

Definitions of severity and outcome measures

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Outcome measurement is still a difficult area in general, and in asthma in particular, with further research needed. (Attributable) outcomes of health care are the only sort of outcome measure which are of direct use as a contracting tool. However, less well-researched and understood outcomes are useful as quality improvement tools, and within more open-ended discussions involving purchasers and providers. In terms of hospital care of acute asthma, there is no well-defined outcome measure which reflects the quality of hospital care; re-admission rates show promise as an outcome measure which relate to the quality of discharge planning and merit further study. In terms of ambulatory care, there is an urgent need to develop and evaluate a symptom-based outcome measure which would be usable in routine practice and could be recommended for widespread use. As a physiological outcome measure, percentage of best function is one which corrects for the degree of irreversible air flow obstruction and is independent of treatment step. It is valuable for individual patients by providing a realistic gold standard and, if best function is assessed in a standard manner, it also allows results of groups of patients to be compared in a meaningful manner. Severity scores, which might allow categorization of patients on the basis of characteristics other than current symptoms or therapy, are currently being evaluated.

Introduction

Busy clinicians may be right in thinking that outcome measurement is a current fashion which will go the way of all fashions with time. Certainly the measurement of outcome is not new — the standard data set recorded on all casualty attendances at the Royal Infirmary in Glasgow in the 18th century included a comment on whether the patient was relieved or unrelieved; and, in the late 19th century, Florence Nightingale also used this as a measure of outcome. There can be no doubt that there is currently interest in outcome measurement and it is worth considering why this should be so.

Different professionals may see outcome measurement as, variously, a tool for purchasing, epidemiological surveillance, good clinical practice (perhaps better described as a goal — something to aim for, with the connotation of open discussion and agreement involving patients), or quality improvement. This final use is based on the premise that it may be more useful to investigate variations in outcome, rather than variations in practices of unknown relative merit.

There are merits in each of these approaches, but they are different. Before reviewing the currently

available and potentially promising outcome measures in asthma, these different perspectives will be examined.

Different Perspectives on Outcomes

Different perspectives are worth considering, especially in view of the differing nature of data which may best be suited for different purposes.

- (1) Purchasers would like to know about health care outcomes (1); these are results which can be causally related or attributed to the care given (see Table 1). Very few currently available outcomes fit this definition, but they are the most valid outcome indicators for contracting purposes since they reflect the processes being contracted for, rather than, for example, the population being served.
- (2) Epidemiologists and the Government, through its Health of the Nation Initiative, are interested in improving health outcomes — results which are defined in terms of health, but with no causal attribution, e.g. a fall in the number of unwanted pregnancies or of suicides. In terms of asthma, the percentage of the population with diagnosed asthma is a health outcome, but this proportion may be influenced by a variety of possible

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Table 1 Definitions of outcomes

Definitions (1)	
An outcome:	A result; an effect
A health outcome:	A result, defined in terms of health
A health care outcome:	A result which is attributable or responsive to health care
A health outcome of health care:	A result (defined in terms of health) which is attributable or responsive to health care

environmental and socio-economic factors, as well as changes in current diagnostic practice. Therefore, it tells us relatively less about the quality of care. It follows from this that health outcomes are not only, or even primarily, the responsibility of health professionals or organizations (2).

- (3) Clinicians are primarily interested in outcomes — whether or not these are attributable to the process of care. They will take into account the different perceived needs of different patients on a more or less explicit basis, depending on individual practice. They will recognize that a good outcome for one patient may be a poor one for the next — exercise-induced asthma may not be important for a teacher, but a disaster for the athlete. Therefore, this perspective recognizes that the definition of a good outcome will differ between patients.
- (4) The Colleges and Specialist Societies, and others, may identify outcome measurement as a short cut through the maze of (often unvalidated) variations in practice recognized to be common throughout the practice of medicine. Therefore, this approach sees outcome measurement as a quality improvement tool, using variations in outcome, providing these can be measured in a valid way, as the starting point for further investigation of current practice.

A final perspective in considering outcomes is that provided by time. An outcome may, at first glance, be a relatively clear-cut entity when, for example, a previously fit patient is subjected to an elective surgical procedure. However, even then there is a need to define terms, time scales and follow-up. This has been well demonstrated in the area of wound infections, where it is now widely recognized that a high wound infection rate is as likely to signal assiduous data collection and follow-up as a major problem in surgical technique (3). For chronic conditions such as asthma, as well as the issues of rigour of follow-up

and definitions, the fluctuating and long-term nature of the disease will present further problems in terms of definition of outcomes.

What Outcome Measures do we Currently Have?

