

## LETTERS TO THE EDITOR

### Regression analysis of visual field progression in low tension glaucoma

EDITOR,—I write to comment on a paper by Nouredin *et al.*<sup>1</sup> The description of the regression analysis is confusing. Also, since there are no controls, it is hard to interpret the results. I reproduce below the two paragraphs in which the authors describe their method.

'Linear regression analysis was done on each tested retinal location in the Humphrey fields of each patient. At and from the third field onwards the sensitivity of each point in decibels was compared with that of the previous field. A slope showing a change in sensitivity of 0.2 decibel per month was considered to denote stability. On the other hand a slope showing a decrease in sensitivity of more than 0.2 decibel per month with a correlation coefficient of significance  $p < 0.05$  was considered to denote progression (that is, worsening) in that specific point.

For the purpose of this analysis progression in a visual field was considered to have occurred if at least the last two consecutive slopes of one or more tested locations were negative ( $p < 0.05$ ). All other possibilities, including a single negative regression slope, were considered to indicate a static field.'

In paragraph 1, the authors could have performed at least two regressions. One is a regression of decibels on time. The other is a regression of decibels at  $t+1$  on decibels at  $t$ . We do not know which they did.

The phrase in paragraph 2 'the last two consecutive slopes . . . ( $p < 0.05$ )' is unclear. For each retinal location in each eye, the regressions of paragraph 1 produce a single slope, not 'two last' slopes. How, then, can one understand the authors' statement? Suppose that, for a patient with  $n$  time points, the 'last two slopes' are those from points  $n-2$  to  $n-1$  and  $n-1$  to  $n$ . Then where does the  $p < 0.05$  come from? There is no  $p$  value for a slope based on only two points. Also, where is the 'regression analysis' of the title? Again, we do not know what the authors did.

Finally, the absence of controls is particularly unfortunate. The Humphrey C30-2 visual field examination produces sensitivity values at some 70 retinal locations. The authors conclude an eye progresses if just one of these 70 retinal locations meets their criterion. This means that even a normal eye has 70 chances to meet the criterion purely by accident. Assume for the moment that the 70 locations are independent of each other, with individual  $\alpha$  levels of 0.05. A simple calculation shows that the authors are almost sure to judge that a normal eye has progressed! This calculation is actually inapplicable, since the 70 locations depend upon each other. The point is, however, that one does not know the probability of misclassifying a non-progressive eye; surely it exceeds 0.05.

How does one use this method, and how many normals 'progress' by it? The authors do not clearly describe their technique and provide no standard for comparison. This brings into question their finding of 50% progression in patients and 37% in eyes.

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1 Nouredin BN, Poinosawmy D, Fietzke FW, Hitchings RA. Regression analysis of visual field progression in low tension glaucoma. *Br J Ophthalmol* 1991; 75: 493-5.

### Reply

EDITOR,—We thank Professor Oden for his interest and are happy to further describe the method used to detect progression at each location of the HFA visual fields using regression analysis.

For each visual field location, beginning with field number three ( $n=3$ ), a linear regression analysis was performed. For example, after the first year, at location (3,3) for fields taken at 6 month intervals, three values in dB would be available for analysis. This then gives a value for the slope and whether the significance was better than 0.05. With the next field, the linear regression is performed for the first four fields ( $n=4$ ) to give a value for the slope and significance. This is repeated until the entire sequence of  $n$  visual fields is completed.

In this way, at each location, an objective value is determined for the slope and significance level using all fields up to field  $n$ . Although, as Professor Oden notes, we could have performed a different form of regression analysis, we chose the method we used as being the most straightforward. We trust this clarifies the pointwise linear regression method we used and also the second point raised by Professor Oden. The 'last two' slopes we refer to are then those from fields 1 to  $n-1$  and 1 to  $n$ . Clearly, there is no meaningful  $p$  value for a slope based on two points as Oden notes and this is why we performed the pointwise regression analysis on all of the visual fields up to  $n$ . A small correction to Oden's quotation from the paper is that we chose stability to be 'a change in sensitivity of less than 0.2 dB per month'. We chose a value of loss of 0.2 dB or more per month with  $p < 0.05$  as a definition of worsening. This corresponds to a loss of 2.4 dB per year or 24 dB per decade and is used as an operational definition for the purposes of this paper. Clearly it is of interest to further investigate progression of sensitivity loss in different groups of patients and normals using this method (particularly for lesser degrees of worsening) and this question is actively being pursued.

On the question of the independence of one visual field location from another, this is an important issue and one that this method of analysis is also being used to address. For example, it could be the case that in some forms of glaucoma the visual field progression is relatively diffuse while in others it may be more localised. It is by using this pointwise regression analysis that we are able to investigate this question and this is currently the subject of intensive study. Some of the advantages of this method are that it allows the detection of localised losses at single or a small number of locations in the visual field as well as of more diffuse losses, it graphically illustrates where in the visual field this objective measure of progression is occurring, and it maximises the power of the analysis by using all of the available visual fields for the statistical analysis instead of, for example, just comparing field  $n$  with field one or the mean of fields one and two.

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## BOOK REVIEW

**Marketing, Managing and Contact Lenses.** . .  
By Robert A Koetting. Pp 206. £26. Oxford: Butterworth-Heinemann, 1992.

This is not in any way a clinical text. There are fewer than four pages with semitechnical information mostly concerned with problem fittings and listing several eye conditions suitable for fitting contacts.

The rest of the book concerns itself comprehensively with all aspects of running a business and looking after one's patients. Every angle is explored and the author's solutions suggested for maximising patient numbers and keeping patients, with a very strong American style.

There are good ideas which could be extracted and used but it would seem that if all the suggestions were implemented in a United Kingdom contact lens practice, the results would be 'way over the top'. Certainly it would be very different from anything yet seen on this side of the Atlantic.

Much of the book would equally apply to any business providing a service on a personal level when client's/customer's names and addresses are stored on file. General principles of business are explored in detail with particular emphasis on dealing with people on a one to one basis. Topics include advertising, staffing, computerisation, and the contact lens practitioner's profile in the community!

C I McPHERSON

All titles reviewed here are available from the BMJ Bookshop, PO Box 295, London WC1H 9TE. Prices include postage in the UK and for members of the British Forces Overseas, but overseas customers should add 15% to the value of the order for postage and packing. Payment can be made by cheque in sterling drawn on a UK bank, or by credit card (Mastercard, Visa, or American Express), stating card number, expiry date, and full name.

## NOTICES

### Systemic lupus erythematosus

An awareness campaign is being conducted by Lupus UK, under the title of Lupus Awareness Week 1993, on 10-17 April 1993. Further information: Yvette Self, Information/Education Advisor, Lupus UK, Queens Court, 9-17 Eastern Road, Romford, Essex RM1 3NG, UK. (Tel: 0708 731251; Fax: 0708 731252.)

### Singapore National Eye Centre

The Singapore National Eye Centre will hold its 1st international meeting on 16-18 April 1993 at the Shangri-la Hotel, Singapore. The theme of the meeting is 'Controversies in ophthalmology'. Further details: The Administrator, Singapore National Eye Centre, 11 Third Hospital Avenue, Singapore 0316. (Tel: (65) 227 7255; Fax: (65) 227 7290.)