CORRESPONDENCE

(*To the Editors of the* Journal of the Institute of Actuaries)

DEAR SIRS

My attention has been drawn to a basic error in my recent paper 'The Components of Mortality' and the note which followed it on 'The Variance of the Product of Two Independent Variables and its Application to an Investigation Based on Sample Data'*. The error is that I overlooked the fact that, when considering whether deviations between actual and expected deaths are reasonable, what we want to consider is not the 'variance of number of deaths' (see heading of column 13 of Tables 11 and 12 of the paper) nor the 'variance of expected deaths' (see expressions (*e*) and (*f*) of the note), but the *variance of the deviation*.

The actual deaths and the expected deaths are, in this particular problem, both subject to random variation, but vary independently. Since the data are regarded as a sample from the 'universe', the actual deaths vary, as usual, from the product of the exposed-to-risk and the 'true' mortality rate. And since the information is confined to a sample of the total data, the expected deaths also vary since the exposed-to-risk which we employ is not the same as the 'true' exposed-to-risk. In other words, besides having the usual variation in the actual deaths, we also have variation in the expected deaths due to the employment of a sample only of the data.

As the actual and the expected deaths vary independently, the variance of the deviation (between actual and expected deaths) is equal to the sum of expressions (*b*) and (*c*) of my note, and reduces to:

$$\text{Expected deaths } \{1+(k-1)\, m_x - u m_x/N\}.$$

If the last term inside the bracket is small enough to be ignored, the same approximate answer is reached as in the note, namely, that

$$\text{Variance of deviation} \doteqdot \text{expected deaths } \{1+(k-1)m_x\},$$

or, in the case of a 1% sample,

$$\text{Variance of deviation} \doteqdot \text{expected deaths} \times (1+99\, m_x).$$

Yours faithfully,

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* See *J.I.A.* 81, 105 and 190. Eds. *J.I.A.*

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