Is the ratio of inhaled corticosteroid to bronchodilator a good indicator of the quality of asthma prescribing? Cross sectional study linking prescribing data to data on admissions

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Abstract

Objective—To investigate the ratio of inhaled corticosteroid to bronchodilator as a measure of the quality of asthma prescribing by general practitioners.

Design—Ecological cross sectional study linking general practitioner asthma prescribing with hospital admission data and a measure of deprivation.

Subjects—11 family health services authorities in the West Midlands region and 99 general practices in North Staffordshire.

Main outcome measures—Hospital admission rates for asthma; the ratio of inhaled corticosteroid to bronchodilator; and Townsend deprivation scores.

Results—No overall significant correlation was found between admission rates for asthma and corticosteroid:bronchodilator ratios for family health services authorities (Spearman's $r_s = -0.109$, $P = 0.750$) or general practices ($r_s = -0.084$, $P = 0.407$). In deprived family health services authority areas and general practices an inverse non-significant correlation existed between admission rates for asthma and corticosteroid:bronchodilator ratios ($r_s = -0.300$, $P = 0.624$; $r_s = -0.218$, $P = 0.136$). In contrast, in more affluent areas and general practices a positive non-significant correlation existed between admission rates and corticosteroid:bronchodilator ratios ($r_s = 0.371$, $P = 0.468$; $r_s = 0.038$, $P = 0.792$).

Conclusion—Although the corticosteroid:bronchodilator ratio may be a valid indicator of the quality of prescribing for individual patients with asthma, caution should be applied in interpreting aggregated ratios. Differences in the severity of asthma or the prevalence of chronic obstructive pulmonary disease may explain inconsistent associations between admission rates for asthma and corticosteroid:bronchodilator ratios in family health services authorities and general practices with different deprivation scores.

Introduction

The ratio of inhaled corticosteroid to bronchodilator is a potential indicator of the quality of prescribing for asthma at aggregated family health services authority and general practice level.¹ A higher ratio reflects greater prescribing of inhaled corticosteroids relative to bronchodilators, a feature regarded as good practice.² Nevertheless, few studies have validated the corticosteroid:bronchodilator ratio as an indicator of good quality prescribing because of the paucity of asthma outcome measures. At aggregated level, hospital admission rates for asthma are the only available outcome measure of asthma morbidity.

At practice level two recent studies in the United Kingdom have found an association between hospital admission rates for asthma and corticosteroid:bronchodilator ratios.^{3,4} Both showed that practices with lower corticosteroid:bronchodilator ratios tended to have higher admission rates. However, these studies were undertaken in highly deprived areas⁵ and based their prescription analysis on "items" prescribed. Very deprived areas have significantly greater hospital admis-

Table 1—Townsend deprivation scores and national ranking for selected districts based on 1991 Census data⁵

	Townsend score	National ranking (n = 366)*
North Staffordshire:		
Newcastle under Lyme	0.0	149
Staffordshire Moorlands	-3.3	315
Stoke on Trent	2.9	65
London ^{3,4} :		
Camden	10.3	8
Islington	12.1	4
Hackney	14.3	2
Tower Hamlets	15.7	1
Newham	10.9	6
City of London	3.5	53

*The higher the ranking—that is, the nearer to 1—the more deprived the area relative to other areas.

sion rates than more affluent areas, not just for asthma but for many diseases.⁶ The item as a unit of prescribing gives no indication of the quantity of drug prescribed and does not distinguish between different drugs in the same category. For example, one item of inhaled corticosteroid could be for one or 10 inhalers and one item of bronchodilator could be an oral xanthine or a salbutamol inhaler.⁷

We analysed data from all 11 family health services authorities in one region and from all 99 general practices in one health district with a broader mix of deprivation scores than the areas investigated in other studies^{3,4} (table 1) using a more accurate unit of prescribing and incorporating a measure of deprivation.

Methods

Prescription prescribing, analysis, and cost (PACT) data were analysed for each family health services authority in the West Midlands region from April 1991 to March 1992 and for each general practice in North Staffordshire district from December 1993 to February 1994. PACT data is a record of all dispensed prescriptions written by general practitioners. Using level 3 PACT, the corticosteroid:bronchodilator ratios for the family health services authorities and general practices were calculated in defined daily doses from prescriptions of inhalers only. The defined daily dose is the assumed average dose per day of a drug used for its main indication in adults.⁸ Unlike the item, it incorporates the quantity of drug prescribed.

The number of hospital admissions for asthma (code A493, *International Classification of Disease*, 9th edition), in the form of finished consultant episodes, was collated for each family health services authority from April 1991 to March 1992 and for each general practice from April 1993 to March 1994, using the regional and district information databases. There were 10 103 admissions for asthma in the West Midlands region during 1991-2 and 823 in North Staffordshire during 1993-4. Readmissions were not excluded. The North Staffordshire Hospital Centre is the only provider of hospital services to the North Staffordshire district. Twenty five admissions in North Staffordshire (3%) were from patients registered with a general practitioner outside the district and 34 (4%) had no general practitioner recorded, so these patients were

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excluded from the analysis. Crude asthma admission rates were then calculated for each family health services authority and each general practice (using list size as the denominator).

