Consultations of Children Living Near Open-Cast Coal Mines

Denise Howel,[1,2] Tanja Pless-Mulloli,[1] and Ross Darnell[2]

[1]Department of Epidemiology and Public Health, [2]Department of Statistics, University of Newcastle, Newcastle upon Tyne, United Kingdom

Because of local concerns, general practitioner consultation rates in children living in communities close to and away from open-cast mines were compared. Information on consultations was collected on 2,442 children 1–11 years of age living in five socioeconomically matched pairs of open-cast and control communities in northern England. The data collection periods were 6 weeks each during 1996–1997 and the 52-week periods preceding these weeks. Consultations were categorized as respiratory, skin and eye conditions (possibly exacerbated by particulate matter), or other conditions. Over the 6-week periods, children in 4/5 pairs of open-cast and control communities had similar consultation rates for all conditions combined [2.7 vs. 2.4 per person-year; odds ratio (OR) = 1.1; 95% confidence interval (CI), 0.96–1.3). Consultations were higher in the open-cast communities for respiratory, skin, and eye conditions (2.1 vs. 1.5 per person-year; OR = 1.4; 95% CI, 1.2–1.7), and respiratory conditions alone (1.5 vs. 1.1 per person-year; OR = 1.5; 95% CI, 1.2–1.8). However, increases in consultation rates in open-cast communities were generally not seen over the portions of the 52-week periods when the open-cast sites were either active or inactive. *Key words*: air pollution, children, open-cast coal mining, respiratory tract diseases. *Environ Health Perspect* 109:567–571 (2001). [Online 21 May 2001] *http://ehpnet1.niehs.nih.gov/docs/2001/109p567-571howel/abstract.html*

Several epidemiologic studies have found a positive association between daily respiratory morbidity and air pollution (*1*,*2*). The current study was initiated in response to concerns expressed by local community groups about a possible link between living near open-cast coal mining sites and respiratory health. These concerns have been raised in many areas of the United Kingdom where open-cast coal mining takes place (*3*). Open-cast coal mines in the United Kingdom are generally sited in rural or semi-urban areas where the ambient levels of air pollution can be expected to be relatively low, but there is potential for increased levels of particulates (e.g., from overburden and diesel fumes) when sites are active. The study as a whole was designed to compare the chronic and acute morbidity of children living in communities near and some distance from open-cast sites, to characterize and compare their exposure to particulate matter, and to assess the link between morbidity and exposure levels. In this paper we present the comparison of children's consultation rates with their family doctor or general practitioner (GP). Additional morbidity data in the study came from parent-completed daily diaries of respiratory events and a survey of parent-reported data on recent ill health.

Methods

Study design. The study was based in five pairs of rural and semi-urban communities (or parts thereof) in northern England, varying in population size between 2,000 and 20,000. The location of these communities has been described elsewhere (*4*). The communities were matched for socioeconomic characteristics and geographic features: five were near operational open-cast sites (open-cast communities), and five paired control communities in the same administrative area were some distance away. The open-cast sites were typically active for 3–4 years and had not involved the building of roads or rail links to the site, nor were they a major employer of local workers. Because socioeconomic status is associated with respiratory morbidity and with lifestyle factors like smoking (*5*), such matching of communities should have led to both similar intrinsic respiratory morbidity and health-relevant lifestyles in the pairs of open-cast and control communities. We chose communities that had no other major sources of particulate matter nearby.

National morbidity data from general medical practices suggested that children 1–11 years of age are likely to consult at a rate of about 1/person-year (*6*). We chose communities (or part-communities) from those among which there were estimated to be at least 300 children 1–11 years of age. A study based on five pairs of communities that recruited about 1,500 children in total from both open-cast and control communities would allow a difference of 12% in annual consultation rates between open-cast and control communities to be detected, with an 80% power and a 5% Type I error rate.