HOSPITAL TREATMENT OF ASTHMA

Deaths

Deaths in hospital due to acute asthma are very rare (4) and have been shown to have only weak links with the process of care (5). Therefore, they can only be considered a crude measure of outcome. There is a large American literature on hospital-specific mortality rates (6) which suggests differences in mortality can have a large number of underlying causes. For asthma, the combination of small numbers of deaths and the confounding effects of differences in case mix, hospital/GP interface and subsequent management in primary care are likely to mitigate against such rates being a useful health care outcome measure, either for hospitals or primary care.

Population-based admission rates

It is possible, using routine data, to relate the number of hospital admissions to a given population. Practices which develop an interest in asthma will report anecdotally that hospital admissions have declined, but there is little published data on this (7). The relationship between admission rates and process of care are largely unexplored, although differences have been identified (8,9). Establishing causal relations is likely to be difficult in view of the number of possible confounding factors, including deprivation, historical provision of acute beds, and differing management practices in primary care. As a quality improvement tool, this could be of value, indicating areas for more detailed review.

Re-admission rates

These are potentially more useful. Many studies have shown a relatively constant 10–20%

re-admission rate in adults (10–12). Improving the process of acute hospital care has been shown not to influence this rate (13), but that audit also showed that the process of discharge planning did not improve over the audit/re-audit cycle, suggesting the possibility that re-admission rates relate to the quality of care at the interface of hospital and GP services. Early results from a controlled study evaluating the impact of detailed discharge planning and close follow-up in childhood asthma have recently shown that re-admission rates are halved in the intervention group (14). Further work is needed, but this data would suggest that re-admission rates do reflect the process of care and, therefore, begin to fit the definition of a 'health care outcome'. Percentage peak flow variability in the 24 h before discharge is, either as a proxy or a true outcome measure, worthy of further investigation. It has been shown to relate to re-admission (12,15), but may be influenced by 'patient' factors as much or more than 'treatment' factors.

Length of hospital stay

It is arguable whether this is truly 'a result or effect' rather than a process measure. However, patients value early appropriate discharge, and hospital managers rightly point to the opportunity costs of unduly prolonged hospitalization. Wide variations in the process of asthma care in hospital have been documented, including variations in the use and early use of corticosteroids (10–12). Whether closer attention to a good process of care has an impact on the length of hospital stay is worth further study. The British Thoracic Society (BTS) Audit Database (hospital management of acute severe asthma) (16) aims to facilitate local audit as a tool for quality improvement, and may also allow this question to be answered with time.

AMBULATORY ASTHMA CARE

Symptom scores

Knowledge of current symptoms, preferably recorded in a standard manner, can be considered a health outcome measure, since symptoms are influenced not only by previous treatment, but also by other factors including compliance and patients' perceptions of the relative claims of symptoms and treatment. It is unlikely that precise causal relationships with the process of care will be proved and, therefore, unlikely that such scores will be established as valid 'health outcomes of health care'. They are likely to be of use mainly within the consultation, and as epidemiological and quality improvement tools.

There are a number of well-validated symptom measures which have been developed as research (17–19) or audit (20) tools, but they are not applicable to everyday clinical practice. Other workers have developed shorter instruments for a variety of purposes including case finding (21,22), audit (23,24), and outcome measurement (25). None of these is in widespread use and, as such, can only be useful as a tool in local audit of practice. Therefore, further work is needed in this area if a valid and usable health outcome measure is to be developed.

Current treatment

This can be considered an outcome of previous consultations, but there are a number of confounding factors. One of these is doctor/patient interactions on the nature of acceptable treatment, and the trade-off which patients make between increasing treatment and the risk (or perceived risk) of side-effects and toleration of a degree of morbidity. Another confounding factor is the problem associated with changes in prescribing practice over time. Thus, an audit cycle conducted in hospital before and after the introduction of Becloforte showed profound differences in the use of this drug, but was unable to establish a relationship between use of Becloforte and severity of asthma (13). The introduction of the five BTS treatment steps may, at least in part, address this problem by categorizing different treatments on an escalating scale into which future new drug therapy can be slotted. Anecdotal data (Mike Pearson, pers. comm.), categorizing patients in primary care and hospital asthma clinics by treatment steps, has shown that those in hospital follow-up were on the higher BTS treatment steps, providing some support for the view that such patients have more severe asthma. In summary, current treatment may be an outcome/health outcome, but not one ever likely to be related causally to the process of care alone.

