

We found that low socioeconomic status in adulthood was related to adverse changes in control beliefs during the six year follow up (results not shown), suggesting that adult socioeconomic conditions further contribute to beliefs of low control. More information is needed on the specific socioeconomic correlates that induce beliefs of low control as these may be easier to modify than the beliefs themselves. Low job control may be one of these conditions.⁵ Other studies with larger numbers are needed to examine the behavioural or psychophysiological pathways through which perceived control affects mortality. Our findings emphasise that only by examining psychological mechanisms more thoroughly can we determine the complex pathways through which social structure affects individual disease and mortality.

The study was conducted in close collaboration with the Public Health Services of the Dutch city of Eindhoven and the region of South-East Brabant. We thank Michel Provoost and Ilse Oonk for carefully constructing the database and Mariel Droomers for providing comments on previous drafts of the paper.

Contributors: HB was the main author, formulated the hypothesis, carried out the analyses, interpreted data, and was partly responsible for data collection. CS helped with writing and interpreting data and was partly responsible for data collection. JPM was principal investigator, helped with writing and interpreting data, was responsible for data collection, and is guarantor for the study.

Funding: Dutch Ministry of Public Health, Welfare, and Sports and the Dutch Prevention Fund.

Competing interests: None declared.

- 1 Syme SL. Control and health: a personal perspective. In: Steptoe A, Appels A, eds. *Stress, personal control and health*. London: Wiley, 1989:3-18.
- 2 Bosma H, Mheen HD van de, Mackenbach JP. Social class in childhood and general adult health in adulthood: a questionnaire study of contribution of psychological attributes. *BMJ* 1999;318:18-22.
- 3 Mackenbach JP, Mheen HD van de, Stronks K. A prospective cohort study investigating the explanation of socio-economic inequalities in health in the Netherlands. *Soc Sci Med* 1994;38:299-308.
- 4 Rotter J. Generalized expectancies for internal versus external control of reinforcement. *Psychol Monogr* 1966;80:1-28.
- 5 Marmot MG, Bosma H, Hemingway H, Brunner E, Stansfeld S. Contribution of job control and other risk factors to social variations in coronary heart disease incidence. *Lancet* 1997;349:235-9.

(Accepted 7 September 1999)

Health Care Evaluation Unit, Department of Public Health Sciences, St George's Hospital Medical School, London SW17 0RE

Joanne Lord
lecturer in health economics

Peter Littlejohns
professor

Rachel Churchill
senior research fellow

continued over

BMJ 1999;319:1470-1

website
extra

A table with baseline data is on the *BMJ's* website

www.bmj.com

Cost effectiveness analysis of inhaled anticholinergics for acute childhood and adolescent asthma

Joanne Lord, Francine M Ducharme, Ronald J Stamp, Peter Littlejohns, Rachel Churchill

A recent systematic review by the Cochrane Airways Group showed that adding multiple doses of anticholinergics to β_2 agonists is safe and effective in improving lung function and avoiding hospital admission for school aged children and adolescents attending casualty departments with severe acute asthma.¹ The estimated reduction in the risk of admission was 9.4% (0.4% to 18.4%). This intervention presumably improves bronchodilatation until systemic corticosteroids take effect. Evidence of cost effectiveness, however, is lacking. To clarify whether scarce health resources should be spent on this intervention we conducted an economic evaluation.

Methods and results

We used various assumptions to estimate the financial implications of treatment (see table on the *BMJ's*

website). The costs of drug administration were not included, as anticholinergics are always given with β_2 agonists and involve little additional manipulation. The cost of nebulisers, other drugs, and the casualty attendance were also excluded. No consideration was given to possible changes in length of stay in casualty. The effect of changing the various assumptions was tested by simple, one way, sensitivity analysis, and by multivariate probabilistic sensitivity analysis.² The latter is a simulation approach that enables estimation of uncertainty ranges containing 95% of replicated results.³

We estimated that treatment would cost about £8 (uncertainty range £1 to £47) per admission avoided (table). This implies a net saving of £80 (£0 to £157) per severe case treated. Varying the risk reduction within 95% confidence limits varied the mean net saving from £3 to £157 per severe case treated. More precision is expected when the Cochrane review is updated. Varying the cost of hospital admissions within the interquartile range for English providers (£620 to £907) varied the mean savings from £58 to £85 per severe case treated. Changes to the dose and unit cost of ipratropium had very little effect on the results.

