as to reduce or removes class differences in health". Class gradients may then reappear in adulthood.

In our study, the association between deprivation and school absence was statistically significant independent of treatment and wheeze severity and, although not statistically significant, children from more deprived areas did report a greater degree of interference with activities. Ernst *et al*, in a study of Canadian primary school children, found that children from the least advantaged homes were more likely to present with exercise induced bronchospasm.²⁹ Our association of deprivation with school absence was consistent with a study of schoolchildren in Tayside.³⁰ We also observed that interference with school or home activities was more likely in those who had hay fever and eczema—that is, in more atopic subjects.

Exposure to cigarette smoke also had a significant impact on current wheeze, use of services, and interference with activity. Among adolescents, smoke exposure is a more important factor than deprivation in relation to symptoms, use of services, and impact on activities. These findings are consistent with other literature. A study of young people aged 13–18 years showed that subjects who smoke, especially girls, report a higher prevalence of respiratory symptoms than non-smokers.³¹ Smoking also influences hospital admissions in children aged between 3 and 15 years.³² Within the UK, Burr *et al* reported an association between deprivation and hospital

What this study adds

- This study used an index of deprivation that reflects rural, as well as urban deprivation
- Using this index, no association between deprivation and prevalence of asthma or wheeze, was found in this national study
- However, deprivation was associated with school absence, both due to asthma and wheeze and to other unspecified reasons
- Active smoking was associated with wheeze, while active and passive smoking were associated with use of medical services and school absence
- It might therefore be expected that reducing deprivation may not affect prevalence of asthma and wheeze in this age group, but may reduce their impact, while reducing smoking may lower prevalence of wheeze, use of services, and impact on activities

admissions not explained by variations in prevalence, but possibly associated with smoking.³³

Conclusion

A significant number of children with wheeze encounter interference with school attendance, sleep, exercise and general activities, and require medical services. The majority report only mild or moderate wheeze, but service providers need to address the needs of subjects with more frequent symptoms who experience the greatest morbidity. In this age group, prevalence of asthma and wheeze are not directly associated with deprivation, therefore measures to ameliorate deprivation per se are unlikely to influence the burden of disease. However, deprivation is associated with school absence, and relieving deprivation may reduce the impact of disease. Both active smoking and passive exposure to smoke have major effects on symptoms, use of medical services, schooling, and other activities. Other associated atopic syndromes also have detrimental effects on symptoms and activities. These observations should inform the design and provision of health promotion and healthcare for this important group in society.

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Authors' affiliations

J B Austin, Department of Child Health, Raigmore Hospital, Inverness IV2 3UJ, Scotland, UK

S Selvaraj, D Godden, Highland and Islands Health Research Institute, University of Aberdeen, The Green House, Inverness IV2 3ED, Scotland, UK

G Russell, Department of Child Health, University of Aberdeen, Foresterhill, Aberdeen AB9 2ZD, Scotland, UK

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