Practice- or practitioner-based admission rates

As noted earlier, general practitioners with a developing interest in asthma will report anecdotally that with developing interest in asthma management, the number of emergency hospital admissions with acute asthma has diminished. Some systematic data on this is now emerging (7) and, since admission rates by practice or general practitioner could be calculated from routine data, it may bear further investigation. There is evidence relating deprivation to admission rates (26), and this, as well as case mix, are possible confounding variables which may limit the use of such a measure as a health care outcome. It may be of value as a quality improvement tool.

Physiological measurements

Peak flow rate or spirometry expressed as a percentage of predicted are valuable if there is no fixed air flow obstruction, but many patients with asthma do develop this. Whether the development of irreversible air flow is affected by the quality of asthma control is unknown, and would require a very long-term study to evaluate. As a long-term outcome measure, therefore, percentage predicted PFR or FEV₁ can only be considered a health outcome.

The problem of evaluating current lung function in a patient who has developed some irreversible air flow obstruction led to the investigation of other measures. Percentage of best function, where this is measured according to a defined protocol, looks promising as a more generally applicable health outcome measure (23). It provides a personal gold standard for an individual patient with mixed reversible/irreversible air flow obstruction, and should, therefore, be useful within the consultation. In patients with no irreversible air flow obstruction, best function and predicted function coincide. Therefore, this measure allows data from both types of patient to be amalgamated. In addition, 'percentage of best function' is independent of current treatment step, which may itself be related to severity of asthma. Thus, within any group of patients on similar therapy, there will be a range of values for 'percentage best function' which they are currently achieving. Since the aim would be for patients to achieve as near 100% of best function as possible, the measure allows inferences to be made about current therapy/supervision. Therefore, it is useful clinically, as well as providing a quality improvement and epidemiological tool.

A possible reservation about the use of 'percentage best function' as an outcome measure is that, to remain valid, best function should be re-assessed from time to time. However, this revision may allow a decline in lung function to go unremarked. This difficulty could be addressed by expressing the change in best function over a period of time in millilitres or litres per year, and would arguably help to identify such patients more readily.

Bronchial hyper-reactivity has not been shown to be influenced by treatment (27). Neither bronchial hyper-reactivity nor the degree of peak flow variability can be considered outcome measures which are useful in routine practice (although PFR variability is undoubtedly a useful tool for assessing patients).

Current 'Best Buys' as Outcome Measures for Asthma

HOSPITAL CARE

There is currently no good outcome measure which is known to relate to the quality of hospital care, rather than case mix. This reinforces the utility of review of the process of care concentrating on the delivery of known effective practices, for example using the BTS Audit Database (16) and giving consideration to changes in practice which improve the delivery of care.

HOSPITAL/GP INTERFACE AFTER HOSPITAL ADMISSION

In view of the recent findings described earlier, where re-admission rates fell in the face of good discharge planning and follow-up, this merits further evaluation as a health care outcome measure.

AMBULATORY CARE

There is an urgent need to identify a standard *symptom score*, building on existing work, in order to produce a tool which would both support good patient care and become a common currency for audit and quality improvement (28). This is particularly important in the face of the often arbitrary decisions on data sets for chronic disease management currently being used in primary care.

In terms of *physiological measures*, for the reasons stated above, percentage of best function offers the best prospect of a valid physiological measure of outcome, and certainly merits further evaluation.

Both of these measures will describe health outcomes which relate to patient as well as treatment factors and are, therefore, unlikely to be attributable to health care delivery alone. As valid health outcome measures, they would be of benefit to epidemiologists and clinicians, and as quality improvement tools.

Severity Measures

The need for a severity measure arises from a recognition of the long-term and fluctuating nature of asthma, and the utility of having different tools for measuring short-term asthma control and longer term overall severity. A valid measure of asthma severity would allow more accurate representation of case mix for epidemiological purposes and in the comparison of groups of patients in audit; it might also be a useful predictor of the need for services.

Factors which may be important in describing severity include lung function, compliance, psychological adjustment and previous service use (e.g. hospital admission). Although there are methodological problems in how any such measure might be validated, work on this is currently underway (A. Hutchinson, pers. comm.).

Another approach to defining severity would be to build a multi-dimensional picture about the severity of asthma, whether for individual patients or groups, based on:

- (1) The current degree of symptom control (see above);
- (2) A physiological measurement which is independent of treatment step (see above); and
- (3) Current BTS treatment step (29).

The relative merits of these two approaches have not been evaluated and both the concept of a severity measure and any practical tools arising from it are, therefore, currently areas for further research.

Acknowledgements

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Appendix

Further details of the BTS Audit Database (hospital management of acute severe asthma) from: Mrs Ida Ryland, Asthma Audit Office, Aintree Chest Centre, Fazakerley Hospital, Lower Lane, Liverpool L9 7AL, U.K.