

CORRESPONDENCE

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

SIRS,

At page 35 of the current volume of the *Journal* I assumed that instantaneous d select = 0 at all ages, which is tantamount to assuming that $\mu_{[x]} = 0$. I feel that the following reference should have been given, which I had previously overlooked. In the course of a paper "On the Premiums for the Insurance of Recently Selected Lives" (1877, *J.I.A.* Vol. xx, p. 101) T. B. Sprague suggested that the force of mortality is zero at the instant the policy is effected. As Vol. xx of the *Journal* is not always at hand, and as moreover Dr Sprague's paper was printed throughout in what Mr Coutts in his Presidential Address spoke of as "a most exasperating form of phonetic spelling", it may be worth while to print the following extract from the paper orthographically: "A strict medical examination, then, greatly reduces the mortality in the years which immediately follow it, that is to say, in the early years of the insurance. The fewer the number of years which have elapsed since the medical examination, the greater will be its effect on the mortality; so that, in the first year subsequent to examination, the mortality is very light; in the first six months after examination it is still lighter in proportion; while it is an extremely rare thing for a life assured to die within three months of the medical examination. But in the application of Mr Woolhouse's formula, μ is the value of the force of mortality at the instant the policy is effected; and we have therefore to consider the effect of a medical examination on the mortality, not during the three months, nor even during the month or the week following the examination, but during the day or even the hour thereafter. We thus see that, assuming the insurance to be effected immediately after the life is passed by the doctor, all persons labouring under diseases from which it is conceivable that they should die within a day will be eliminated; and we may almost say that there is only left the chance of the life being knocked down, run over, and killed, when leaving the office of the company. The chance of this, or any other similar cause of death, is so extremely minute that we arrive at the conclusion that, at the instant a policy is effected, $\mu = 0$."

No one who joined in the subsequent discussion accepted the suggestion that $\mu_{[x]} = 0$, and in the course of his reply Dr Sprague said: "Mr Woolhouse and others doubt whether I am theoretically correct in assuming the force of mortality to be zero immediately after the medical examination. This is a point well deserving further consideration, and will no doubt receive it. At present the only argument brought against

my view is Mr Sutton's, that the force of mortality is made up of two parts, one constant and the other increasing with the age, and that my assumption practically amounts to considering each of these parts to be zero. But the above representation of the force of mortality applies only to a mixed body of lives, and not to a body consisting wholly of lives which have just passed a medical examination. If we take a body of lives, all of the same age, but otherwise mixed, good and bad, such as we find among the general population, and divide them into two groups, of which one contains the lives which would be pronounced by a competent medical examiner to be insurable at the ordinary rate, and the other contains the remaining lives, which are all more or less damaged, it would be clearly improper to suppose that the force of mortality is the same in the two groups or is capable of being represented by the same formula. It appears to me the more reasonable supposition that the instantaneous mortality of the latter group will be the same as that of the whole body, and consequently that the instantaneous rate of mortality, or the force of mortality, in the former group will be zero. Strictly speaking, the assumption that the force of mortality is zero for a body of lives that have been just medically examined only amounts to this, that none of them will die in the instant (or practically, say, in the day) after the medical examination."

Even if it be accepted that $\mu_{[x]} = 0$ and that accordingly instantaneous $d_{[x]} = 0$, there are admittedly a number of other assumptions incidental to the free-hand drawing of the solid curve lines in diagram x at page 36 of the current volume, and it was for this reason that on pages 61 and 62 I warned the student not to attach undue significance to the fact that for the moment the implication had remained unchallenged, that in any future investigation into mortality amongst insured lives it would appear feasible to eliminate all data relating to the first three years of insurance, eventually completing the select table from the ultimate by a purely graphical process, a suggestion at first sight so astounding as apparently to need no warning. In view of the enormous amount of labour which would be saved, however, I venture to suggest in the words used by Dr Sprague sixty-eight years ago that "this is a point well deserving further consideration".

I am, Sirs, etc.,

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