Further assumptions were used to extrapolate the findings to a national level. About 7200 children aged 5-15 years are admitted from casualty with a diagnosis of asthma each year (hospital episode statistics 1988 to 1996). About 40% of children in this age group attending casualty with asthma are admitted.⁴ We assumed that 50% of people with asthma attending casualty have severe asthma.⁵ The rate of uptake of the review recommendations was assumed to be 5% a

Results of baseline analysis, with uncertainty ranges estimated by probabilistic sensitivity analysis

| | Per severe case treated | |
|---------------------------------------------|-------------------------|--------------------|
| | Best estimate | Uncertainty range* |
| Admissions avoided† | 0.09 | 0-0.18 |
| Cost of treatment‡ | £0.75 | £0.28-£1.40 |
| Savings due to avoided admissions§ | £81 | £0-£158 |
| Cost of treatment per admission avoided¶ | £8 | £1-£47 |
| Net monetary saving to the health service** | £80 | £0-£157 |

*Interval containing 95% of 5000 simulation replications. †Risk difference estimated by meta-analysis.¹

‡Cost of ipratropium bromide 25p per 0.25 mg (from *British National Formulary* March 1999), and total dose per patient 0.625 mg (median for multiple dose protocols included in the meta-analysis¹). Authors assumed that one mild to moderate case is treated for every five severe cases treated.

§Mean cost of non-elective inpatient admissions £860 (NHS Executive's reference costs 1998 (HRG D21 and D22)). ¶Cost of treatment divided by the number of admissions avoided.

**Savings due to avoided admissions minus the cost of treatment.

year; therefore an additional 5% of eligible patients would be treated in the first year, 10% in the second year, and so on. If doctors treated patients with mild or moderate asthma, this would add to treatment costs with no evidence of clinical benefit. We assumed that for every five patients with severe asthma who were treated, one patient with mild or moderate asthma would be treated. Costs were discounted at an annual rate of 6%.

Net savings were estimated to be £437 800 (–£3700 to £1 078 100) over five years in England. An increase in the number of patients for whom treatment is indicated, or in the proportion of eligible patients who are treated, leads to a proportionate increase in savings. For example, if all eligible patients were to be treated, after five years the estimated savings would be quadrupled. A reduction in the annual discount rate from 6% to 3% leads to an increase of £47 600 in expected savings. Increasing the ratio of inappropriate to appropriate treatment from 20% to 100% leads to a small decrease (£2800) in expected savings.

Comment

The addition of multiple dose anticholinergics to inhaled β_2 agonists for children and adolescents attending casualty with severe acute asthma would result in savings in health service resources. This finding is robust to changes in modelling assumptions, although some uncertainties remain. The personal value of the health effects and avoided hospital

admissions provide additional benefits that have not been quantified in this analysis.

We thank Paul Jones and Steve Milan of the Cochrane Airways Group; Janine Bestall for her help in literature searching; Richard Atkinson for providing data on hospital episode statistics; and Debbie Latouche and Martyn Partridge for providing data from the UK National Asthma Task Force audit. A referee gave very helpful comments on an earlier draft of the report.

Contributors: RJS had the original idea for the project. JL conducted the computer modelling and drafted the report. FMD gave specific advice on the systematic review and the modelling assumptions. All contributors participated in the design of the project and commented on drafts of the report. JL will act as guarantor.

Funding: The health care evaluation unit is supported by the research and development offices of the South East and London regional offices of the NHS Executive.

