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### **Recognizing expected patterns of relative differences in the Whitehall cohort**

Van Rossum et al.[1] studied the extent to which the social gradient in mortality observed in the Whitehall studies applied to most causes of death, finding that it did. They also found that the social gradient persisted at older ages, but was less pronounced at older ages.

Certain points the authors made are open to question for failure to recognize the tendency whereby the rarer an outcome, the greater the relative difference between rates of experiencing it and the smaller the relative difference between rates of avoiding it.[2-7]. The authors find support for the conclusion that the social gradient observed in the Whitehall workforce could not be a function of risk factors in the fact that a gradient is also found among a low risk group. They also note that for most causes of death other than lung cancer, the gradient is steeper within the low risk group than among the total study population. But given that lower-graded employees are less likely to fall into the low risk group, lower-graded employees are also likely to have somewhat less favorable risk profiles within that group. And so long as there is some difference in risk distributions of higher- and lower-graded employees within the low risk group, one would expect to find relative differences in mortality rates within that group, and those could easily be large ones, simply because mortality is low within the low risk group. Presumably, the underlying data will show that the social gradient in survival is smaller within the low risk group than among the total study population. That does not mean that the study wrongly concluded that risk factors accounted for only about a third of the overall gradient. But it is a mistake to attach much significance to large relative differences in adverse outcomes in populations where those outcomes are rare.

The same holds for the authors' concluding observations concerning the fact that, while the Whitehall population is largely white collar, mortality differentials between the different grade levels are on the same order found in the general populations, an issue that the authors call of profound importance. That the Whitehall population shows mortality differential comparable to those in the population at large (or larger, as some have noted [8,9]) is hardly surprising precisely because it is a white collar, relatively healthy workforce. Relative differences in survival are almost certainly smaller within that workforce than in the population at large.

The study also found that for most causes of mortality the social gradient in mortality tended to be smaller among the older Whitehall population. Again, such pattern in to be expected because mortality is greater among the older population. But the relative risk of survival is sure to be lower among the young than the old, as one finds in cases where data from Whitehall analyses allow calculation of differences in survival rates. Tables in Marmot and Shipley[10], for example, allow demonstration that, while relative differences in mortality according to occupation type or car ownership are greater among

the younger workforce, relative differences in survival are greater among the older workforce. Table 1 from Marang-van de Mheen et al. [11] allows demonstration of the same pattern.

Failing to appreciate the near inevitability of the decline in relative differences in mortality with age, the authors offered three possible explanations for that decline. First, they suggested that the practical importance of employment grade might be diminished among retired employees. This is a plausible point and it is possible that risk distributions of higher- and lower-graded employees might therefore be more similar among retired employees than active ones – thereby enhancing the effect of the tendency for relative mortality differences to be smaller among the older subjects (while mitigating the tendency for relative survival differences to be larger among the older subjects). It is also possible, however, that the cumulative effect of the factors underlying the gradient caused the distributions to differ more among the older than the younger subjects – though not enough to outweigh the statistical tendency for relative differences in mortality to be smaller where mortality is greater. Chandola et al.[12] recently found that differences in self-assessed health in the Whitehall cohort, as measured by differences in average SF-36 scores, increased with age. While there are questions as to whether the methodology employed by Chandola et al. suffers from the same problems as binary variables with respect to identifying changes in differences between groups that are not solely a consequence of changing prevalence,[13] the conclusion the authors reached seems probably to be correct.

Second, the authors suggested that selective removal of sick people would cause the older population to be relatively healthy (though they express doubt that it had much impact). It is possible that the higher mortality rates of the lower-graded employees than the higher-graded employees at younger ages would tend to diminish the difference in the risk distributions of lower- and higher-graded employees at older ages. Whether or not that is the case, however, to the extent that the selectivity leads to a generally healthier older population, such factor, by reducing overall mortality among the older population, would tend to increase the relative difference in mortality in that population rather than reduce it (though it would tend to reduce the relative difference in survival).

Third, the authors suggested that the declining gradient may be related to the fact that inequalities are widening in recent decades and that in the future inequalities would increase among the old. Apparently the underlying thought was that the widening inequality among the young soon would be observed among the old. Yet, with declining mortality among both the old and the young, relative differences in mortality have increased among the old as well as the young. To the extent that the greater health enjoyed by the young (as reflected in the decline in mortality among the young) leads to even greater decline in mortality in the future among the old, we should indeed see increases in relative differences in mortality (and declining differences in survival) among the old. But neither the mechanisms underlying such patterns nor the implications of those patterns are exactly what the authors envision.

In any case, even if some of the authors' hypotheses as to ways certain factors might contribute to the decline in the social gradient with age are sound, it is unlikely that the identified factors are nearly as important as the overlooked factor – that the social gradient, as measured by relative differences in mortality, will be smaller among the older population simply because mortality is greater there and even if, in fact, the risk distributions of higher- and lower-graded employees differ more among the older population than the younger population.

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