Predictive value of a simple asthma morbidity index in a general practice population

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SUMMARY

Background. *There is a need in primary care for simple asthma outcome measures that are valid in terms of their relationship with lung function and capable of predicting those patients for whom additional management is indicated.*

Aim. *To assess the predictive validity of a revised asthma morbidity index in United Kingdom (UK) general practice.*

Method. *Morbidity index and peak flow rate data were gathered from nine general practices over a three-month period. Two postal questionnaire surveys, one year apart, were conducted in one Tyneside general practice. Morbidity index data from 570 asthmatic patients were gathered in the first survey and used to predict morbidity over the next year.*

Results. *For 120 responders with low morbidity, mean peak flow as a percentage of the predicted value was 91% (SD = 21%); for 91 responders with medium morbidity, the percentage was 77% (SD = 21%); and for 90 responders with high morbidity, it was 63% (SD = 29%). Fifty-seven per cent of the morbidity index categories remained unchanged after 12 months. The relative risks of high morbidity for having any acute asthma attacks, more than four attacks, and needing oral steroids during a one year period were 2.88 (CI = 1.87 to 4.43), 2.52 (CI = 1.84 to 3.44) and 2.38 (CI = 1.70 to 3.33) respectively.*

Conclusion. *The revised morbidity index is a simple and valid tool for the opportunistic surveillance of asthma in primary care.*

Keywords: asthma; morbidity; family practice.

Introduction

ASTHMA remains the most common chronic disease of any sort in childhood and the most frequent chronic respiratory disorder at any age. In terms of both morbidity and mortality, the therapeutic and organizational management of this condition pose a considerable and continuing challenge to health care delivery. One element in attempts to meet this challenge is the recognition of appropriate outcome measures to assess progress in tackling the burden of asthma.

In 1995, the Department of Health commissioned a committee of experts, chaired by Dr Mike Pearson of Liverpool, to examine a wide range of possible outcome measures and to propose some that might be useful in monitoring health care across the country. Among the measures suggested in their 1996 report[1] was a short, pragmatic morbidity index such as that previously proposed and tested by KJ and colleagues at Southampton.[2,3] A number of other, undoubtedly more accurate morbidity instruments have been evaluated, including the Canadian Guyatt questionnaire,[4] the short-form St George's questionnaire,[5] and the pair of five question sets proposed by Hutchinson *et al*;[6] but these are perhaps more suited to research enquiry than to routine clinical use. Measurement of quality of life for people with asthma is also considered important, but again the available instruments are necessarily fairly long.[7]

The concept of a short, pragmatic morbidity index for routine clinical use seems very attractive, but it is clearly important to find the most useful number, wording, and combination of questions. The original Jones morbidity index (based on simple yes/no answers to three straightforward, clinically relevant questions and producing categories of low, medium, and high morbidity significantly associated with lung function) was well received by general practitioners (GPs) and was found useful for one-off enquiries; however, it required the inclusion of a temporal qualifier to enable repeated testing. Evidence of the susceptibility to change of the revised index in the setting of a nurse-run asthma clinic in primary care — and indeed of the effectiveness of such care — has already been established.[8] However, data on the relationship of the revised index to lung function have not previously been presented, nor has the prospective, predictive validity of the instrument been tested. The second point is clearly important if the index is to be used more widely in routine practice.

The authors have therefore conducted a further evaluation of the revised form of the Jones morbidity index using postal questionnaires in the setting of routine general practice to address the validity of the revised index, in terms both of its association with lung function and of its predictive usefulness.

Methods

A two-stage process was employed to investigate validity. First, the relationship of the morbidity categories produced by the revised index to lung function was established in the context of a larger study gathering activity data in nine volunteer general practices in the north-east of England. Individuals with a known label of asthma, and presenting within a three-month period to a GP either with this condition or for unrelated purposes, were invited to answer the three questions of the index (the revised form is shown in Box 1) and to perform a peak flow measurement using a mini-Wright meter during the consultation. In accordance with standard practice, the best of three peak flow estimations was recorded.