Competing interests: None declared.

- 1 Plotnick LH, Ducharme FM. Should inhaled anticholinergics be added to β_2 agonists for treating acute childhood and adolescent asthma? A systematic review. *BMJ* 1998;317:971-7.
- 2 Briggs A, Sculpher MJ, Buxton MJ. Uncertainty in the economic evaluation of health care technologies: the role of sensitivity analysis. *Health Economics* 1994;3:95-104.
- 3 Lord J, Asante MA. Estimating uncertainty ranges for costs by the bootstrap procedure combined with probabilistic sensitivity analysis. *Health Economics* 1999;8:323-33.
- 4 Partridge MR, Latouche D, Trako E, Thurston JGB. A national census of those attending UK accident and emergency departments with asthma. *J Accident Emerg Med* 1997; 14:16-20.
- 5 Stell IM. Asthma management in accident and emergency and the BTS guidelines—a study of the impact of clinical audit. *J Accident Emerg Med* 1996;13:392-4.

(Accepted 24 August 1999)

Departments of Pediatrics and of Epidemiology and Biostatistics, Montreal Children's Hospital, McGill University, 2300 Tupper Street, Montreal, Quebec, Canada H3H 1P3

Francine M Ducharme
associate professor

Wessex Institute for Health Research and Development, Biomedical Services Building (mailpoint 727), University of Southampton, Southampton SO16 7PX

Ronald J Stamp
honorary senior research fellow

Correspondence to: J Lord
j.lord@sghms.ac.uk

A memorable patient Unforeseen consequences

It was not long after I had arrived to take over a singlehanded practice in a rural part of Ireland that I first met Jean. I was struck by her big hands, jutting chin, and rather waxy facial features. The fact that she had hypertension and diabetes lent support to my clinical impression of acromegaly and that this had gone unnoticed in over three years of attendance at the hospital medical outpatient department added to the glow of satisfaction when the diagnosis was confirmed by an endocrinologist.

Jean was glad to have a diagnosis but was nervous of the prospect of surgery when a computed tomogram showed the pituitary tumour responsible. Her daughter had died some years earlier of a brain tumour and neurosurgery was linked in her mind with this. Thanks to a skilled neurosurgeon (the same man who had operated on her daughter) everything went well and Jean had her tumour resected.

Six months later at routine follow up, a scan raised the possibility of a middle cerebral artery aneurysm, an unrelated condition which might never have been diagnosed normally. An angiograph confirmed bilateral middle cerebral artery aneurysms and Jean was admitted to have them clipped. The right artery was clipped but she developed a hemiparesis which resolved fairly quickly. It was decided to readmit her at a later date to clip the left side.

The experience frightened Jean and she was dubious about further surgery. I spoke with the neurosurgeon who said that about one patient in 20 would develop spasm following surgery and this could give a stroke-like effect. However, he thought that the risk of surgery was less than the risk of an untreated aneurysm. Jean made a pilgrimage to Lourdes.

Two months later Jean decided to go ahead with the operation. Postoperative recovery was slow and unfortunately she developed

another hemiparesis dysphasia and became completely dependent on nursing staff.

Now three years on, Jean is in a nursing home. Her hemiparesis has resolved considerably, but she is unable to speak and seems to have a global dysphasia. Her husband, Michael, attends me regularly. He lives alone about 15 miles from the nursing home and visits Jean nearly every day. He blames no one for what has happened. He accepts that the doctors made their decisions in good faith and after careful consideration.

If I come across another patient with signs and symptoms like Jean I would undoubtedly refer that patient to an endocrinologist. However, I feel sad and humbled by Michael's loneliness and cannot help wondering whether or not Jean might still be living with him albeit unaware of her acromegaly and dilated middle cerebral arteries, were it not for the arrival of the new doctor and his clever diagnosis.

Garrett Igoe *general practitioner, Virginia, County Cavan, Republic of Ireland*

We welcome articles of up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.