Each family health services authority and general practice was allocated a Townsend deprivation score based on 1991 census data. The Townsend score of the electoral ward in which the practice was located was assigned to the practice.⁹ Townsend scores reflect the extent of material deprivation in an area,¹⁰ and the greater the score the more deprived the area.

Data on hospital admission rates for asthma, corticosteroid:bronchodilator ratios, and Townsend deprivation scores were entered into the statistical package SPSS. Spearman's rank correlation coefficients (r_s) were used to describe the overall correlation between admission rates and corticosteroid:bronchodilator ratios. Spearman's correlation was preferred to Pearson's product moment correlation coefficient because of the non-normal distribution of the data and to minimise the effect of outliers.

To investigate the effect of deprivation in more detail, we arbitrarily dichotomised the Townsend deprivation scores of both the family health services authorities and the general practices into high or low. If the Townsend score was above the median it was considered high (deprived) and if equal to or below the median it was considered low (more affluent). The correlations between admission rates for asthma and corticosteroid:bronchodilator ratios in both deprived and more affluent family health services authorities and general practices were calculated.

Results

The distribution of the variables under investigation is summarised in table 2. There was a positive correlation between admission rates for asthma and Townsend deprivation scores at both family health services authority ($r_s = 0.682$, $P = 0.021$) and general practice level ($r_s = 0.117$, $P = 0.251$), although this was significant only for the family health services authorities. There was also an inverse non-significant correlation between Townsend deprivation scores and corticosteroid:bronchodilator ratios at both authority ($r_s = -0.564$, $P = 0.071$) and general practice level ($r_s = -0.017$, $P = 0.864$). These results imply that more affluent authorities and general practices have lower admission rates for asthma and higher corticosteroid:bronchodilator ratios.

There was no overall significant correlation between admission rates for asthma and corticosteroid:bronchodilator ratios for either family health services authorities or general practices (table 3). The association between admission rates and corticosteroid:bronchodilator ratios in deprived authorities and general practices was, however, an inverse correlation, while in the more affluent authorities and general practices the correlation was positive (table 3). The direction of these

Table 3—Spearman's correlation coefficients for the association between hospital admission rates for asthma (per 1000 patients on list) and corticosteroid:bronchodilator ratios in deprived and more affluent family health services authorities in West Midlands region 1991-2, and in deprived and more affluent general practices in North Staffordshire district 1993-4

	Admission rate for asthma v corticosteroid:bronchodilator ratio
Family health services authorities:	
All (n = 11)	-0.109, P = 0.750
Deprived (n = 5)	-0.300, P = 0.624
More affluent (n = 6)	0.371, P = 0.468
General practices:	
All (n = 99)	-0.084, P = 0.407
Deprived (n = 48)	-0.218, P = 0.136
More affluent (n = 51)	0.038, P = 0.792

correlations implies that in deprived authorities and general practices lower corticosteroid:bronchodilator ratios are associated with higher admission rates for asthma, whereas in more affluent authorities and general practices there is no such association.

The distribution of admission rates for asthma and corticosteroid:bronchodilator ratios for deprived and more affluent general practices is summarised by scatter plot (fig 1).

Discussion

We have been unable to confirm a clear link between corticosteroid:bronchodilator ratios and hospital admission rates for asthma across family health services authorities in one region and across general practices in one district. By contrast, there was a consistent association between admission rates for asthma and deprivation in these study populations: the more deprived the area the higher the admission rate. At family health services authority level the inverse correlation between deprivation and the corticosteroid:bronchodilator ratios suggests that inappropriate prescribing may occur in areas of high deprivation: the more deprived the area the less "preventive" the corticosteroid:bronchodilator ratio.

Fig 1—Relation between hospital admission rates for asthma and practice corticosteroid:bronchodilator ratios for (top) 48 deprived practices and (bottom) 51 more affluent practices in North Staffordshire district 1993-4

Table 2—Hospital admission rate for asthma (per 1000 patients on list), corticosteroid:bronchodilator ratio, and Townsend deprivation score in all 11 family health services authorities in West Midlands region 1991-2 and all 99 general practices in North Staffordshire district 1993-4

	Median	Interquartile range	Range
Family health services authorities:			
Hospital admission rate for asthma	1.9	1.5, 2.3	1.4, 2.9
Corticosteroid:bronchodilator ratio	0.48	0.46, 0.50	0.40, 0.57
Townsend score	-1.4	-3.7, 4.4	-4.1, 5.6
General practices:			
Hospital admission rate for asthma	1.4	0.9, 2.3	0, 11.3
Corticosteroid:bronchodilator ratio	0.56	0.46, 0.66	0.24, 1.53
Townsend score	3.1	-0.3, 3.8	-5.9, 6.9