Secondly, the index categories (which now refer to a retrospective four-week period) were compared with four other morbidity variables covering a 12-month period, namely admission to hospital, courses of oral steroids required, self-report of more than four attacks of asthma, and self-report of one or more *acute* attacks. The definition of the last two variables was deliberately left to the individual responder.

A two-sided postal questionnaire comprising the three questions of the revised Jones morbidity index and a short series of closed questions addressing these other morbidity variables was

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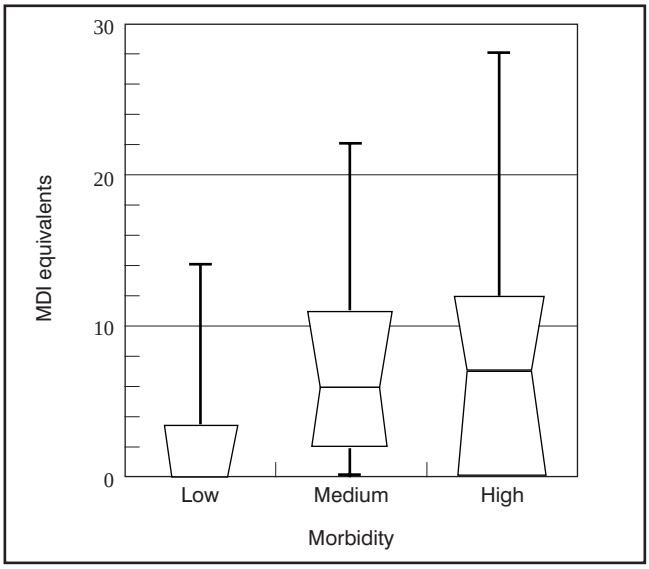

Figure 1. β_2-agonist usage: box and whisker plot.

sent to all patients in a single practice whose computer records indicated the Read code for 'asthma NOS'; the practice was in urban Tyneside and had 5.5 whole-time equivalent GP principals and a list size of just under 10 000. One reminder was sent to non-responders after approximately three weeks. This mailing was done on two occasions, the first in late 1994 (mailing 1) and the second in late 1995 (mailing 2), thus enabling the second question of the study to be addressed.

From mailing 2, patient-reported data on hospital admissions and use of oral steroid courses were checked against the relevant written and computerized practice records. This was done for all patients reporting hospital admissions, and for a random sample of 50 patients reporting use of oral steroid courses. As a further check on predictive validity, data on the use of β_2-agonists were collected from electronic practice records. This was measured by the number of prescriptions of metered dose inhaler (MDI) canisters or MDI equivalents in the 12 months prior to the date of mailing 2. A random sample of 50 cases was taken from each of the three morbidity categories from mailing 1 for this analysis.

Analysis was conducted using the SPSS for Windows package.[9] Simple frequency data with cross-tabulations and chi-square values are reported as appropriate; *t*-tests were used to compare the lung function data. Relative risks and confidence intervals are tabled for the predictive validity data; non-parametric analyses were carried out for bronchodilator usage.

Results

From the wider study, 301 responses were obtained. The mean peak flow values as a percentage of predicted were significantly different in the three morbidity categories (Table 1).

Mailing 1 comprised 867 patients, from whom 754 usable replies were received (84%). Mailing 2 comprised 942 patients, from whom 581 replies were received (62%). A total of 570 patients recorded as having asthma replied to both surveys, although data were not complete on all of these. All subsequent results apply to this cohort; precise numbers of patients with usable data are given in each case.

No significant alterations in health care delivery for people with asthma occurred in the practice between the two surveys. Therefore, although asthma is clearly a variably symptomatic disease, comparisons of the morbidity categories resulting from mailings 1 and 2 give some indication of the robustness of the index on a year-by-year basis. One hundred and three patients had low morbidity in both surveys, 60 had medium morbidity, and 163 had high morbidity — a consistency rate of 57% (Table 2). One hundred and twenty patients (21%) had a higher category at mailing 2, and 124 (22%) had a lower category.