All children of 1–11 years of age who resided in the 10 communities and registered with a GP were identified from local health authority records: approximately 99% of children are registered with a GP in the United Kingdom. Using a postal questionnaire, we collected information on family circumstances and children's history of respiratory illness. We sought GP data for those children whose parents returned a completed questionnaire by approaching the practice with which each child was registered.

A database was designed to collect information on consultations: a consultation was recorded if it involved one of the practice staff (at the practice, by telephone, or at home). There was particular interest in respiratory, skin, and eye conditions that might have been exacerbated by increased particulate matter levels. It was also noted whether the child had ever been diagnosed with asthma as documented by an entry in the GP record. Consultation data were collected and entered by three research nurses from either computer-held or paper records. They followed a standard data collection protocol. To check reliability, different nurses collected a 5% sample of children's consultation data in duplicate.

GP data were collected for 6-week periods during 1996–1997, simultaneously in the open-cast and control communities, for each of the five community pairs in turn. Data on monitored particulate (particulate matter ≤ 10 μm; PM_{10}) levels (*4*) and daily diaries of respiratory events were also collected during these periods. GP data were also collected over the 52-weeks before the first day of monitoring in each community. The 52-week periods allowed precise estimation of consulting rates, before any publicity about the study, whereas the final 6-week periods allowed the association between respiratory events and other study data to be assessed.

Exposure was assessed by residential proximity to an active, open-cast site (yes/no) at the time of the study. All the open-cast sites were active throughout the 6-week periods, but they were active for differing portions of the 52-week periods. Table 1 shows

Address correspondence to D. Howel, Department of Epidemiology and Public Health, The Medical School, Newcastle upon Tyne, NE2 4HH, United Kingdom. Telephone: +44 191 222 7381. Fax: +44 191 222 8211. E-mail: d.howel@ncl.ac.uk

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the dates of GP data collection and those of the start of site activities. The actual activities on the site were not known precisely, but the start of a contract usually meant that there were dust-producing activities, such as the removal of overburden and extra site-related traffic. The sites in open-cast communities 1 and 4 were only active for part of the 52-week GP data collection, whereas open-cast coal mining activity had been taking place in the vicinity of open-cast community 3 for some years (but close to the community for less than a year). The approximate distances between the centers of the five open-cast communities and the nearest point of operational activity during the 6-week data collection periods were as follows: 800 m in community 1; 750 m in community 2; 1,300 m in community 3; 800 m in community 4; and 1,400 m in community 5.

Statistical analysis. We calculated the daily prevalence of specified consultations as the proportion of children whose GP records had been accessed who had made a GP consultation on a given date. Logistic regression models were fitted with the prevalence of consultation on a given day as the response, and the effect of living near an open-cast site as predictor, controlling for the effects of previously agreed covariates (age, sex, previous asthma, housing tenure, and community pair). Previous asthma (as reported by the parents) was included as an indicator of respiratory health; housing tenure (owned or rented) was chosen as an indicator of socioeconomic status. The main predictor of interest was proximity to open-cast sites, and interactions between this and other covariates were included in the model as appropriate. Terms were removed when changes in deviance were large compared to the appropriate chi-square distribution. We performed the analyses separately for the portions of the 52-week data collection period when the open-cast sites were thought to be active or inactive.

The GP data contained repeated measures (over 42 and 365 days) on a large number of children, which raised two issues for the data analysis. First, serial correlation may have been present: a consultation on 1 day may be associated with consultations on previous days. Second, extrabinomial variation may have been present, in that some children had consultations with their GP more often than others (e.g., because of chronic illness or a different threshold for making a consultation). We addressed serial correlation by fitting a logistic regression model using the method of generalized estimating equations (GEE) for longitudinal data analysis of discrete outcomes (*7*) within the package STATA (*8*). Three possible correlation structures for the data were considered for each outcome variable: *a*) that all observations were independent of each other; *b*) that there were equal correlations between the observations for any one individual; and *c*) that correlations were stronger between close than between distant time points (autoregressive). We addressed extrabinomial variation in two ways. The first approach fitted models that incorporated extrabinomial variation (*9*) using the library macro ODBIN within the package GLIM4 (*10*). A saturated model with main effects and interactions was fitted first to estimate the factor defining the extrabinomial variation. Using this estimate, the analysis then reduced the model to those terms considered significant by noting the changes in deviance between nested models. The second approach, by Aitkin and Francis (*11*), fitted models by maximum likelihood estimation in GLIM4, which allowed random terms for each child.

