

LETTERS TO THE EDITOR

Dose classification

EDITOR.—In a paper by Dickinson and colleagues they discuss the sex ratio of children in relation to preconceptional radiation dose,¹ and suggest a simulation method to take account of dose misclassification. The analysis by Dickinson and colleagues hinges on a comparison between two groups: those with 90 day preconceptional dose less than or greater than 10mSv. However, for this comparison, the dose was estimated from annual dose summaries. To investigate the likely magnitude of the resulting misclassification, Dickinson *et al* compared these estimated doses with accurate dose calculations for a sample of 51 children. Let X_T (MFB90 in the terminology of Dickinson *et al*) and X_E (ADS90 in Dickinson *et al*) denote the true and estimated doses, respectively. Using data on both X_T and X_E available for 51 of the children in the study, Dickinson *et al* note that the proportional misclassification, which they define as $Z = (X_E - X_T)/X_E$, follows an approximately normal distribution with mean zero and standard deviation τ , say, which they estimate to be approximately 0.4. They then propose to sample putative values of Z from this distribution by simulating a value of z_i for each child in the study and to use these simulated values to reconstruct an X_T value for each child as $\hat{X}_T = X_E(1 - Z)$. They find that whereas there is a significant difference between the sex ratios in the low dose and high dose groups as determined by the X_E , when the imputed values \hat{X}_T are used in place of the X_E the difference becomes non-significant in 722 of 1000 simulations. They conclude that the statistical association between sex ratio and 90 day preconceptional dose "may be a chance finding due to imprecision in the dose estimates and consequent misclassification."

While it is hard to disagree with the literal interpretation of the conclusion by Dickinson *et al*, their simulation method in fact exacerbates rather than alleviates the misclassification problem, and the diminution of the notional significance of their findings is artefactual. The underlying statistical basis for this is well known, and can be described briefly as follows.

In general, the effect of using an imprecisely measured explanatory variable in a regression analysis is to attenuate the corresponding regression coefficient. Suppose that a "true" explanatory variable X_T and a response Y are jointly normally distributed with respective variances σ_T^2 and σ_Y^2 , and correlation ρ , then the regression coefficient of Y on X_T is $\beta = \rho\sigma_Y/\sigma_X$. If $X_E = X_T + Z$, where Z is normal with mean zero and variance τ^2 , the regression coefficient of Y on X_E is

$$\beta^* = \beta / (1 + \tau^2/\sigma_X^2)$$

The degree of attenuation between β and β^* clearly increases with τ^2 .

In the procedure used by Dickinson *et al*, $\hat{X}_T = X_E(1 - Z)$ and the effect of multiplying X_E by $1 - Z$, where Z is necessarily independent

of the unknown proportional misclassification for the child in question, is to increase the variance. This must result in attenuation of any regression relation in which the estimated dose is used as an explanatory variable and, in particular, an understatement of the significance of the difference between the low dose and high dose groups.

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- 1 Dickinson HO, Parker L, Binks K, *et al*. The sex ratio of children in relation to paternal preconceptional radiation dose: a study in Cumbria, northern England. *J Epidemiol Community Health* 1996;50:645-52.

Reply

We wish to thank Professor Diggle and Dr Morton-Jones for clarifying in full the difficulties of interpreting associations between variables measured imprecisely. Misclassification of occupational exposures over short time periods by apportioning of annual dose summaries is particularly difficult to measure as we believe there are extraneous factors such as occupational dose limits influencing the rate of dose accrual such that misclassification may not be random. The effects of such dose misclassification clearly need to be reassessed and we are tackling this in our current work. However, pending such reassessment, our conclusions, which are based on other considerations as well as the question of misclassification, remain unchanged: the statistical association between sex ratio and dose should be interpreted cautiously.

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the perspective taken is clearly that of the provider and I feel the lack of a purchaser viewpoint diminishes its value.

Health authorities are still ultimately responsible for consulting on and implementing the results of any rationalisation of acute services and in my experience and contrary to what is stated on page 33, it is the purchaser, not the hospital management that incurs the wrath of the public when beds are closed or the number of sites reduced. It does not seem to matter why rationalisation takes place, the public assume it is related to resource allocation and the blame is laid firmly with the purchaser.

Indeed, despite their importance, I feel the reasons for rationalising acute services are not covered in enough depth in this book and anyone wanting more information might be better reading the recent Centre for Reviews and Dissemination Report on "Concentration and Choice in the Provision of Hospital Services".¹

There is also little acknowledgement that, as with many things, success is more likely if a multi-sectoral approach is taken. Acute services cannot be considered in isolation. Almost any rationalisation of hospital services will have an impact on the local authority and the voluntary sector, as well as primary and community-based health services.

Nevertheless, this book is topical and timely, providing an up to date description of the current NHS, highlighting some of the future uncertainties it faces. It includes some areas that may be overlooked in the overall process of rationalisation, for example site and facilities appraisal as well as providing good advice around data and information needs; public relations; communication; and consultation.

Given the complexity of the problem, it is perhaps not surprising that this book does not provide the answer to my colleague's dilemma of what services to put where but I feel it tells only part of the story and consequently provides only part of the solution.

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- 1 Centre for Health Economics. York Health Economics Consortium. NHS Centre for Reviews and Dissemination. *Concentration and Choice in the Provision of Hospital Services. CRD Report 8 (Summary)*. York: University of York, 1997.

BOOK REVIEW

Rationalizing acute care services.

Pauline Mistry. (Pp 103; £18.95). Oxford: Radcliffe Medical Press, 1997. ISBN 1-85775-125-6.

Having previously spent two years sharing an office with the project manager of an acute services' review, I picked this book up enthusiastically thinking I had found the answer to all his problems. Despite being easy to read, however, I am not sure of its usefulness. Described as being of value to managers and clinicians involved in acute care services, non-executive members of boards and trusts and students of health services management,

CORRECTIONS

There were two authors' errors in the paper by Sarah Wamala and others (*J Epidemiol Community Health* 1997;51:400-7).

In table 1 the number of rooms in the household should be 4.0 [not 410] and in table 2 educational levels should be 1 (highest) and V11 (lowest) [not 1 (lowest) and V11 (highest)].

An error occurred in the paper by Higham and others (*J Epidemiol Community Health* 1997;51:233-8). The correct spelling of the third author should be Kupek [not Kopek] and his affiliation should be Academic Department of Public Health, St Mary's Hospital Medical School, London.