Table 3 shows the relative risks of adverse events in the 12 months prior to mailing 2 for patients of medium or high morbidity at mailing 1 compared with those of low morbidity at mailing 1. Values varied from 1.28 to 1.95 for medium-morbidity patients (only one of the risks was statistically significant) and from 2.17 to 2.88 for high-morbidity patients (all the risks were statistically significant). Relative risks for hospital admissions were discounted as the numbers were so small.

The median use of MDIs or equivalents in the 12 months prior to mailing 2 were 0 (interquartile range = 4) for 45 low-morbidity cases, 6 (interquartile range = 9.5) for 41 medium-morbidity cases, and 7 (interquartile range = 12) for 39 high-morbidity cases (Figure 2). This difference is significant ($P<0.0001$ using Kruskal-Wallis one-way analysis of variance), and is fully explained by differences between the low- and medium-morbidity groups.

Discussion

The revised morbidity index appears to have better validity in terms of lung function than the original version, and the relative risks of morbidity events which were demonstrated for the index are likely to be of clinical benefit. This study therefore reinforces the potential usefulness of the Jones morbidity index in routine clinical practice.

The study was conducted in the pragmatic setting of routine general practice. It is therefore important to consider what limitations this may have imposed on our data. It is generally accepted that single peak flow measurements are of little relevance to the care of individual patients with asthma, but the authors believe that the use of such measurements is acceptable for the validation of the revised index. Further validation comparing morbidity categories to more formally conducted lung function tests would have been useful, but is not possible in most primary care settings without the provision of new equipment for spirometry. Quality control in this part of our data was obviously impossible to assess, but it is a reasonable assumption that peak flow measurements taken by a GP in his or her surgery will be acceptably accurate.

The response rates to the study questionnaires were high on both mailings, but some responders may have had difficulty in answering the questions accurately, particularly with regard to the time period for which the questions should be answered. The authors acknowledge the potential for error in basing their analysis on self-reporting.

One of the major problems experienced by all researchers in trying to validate simple outcome measures such as the Jones morbidity index is the absence of any widely accepted and reliable gold standard for the activity of asthma. Some authors argue that measurements of bronchial hyperreactivity offer the nearest thing to a standard,[10] but this is by no means accepted by all, and in any case such measurements could not easily and economically have been performed in this study. Although some other outcome measures, such as the Guyatt questionnaire,[4] have been assessed against bronchial reactivity measurement (as well as lung function and β-agonist use),[11] the two five-item, symptom-based instruments of Steen *et al*[6] were validated against other morbidity variables using a method similar to that of the current

Table 1. Validity of the revised morbidity index in terms of lung function.

Morbidity index category	Number of patients	Mean peak flow as percentage of predicted	Standard deviation
Low	120	91	21
Medium	91	77	21
High	90	63	29

All t-tests performed on this data were significant at $P<0.001$.

Table 2. Robustness of the revised morbidity index.

Morbidity category at mailing 1	Morbidity category at mailing 2			
	Low	Medium	High	Total
Low	103 (18%)	30 (5%)	34 (6%)	167 (29%)
Medium	39 (7%)	60 (11%)	56 (10%)	155 (27%)
High	42 (7%)	43 (8%)	163 (29%)	248 (44%)
Total	184 (32%)	133 (23%)	253 (44%)	570 (100%)

Percentages are rounded to the nearest whole number and thus do not always add up exactly to the column or row totals.

Table 3. Relationship between the morbidity index at mailing 1 and four adverse events in the year prior to mailing 2 (plus morbidity at mailing 2).