The results have been reported for an independent error structure with extrabinomial variation using Williams's method to incorporate extrabinomial variation where appropriate. When the logistic regression model was fitted via GEE for each of the three possible correlation structures, the estimates and standard errors of regression coefficients changed very little, suggesting that an independent correlation structure was adequate. The parameter estimates using the random effects method were not stable, and therefore have also not been reported.

Results

We identified 4,860 children 1–11 years of age in the 10 communities. Parents of 1,639 children in open-cast communities and 1,577 children in control communities returned the questionnaire (response rate 69% and 68%, respectively); their GPs were approached for access to their records. Table 2 shows the numbers of practices and GPs contacted in each community. In all, 77 practices participated, allowing for those practices that served more than one community. The number of practices it was necessary to contact was not evenly distributed across communities, ranging from 32 in community pair 1 to only 3 in community pair 3. This was linked to the fact that study

Table 1. Dates of GP data collection and activity dates at the nearby open-cast coal mining sites.

Community	GP data collection period		Start of contract	Start of coaling
	52-week	6-week		
1	Nov 1995–Nov 1996	Nov–Dec 1996	May 1996	Oct 1996
2	Feb 1996–Feb 1997	Feb–April 1997	Sept 1994	Sept 1994[a]
3	June 1996–June 1997	June–July 1997	Sept 1996[b]	Nov 1996[b]
4	Sept 1996–Sept 1997	Sept–Nov 1997	Jan 1997	April 1997
5	Oct 1996–Oct 1997	Oct–Dec 1997	July 1995	July 1995[a]

[a]The local authority was informed they intended to start on this date. [b]These dates are for an extension of a site active since 1986; the original site was further from the community.

Table 2. Practices and GPs contacted and children's records retrieved.

Community	No. of GP practices	No. of GPs	No. of children's records requested	No. of records retrieved (%)
Open-cast 1	22	56	438	382 (87)
Control 1	10	20	301	215 (71)
Open-cast 2	7	19	338	280 (83)
Control 2	10	28	438	345 (79)
Open-cast 3	1	7	461	412 (89)
Control 3	2	12	370	251 (68)
Open-cast 4	10	15	219	164 (75)
Control 4	13	30	133	85 (64)
Open-cast 5	7	25	183	51 (28)
Control 5	3	19	335	257 (77)
Total open-cast	47	122	1,639	1,289 (79)
Total control	38	109	1,577	1,153 (73)

Table 3. Characteristics of children and their households in open-cast and control communities.

Characteristic	Open-cast (%)	Control (%)
Age (years)		
1–4	27	28
5–8	39	36
9–11	34	35
Male	52	48
Asthma ever[a]	22	21
Unemployment[b]	11	10
House not owner occupied[c]	36	35
> 1 indicator of damp[d]	17	22
No. of smokers		
None	55	58
1	27	27
≥ 2	18	16
Use polluting cooking fuel[e]	45	60
Use polluting heating fuel[f]	66	65
Sample size (*n*)	1,289	1,153

[a]Ever had asthma. [b]One of more members of household seeking work. [c]Those who live in rented, leased, or employee housing or with family or friends. [d]Mold on walls, stained or peeling walls or wallpaper, damp, condensation. [e]Household currently uses or has used in the past year gas (distributed by utility company), bottled gas, solid fuel, or oil. [f]Household currently uses or has used in the past year coal or open fire, solid fuel radiators, unspecified solid fuel, coke, wood burning, gas fires, gas radiators, bottled gas, or paraffin heaters.

children were not evenly distributed between practices: the number registered with a practice varied between 1 and 461.