Key messages

- Linking aggregated prescribing data to hospital admissions is difficult to interpret because of bias and confounding.
- The use of the corticosteroid:bronchodilator ratio as an indicator of the quality of asthma prescribing at family health services authority or general practice level should be viewed with caution.
- The association between corticosteroid:bronchodilator ratios and hospital admission rates for asthma shows inconsistency between deprived and more affluent areas.
- Differences in asthma severity or the prevalence of chronic obstructive pulmonary disease may offer explanations for this inconsistency.
- Individual prescribing data linked to more accurate measures of asthma morbidity and the general practitioner's diagnosis are required.

The finding that admission rates for asthma are higher in more deprived areas confirms observations in America.¹¹ Although not significant, the inverse correlation between admission rates for asthma within such areas and the corticosteroid:bronchodilator ratio is similar to that observed in studies from two deprived areas of London.^{3,4} Taken together, these results seem to indicate that in deprived areas the quality of prescribing is an important indicator of the outcome of asthma care.

The results in more affluent areas and practices did not, however, follow the same pattern in our study. Although the relation was not significant, our findings suggest that in more affluent areas lower practice corticosteroid:bronchodilator ratios were associated with lower admission rates for asthma. There are two potential explanations for this inconsistency.

Firstly, severe asthma is more common in those who are socioeconomically deprived.¹² This may be due to a variety of reasons such as poorer environmental conditions¹³ or lack of access to health care services.¹⁴ In more affluent areas patients may therefore have milder asthma and might also have lower corticosteroid:bronchodilator ratios and be less likely to require admission. The interpretation of hospital admissions as an outcome measure of morbidity will be confounded by different degrees of asthma severity in different family health services authorities or practice populations.

Secondly, variation in the proportion of patients with chronic obstructive pulmonary disease will confound the associations we are trying to measure because the prescribing data are not specific to patients with asthma. Patients with chronic obstructive pulmonary disease generally require less inhaled corticosteroids than those with asthma and would be expected to have lower corticosteroid:bronchodilator ratios. Smoking is a major risk factor for chronic obstructive pulmonary disease¹⁵ and is more common among people in deprived areas,¹⁶ so deprived areas are likely to have a greater proportion of people with chronic obstructive pulmonary disease. This may explain the lower practice corticosteroid:bronchodilator ratios seen in these areas and hence their apparent link with higher admission rates.

This effect will be exaggerated when a corticosteroid:bronchodilator ratio based on "items" is used. The bronchodilator item incorporates oral as well as inhaled bronchodilators. Oral bronchodilators are likely to be used in chronic obstructive pulmonary disease and reduce the corticosteroid:bronchodilator ratio further. To investigate the influence of such confounding we re-examined our data using the item as the unit of analysis. Within the deprived group of authorities and practices, the correlation between admission rates for asthma and corticosteroid:bronchodilator ratios based on items remained in the same direction as for the defined daily dose analysis but was stronger ($r_s = -0.900$, $P = 0.037$; $r_s = -0.251$, $P = 0.086$), suggesting the presence of some confounding.

Several problems need to be considered in interpreting results from aggregated data. Hospital admission data are a potential source of bias. However, any errors in the classification of admission data are likely to be consistent both between family health services authorities and between general practices. The PACT data used to calculate the corticosteroid:bronchodilator ratios is unlikely to be a major source of bias, although patients presented with a prescription who elect not to have it dispensed will not be recorded by PACT. We have assumed patient compliance rates were consistent both between family health services authorities and between general practices and that any effects from seasonal variations were minor. Prescription analysis at the level of West Midlands regional health authority has not indicated any evidence for seasonal effects in the item corticosteroid:bronchodilator ratio (range during April 1993 to March 1994 = 0.38-0.41).

In conclusion, the use of the corticosteroid:bronchodilator ratio in primary care as an indicator of the quality of asthma prescribing by general practitioners should be interpreted with caution. We found no overall significant correlation between admission rates for asthma and corticosteroid:bronchodilator ratios at either family health services authority level or general practice level. An inverse association between admission rates for asthma and corticosteroid:bronchodilator ratios did exist in more deprived areas but not in more affluent areas. The severity of asthma and the proportion of patients with chronic obstructive pulmonary disease in the population are potential explanations for this inconsistency. More accurate outcome measures of asthma morbidity are required, linked to individual prescribing information and the general practitioner's diagnosis. We are currently analysing such data from selected practices in North Staffordshire to explore further the validity of the corticosteroid:bronchodilator ratio as an indicator of the quality of general practitioner prescribing.

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