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Logistic regression models used in medical research are poorly presented

EDITOR,—The application of multiple regression models in medical research has greatly increased during the past years.¹ Nevertheless, assessing the accuracy of regression models in describing the data (goodness of fit) is almost unknown in medical research. Hence, medical journals may be publishing papers in which regression models are misused or results are misinterpreted.

We investigated the use of logistic regression in papers published in the *BMJ*, *JAMA*, the *Lancet*, and the *New England Journal of Medicine* during 1991-4. A Medline search using the strings logistic regression and proportional odds model yielded 111 papers. Of these, two articles stated the use of logistic regression in the abstract but the Cox model had been used instead. The remaining 109 papers used some kind of logistic regression. We investigated which kind of logistic regression was used (binary, polytomous, ordinal), whether a statistical reference and the computer software were specified, and whether a valid assessment of the goodness of fit of the logistic models² was reported.

Only one paper used the proportional odds model for ordinal response; the other 108 articles used binary logistic regression. A reference for logistic regression was specified in 48 papers, for the software in 57, and for both in only 26 papers. This is not in line with the guidelines of the International Committee of Medical Journal Editors.³ The most frequently specified reference was the book by Hosmer and Lemeshow,² followed by the book by Breslow and Day⁴ and various SAS manuals, while the most popular software packages in descending order were SAS, SPSS, BMDP, EGRET, and GLIM.

Goodness of fit was rarely assessed. Three papers stated the use of the Hosmer-Lemeshow test,² two compared the predicted and observed outcomes, and two reported the analysis of residuals. A further two reported the use of likelihood ratio statistics, but as the models contained continuous covariates the likelihood ratio test was inadequate.² Thus only seven papers reported a valid assessment of the adequacy of their regression model.

As the validity of all results and conclusions strongly depends on the goodness of fit of the models used, this practice of reporting is unsatisfactory and should be changed. We agree with Campillo that clear standardised publication criteria are needed to improve the current poor presentation of regression models in biomedical journals.⁵ We recommend that authors should always report the goodness of fit of regression models to avoid invalid results.

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Employing general practitioners in accident and emergency departments

Better to increase number of consultants in accident and emergency medicine

EDITOR,—Recent papers have studied the role of general practitioners in accident and emergency departments. The medical media have reported that employing family doctors in these departments may save £8 a patient.¹ Dale *et al* showed significant differences between the care provided by general practitioners and by junior staff working in accident and emergency for primary care attenders in an accident and emergency department.² When general practitioners were included as part of the accident and emergency team and saw all new attenders except those classified as having life threatening or urgent conditions they were found to manage these patients safely and to use fewer resources.³ It has also been shown that general practitioners manage primary care problems presenting to accident and emergency departments at reduced cost (£11.70) when compared with senior house officers (£19.30) and registrars (£17.97) in accident and emergency medicine.⁴

All these studies compared general practitioners who had had full vocational training with junior doctors training in accident and emergency medicine. The general practitioners had therefore completed their training in primary care, so one would expect them to provide better care than doctors still undergoing training. The new breed of vocationally trained consultants in accident and emergency medicine have an active role in the initial care of patients with both major and minor conditions in many centres. I have no doubt that consultants would show much better use of resources than their juniors: if they did not then what does training achieve? We have no comparative data for the care given by general practitioners and consultants in accident and emergency medicine.

Before accepting that the way forward is for general practitioners to work in accident and emergency departments we need evidence that this is preferable to an expansion in the number of consultants in accident and emergency medicine. Consultants have the advantage of being able to treat major as well as minor injuries.

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- 2 Dale J, Green J, Reid F, Glucksman E. Primary care in the accident and emergency department: Comparison of general practitioners and hospital doctors. *BMJ* 1995;311:427-30.
- 3 Murphy AW, Bury G, Plunkett PK, Gibney D, Smith M, Mullan E, *et al*. Randomised controlled trial of general practitioner versus usual medical care in an urban accident and emergency department: process, outcome, and comparative cost. *BMJ* 1996;312:1135-42. (4 May.)
- 4 Dale J, Lang H, Roberts JA, Green J, Glucksman E. Cost effectiveness of treating primary care patients in accident and emergency: a comparison between general practitioners, senior house officers, and registrars. *BMJ* 1996;312:1340-4. (25 May.)

All doctors should spend time in general practice to learn skills of GPs

EDITOR,—I felt little surprise on reading Jeremy Dale and colleagues' paper comparing the cost effectiveness of general practitioners, senior house officers, and registrars in treating primary care patients in accident and emergency departments.¹ The authors conclude that employing general practitioners in accident and emergency departments offers a potential means of reducing the costs of treating patients with primary care problems. I, however, would suggest an alternative conclusion: that there is a compelling argument for hospital doctors—probably in all specialties—to spend a period in general practice learning some of the skills that seem to allow general practitioners to use clinical judgment rather than expensive investigations to assess patients with primary care needs.

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- 1 Dale J, Lang H, Roberts J, Green J, Glucksman E. Cost effectiveness of treating primary care patients in accident and emergency: a comparison between general practitioners, senior house officers, and registrars. *BMJ* 1996;312:1340-4. (25 May.)

Meaning of term "observational study" needs to be defined

EDITOR,—Is anyone else confused about the use of the term "observational study"? Nick Black uses it when referring to cohort and case-control studies,¹ whereas in last year's series of articles on non-quantitative techniques it was used to describe a qualitative social science research method.²

The development of evidence based medicine and critical appraisal skills encourages us to improve our understanding of the quality of evidence and the methods of health service research. I would find it helpful if the terminology for these two research techniques could be clarified. How about changing to the terms "analytical observational study" and "qualitative observational study"?

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General practice records should be kept on CDs

EDITOR,—Ian N Purves fails to address some important points in his editorial on the paperless general practice.¹

Firstly, how many of the practices that are now paperless have transferred all of their patients' old records to computer?

Secondly, how are records to be transferred from one practice to another when several different computer systems exist and the family health services authorities and health authorities must physically have the medical record envelope and its contents to effect a transfer?

Thirdly, when records are transferred the computer records will have to be downloaded into the medical record envelope in case the receiving doctor does not have a computer system or that system is incompatible with the previous general practitioner's.