Table 2 also shows how permission for access to records differed between communities. GP records were available for 76% of the children for whom they were requested, varying from 87% in open-cast community 1 to only 28% in open-cast community 5. Seven (9%) practices refused access to patient records because of concerns over space, time, or parental consent. Ten practices requested that parental consent for data collection be obtained individually for each study child. This particularly reduced the data collection in open-cast community 5, where the parents of 110 children were sent a consent form, but consent was only received from 13 of them.

Table 3 shows the characteristics of children and their households for whom GP data were available. The open-cast and control communities were well matched, except on the proportions using polluting cooking fuels (largely gas distributed by a utility company). Nevertheless, any further comparisons between open-cast and control communities were adjusted for demographic and lifestyle factors.

In total, 8,694 consultations were recorded, of which 7,853 fell in the 52 weeks before the main study periods and 791 fell within the 6-week periods. This total included all consultations with any member of the practice team. The 6-week consultation rates and a summary of the levels of particulate matter for each community are shown in Table 4. Consultation rates varied across communities, with control community 5 having consistently high consultation rates. For each type of consultation, there was little overall difference in the crude rates between open-cast and control communities. However, there was variation in the difference between the pairs of communities. If the rates in pairs 1–4 only were compared, there was some evidence of higher crude rates in open-cast communities. However, there was considerable difference between the rates in the two communities in pair 5, and the control community appeared to have had anomalous rates. Average particulate levels were slightly higher in the open-cast communities.

The 52-week consultation rates are given in Table 5, along with separate rates over those periods when the open-cast sites were inactive and active. In general, the 6-week consultation rates were slightly lower than those in the 52-week study periods. Otherwise, the patterns in the crude consultation rates were similar over 6 and 52 weeks. There was little sign of a consistent difference in consultation rates between periods during which the open-cast sites were active or inactive: some differences probably reflect seasonal effects.

Table 6 gives the adjusted odds ratios associated with proximity to an open-cast site over the 6-week periods and for the periods in which the open-cast sites were active and inactive during the 52-week periods. Because there was a significant interaction between pairs and proximity over the 6-week periods, the odds ratios were reported for two sets of pairs (pairs 1–4 and pair 5). For pairs 1–4 there was no significant association between living near an open-cast site and the rate of consultation for any condition. However, the adjusted odds of respiratory, eye, and skin consultations, and respiratory consultations alone were 1.4 (2.1 vs. 1.5/person-year) and 1.5 (1.5 vs. 1.1/person-year), respectively, in open-cast than in control communities. However, in pair 5, there was a significant negative association for all three outcomes, with particularly high rates in the control community.

Table 4. Consultation rate with GP practice per person-year and other characteristics of 6-week collection periods.

	Study community											
Consultation/characteristic	O1	C1	O2	C2	O3	C3	O4	C4	O5	C5	O total	C total
All consultations	3.1	3.2	2.5	2.3	2.7	2.0	2.3	2.7	2.2	4.6	2.7	3.0
Respiratory-, eye-, or skin-related	2.4	2.3	2.0	1.4	1.9	1.0	1.7	1.2	0.9	3.8	2.0	2.0
Respiratory	2.0	1.6	1.2	0.9	1.4	0.8	1.4	0.9	0.7	3.2	1.5	1.6
No. of consultations with practice	136	79	80	92	127	58	43	26	13	137	399	392
No. of children	382	215	280	345	412	251	164	85	51	257	1,289	1,153
Daily PM_{10} ($\mu g/m^3$)												
Geometric mean	17	13	18	15	17	14	23	21	18	19	19	16
Range	8–54	5–30	9–47	5–40	7–35	6–31	10–49	10–42	8–36	9–38	7–54	5–42

Abbreviations: C, control community; O, open-cast community.

Table 5. Consultation rate with GP practice per person-year over 52-week collection period for times when open-cast sites were active and inactive.