Morbidity variable	Low morbidity index		Medium morbidity index					High morbidity index				
	Frequency	%	Frequency	%	Relative risk	95% CI	P	Frequency	%	Relative risk	95% CI	P
Admission	6/157	3.8	10/150	6.7	1.74	0.65–4.68	0.27	32/243	13.2	3.45	1.47–8.05	0.0045
Steroids	32/161	19.9	43/151	28.5	1.43	0.96–2.14	0.079	114/241	47.3	2.38	1.70–3.33	<0.0001
More than four attacks	35/158	22.2	42/148	28.4	1.28	0.87–1.89	0.21	135/242	55.8	2.52	1.84–3.44	<0.0001
Acute attack(s)	21/159	13.2	27/149	18.1	1.37	0.81–2.32	0.23	91/239	38.1	2.88	1.87–4.43	<0.0001
Medium/high morbidity index at mailing 2	64/167	38.3	116/155	74.8	1.95	1.58–2.42	<0.0001	206/248	83.1	2.17	1.77–2.65	<0.0001

study. Another study validated daytime and nocturnal diary scales using only lung function and use of β-agonist inhalers.[12]

The Jones morbidity index was originally proposed as a simple, pragmatic tool of relevance to the opportunistic surveillance of the activity of asthma in patients presenting for other purposes in primary care.[2,3] Clinical experience with its use in different general practice settings over the past five years suggests that the three-question format is valued by doctors and nurses alike. It is therefore much more likely to see widespread use than any longer (and undoubtedly more accurate) asthma questionnaires.

The symptoms of asthma, and thus the perception of patients that they have the disease, are clearly variable. However, the data presented in this study indicate that the very simple morbidity index has robustness over time. In this practice, where no significant innovations in the organization and delivery of care for people with asthma occurred during the study period, the fact that more than 50% of responders remained in the same morbidity category a year later is impressive. Other research has demonstrated that the index is sensitive to change when innovations do occur,[8] and so we have confidence in recommending its use.

It is clear that all patients with a past or present history of asthma have at least some risk of suffering potentially severe exacerbations. Some may therefore argue that all people with asthma should receive enhanced primary care management, but given the high prevalence of the condition in the community it seems important to explore means of prioritizing extra care towards those most in need of it. Use of the Jones morbidity index must not replace clinical judgement, but can be of particular benefit as a simple, quick, useful, and validated additional tool where patients are consulting for other purposes (or are just collecting prescriptions without seeing a health professional).

The most important purpose in using any clinical outcome measure, such as the Jones morbidity index, is surely to attempt to predict and focus on those who may be at higher risk of adverse events in the course of their asthma, while not expending additional resources on those at lower risk. Using the 'more than four attacks' variable, the positive predictive value of high morbidity versus medium or low morbidity is 56%. The negative predictive value of low morbidity versus medium or high morbidity is 78%. Although the first value is not particularly high, the second would offer some security to a strategy for targeting additional resources at patients who fall outside the low-morbidity category.

Demonstrating the effectiveness of proactive asthma care in general practice is not easy,[13] and methods suggested for assessing the quality of such care include proxies such as the existence of recent audits,[14] hospital admission rates, and the preventer-reliever prescribing ratio.[15] Further use of the revised index may offer the opportunity to use data aggregated by practice as a more direct comparative measure.

Conclusion

The revised morbidity index is strongly associated with lung function. Considering its simple and pragmatic nature, it also has a predictive validity of use in clinical practice. It could be benefi-

During the past four weeks:

1. Have you been in a wheezy or asthmatic condition at least once a week?
2. Have you had time off work or school because of your asthma?
3. Have you suffered from attacks of wheezing during the night?

Box 1. The Revised Jones Morbidity Index. Patients' responses are assessed as follows:

NO to all questions	=	LOW morbidity
One YES answer	=	MEDIUM morbidity
Two or three YES answers	=	HIGH morbidity

Questions 1 and 3 can be answered 'yes' or 'no' by all responders, but question 2 will not apply to those who do not attend work or school. For the purposes of morbidity classification, a 'not applicable' answer is treated as a 'no'.

cial if used more widely in primary care and perhaps also in hospital practice.

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