	Study community											
Consultation/characteristic	O1	C1	O2	C2	O3	C3	O4	C4	O5	C5	O total	C total
All consultations												
52 weeks	3.1	3.2	3.1	3.2	3.4	2.5	2.6	2.7	3.0	4.6	3.1	3.3
Active	2.4	2.9	3.1	3.2	3.6	2.7	2.5	2.7	3.0	4.6	3.1	3.3
Inactive	3.8	3.6	NA	NA	2.7	2.2	2.6	2.9	NA	NA	3.0	3.2
Respiratory-, eye- or skin-related												
52 weeks	2.2	2.2	2.2	2.1	2.4	1.7	1.8	1.7	2.1	3.5	2.2	2.3
Active	1.7	1.9	2.2	2.1	2.7	1.8	1.8	1.5	2.1	3.5	2.2	2.4
Inactive	2.7	2.5	NA	NA	1.7	1.3	1.7	2.2	NA	NA	2.2	2.1
Respiratory												
52 weeks	1.7	1.8	1.5	1.6	1.8	1.2	1.3	1.6	1.6	2.4	1.6	1.7
Active	1.3	1.5	1.5	1.6	2.0	1.3	1.3	1.0	1.6	2.4	1.6	1.7
Inactive	2.1	2.1	NA	NA	1.2	1.0	1.3	2.0	NA	NA	1.7	1.7
Length of open-cast activity (weeks)	26		52		41		36		52			
No. of consultations with practice	1,183	697	881	1,089	1,384	639	419	233	152	1,176	4,019	3,834
No. of children	382	215	280	345	412	251	164	85	51	257	1,289	1,153

Abbreviations: O, opencast community; C, control community.

We found significant interaction between community pairs, asthma status, and proximity over the 52-week periods for some of the outcomes, so the odds ratios were reported for subgroups as appropriate. During the periods when the sites were active, there was no significant association for pairs 1, 2, and 4 between living near an open-cast site and GP consultation rates for any of the three outcomes. In pair 3 there was a significant positive association between proximity to open-cast sites and consultation rates for all three outcomes (and this differed in strength for asthmatics and nonasthmatics for one outcome). However, in pair 5 there was a significant negative association for two of the three outcomes.

During the periods when the sites were inactive, the only significant association for any of the three outcomes was in consultation for any condition in asthmatic children. Any association between consultation rates and proximity to open-cast sites was not significantly different for children of different ages or sex, or from more or less deprived backgrounds.

Discussion

The GP consultation data collected covered morbidity that was sufficiently serious to require medical attention, but not hospital care. Although general practice records are well recognized as a potential source of morbidity information (*6,12*), they are an imperfect measure of morbidity because they depend on children and their parents seeking help and on professionals recognizing problems (*13*).

The cooperation of GP practices was very good overall, leading to retrieval of GP data for 76% of the children. However, data collection was poor in some communities, particularly in open-cast community 5, where access to only 31% of identified records was achieved. Some variation in annual consultation rates across the 10 communities was expected because the children came from communities that varied in socioeconomic status and that were served by many practices and GPs. The variation in the numbers of study children registered with each practice reflected the differing degrees of choice between GPs in the study communities and nearby areas. Given the large numbers involved, we thought that any contribution of individual practices or GPs to the overall patterns of diagnosis would be small. However, in control communities 3 and 5, study children were only registered with a small number of GP practices. There was anecdotal evidence that control community 3 had a 24-hr hospital casualty department that was used by some residents at night instead of the GP service, which would affect any difference between open-cast and control community rates in that pair.

The rates in control community 5 were the most extreme: all consultation rates were higher in this control community than the paired open-cast community, and, indeed, than in any other community. The fact that the rates in open-cast community 5 (albeit based on a low retrieval rate) were similar to other study communities suggested that it was control community 5 which was anomalous. Because the high rates in the control community occurred in both 6-week and 52-week data, it would not appear to be a seasonal phenomenon (e.g., an outbreak of infectious illness). Although inquiries were made of the district health authority and local GPs, no explanation has been found so far for the high use of GP services in control community 5. The combination of low access to children's records in the open-cast community and unexpectedly high consultation rates in the control community made comparisons in pair 5 difficult to interpret. The large, consistent differences between consultation rates within pair 5 were not seen in other measures of respiratory morbidity collected as other study outcomes.

No significant association was found between proximity to an active open-cast site and consultations for all conditions over the 6-week study periods in pairs 1–4. We did not think that living near an open-cast site, with the potential for higher particulate levels, would affect consultations for all possible conditions. We expected that any effect would be reflected in consultations for the subset of respiratory conditions associated with particulate levels. If these conditions were only a small proportion of the total, then little or no association would be expected with total consultations for all conditions: this was generally the case. However, a significant association was found in pairs 1–4 between proximity and consultations for respiratory, skin, and eye conditions and respiratory conditions only: the odds on consultation were about 40% higher for children in open-cast than in control communities for conditions that might be affected by particulate levels. In pair 5 the associations were reversed. The size of these associations needs to be considered in the context of the monitored differences in PM_{10} levels over the 6-week periods: the average daily difference in PM_{10} levels between open-cast and control communities (17.0 vs. 14.9 $\mu g/m^3$) was quite small (*4*).

GP data were collected over a year to achieve sufficient power for the open-cast/control comparisons. If there were a genuine change in consulting in communities near open-cast sites, then, if other factors had remained constant, more statistically significant results would be expected over the 52-week rather than over 6-week periods. However, there were two differences between the 6- and 52-week periods. First, residents were aware that a study was being carried out by the time of the 6-week data collection, and second, the open-cast sites were unexpectedly

Table 6. Odds ratios and 95% confidence intervals (CI) from logistic regression models for the association between proximity to open-cast sites and GP consultations by subgroup.

Consultations	Subgroups	Crude rate per person-year: Open-cast[a]	Crude rate per person-year: Control	Adjusted OR[a]	95% CI
6-Week period					
All	Pairs 1, 2, 3, 4	2.7	2.4	1.12	0.96–1.31
	Pair 5	2.2	4.6	0.47	0.27–0.82
Respiratory-, skin-, and eye-related	Pairs 1, 2, 3, 4	2.1	1.5	1.43	1.20–1.70
	Pair 5	0.9	3.8	0.23	0.10–0.49
Respiratory	Pairs 1, 2, 3, 4	1.5	1.1	1.47	1.22–1.78
	Pair 5	0.7	3.2	0.22	0.09–0.49
52-Week period, active sites					
All	Pairs 1, 2, 4	2.8	3.1	0.97	0.87–1.08
	Pair 3	3.6	2.7	1.30	1.07–1.57
	Pair 5	3.0	4.6	0.68	0.52–0.88
Respiratory-, skin-, and eye-related	Pairs 1, 2, 4	1.9	2.0	1.02	0.91–1.14
	Pair 3	2.4	1.7	1.30	1.06–1.60
	Pair 5	2.1	3.5	0.60	0.44–0.80
Respiratory	Pairs 1, 2, 4, 5 and not A[b]	1.2	1.7	0.84	0.73–0.97
	Pair 3 and not A[b]	1.7	1.1	1.39	1.12–1.73
	Pairs 1, 2, 4, 5 and A[b]	2.3	2.3	1.12	0.91–1.36
	Pair 3 and A[b]	3.0	2.0	1.62	1.23–2.11
52-Week period, inactive sites[c]					
All	Asthmatics	4.9	3.4	1.33	1.06–1.77
	Nonasthmatics	2.8	2.9	0.98	0.85–1.12
Respiratory-, skin-, and eye-related	All	2.2	2.1	1.05	0.92–1.20
Respiratory	All	1.7	1.7	0.94	0.79–1.01

[a]Odds ratio for effect of proximity to open-cast sites taking into account the effect of pairs, child's sex, household tenure, child's age, and asthma status; values >1 indicate that the odds of consulting a GP were higher in open-cast communities. [b]Asthmatics. [c]Only sites in pairs 1, 3, and 4 had periods of inactivity during 52-week data collection.

not all active in each community for the whole 52 weeks of data collection. In three of the communities, up to half of the 52-week data collection period was during a period of inactivity at an open-cast site.

No significant association was found in pairs 1, 2, and 4 between proximity to an active open-cast site and all three outcomes over the portions of the 52-week periods when the open-cast sites were active. However, a significant positive association was found in pair 3 for all three types of consultations, and pair 5 results were, again, anomalous. No difference had been expected in consultations for all conditions. The positive associations seen over 6 weeks for respiratory conditions in 4/5 community pairs were seen in pair 3 only in the portions of the 52-week periods when the open-cast sites were active. Because similar associations had been found in 4/5 pairs over the 6-week period, different health service use in control community 3 is unlikely to fully explain these anomalous results. PM_{10} monitoring did not take place over the 52-week periods, so it is not possible to consider these GP consultations patterns in the context of particulate levels.

When the association of GP consultations with proximity to open-cast mining sites was investigated over the periods when the open-cast sites were not thought to be active, the only significant association was between proximity to open-cast sites and consultations for all conditions in asthmatics only. Although it is possible that any effect of living near open-cast mines is greater in the minority of children who have ever had asthma, this trend would not be expected to show in consultations for all conditions rather than in respiratory conditions.

We consider it unlikely that the GP consultation rates over the 6-week period were affected by changes in behavior by parents and GPs because they were aware of the study. There were a number of reasons for this: no correspondence about the study mentioned that the open-cast mining was an issue of interest; the differences in GP consultation rates were only seen in conditions likely to be affected by particulate levels rather than all conditions; and the consultation rates for the 6-week periods were generally lower than for the 52-week periods (inconsistent with an increase in recorded consulting when people were aware of the study). We also found no consistent differences between prevalence of wheeze, cough, or other self-reported respiratory symptoms from daily diaries collected in parallel with the 6-week GP data (*14*).

A comparison suggested that rates in the 10 study communities were slightly higher than national rates based on 60 volunteer practices (*6*). However, the comparisons were only approximate because of differing definitions. Another reason for a difference between children's consulting rates in this study and the national study is the known variation of consulting rates with socioeconomic factors (*15*). This issue was considered at the design stage of the current study. The use of pairs of communities matched on socioeconomic factors and the incorporation of a socioeconomic household-level variable in the analysis meant that comparisons of consulting rates between open-cast and control communities were unlikely to have been confounded with socioeconomic status.

No studies have looked at the effect of open-cast mining on GP consulting rates in a comparable manner, but there are a few which have addressed related questions. A study in South Wales reported a significant rise in episodes of asthma at a GP practice serving a community after an open-cast coal mine became active (*16*), but their outcome measures are not comparable with the current study. Another study compared GP consultation data for the 4-day period of a high air pollution episode in London in December 1991, with comparable periods in previous years (*17,18*). A third study, from West Germany, compared consultations in doctors' offices for a week containing a smog episode with the 5 weeks surrounding the episode (*19*). However, because all three studies compared the same communities at times with differing air-pollution levels, as opposed to the current study design of simultaneous data from matched communities, direct comparisons are inappropriate. In addition, the South Wales study has been criticized for potential observer bias (*20,21*).

In conclusion, children in open-cast and control communities generally had similar levels of GP consultations when all conditions were considered together. However, over the 6-week periods, those in open-cast communities had 2.1 GP consultations per person-year for respiratory, skin, and eye conditions compared to 1.5 in control communities (1.5 and 1.1, respectively, for respiratory conditions only) in 4 out of 5 community pairs: the odds on GP consultations were significantly higher than those in their paired control communities (by approximately 40%). The patterns seen in the 6-week data were not generally found in the 52-week periods, where the differing periods during which the open-cast sites were active complicated the interpretation of the results.

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