Notes and miscellanea

Hanford radiation study

A note on “Hanford radiation study III: a cohort study of the cancer risks from radiation to workers at Hanford (1944–77 deaths) by the method of regression models in life tables.”

Mole\(^1\) has raised the important question of the healthy worker effect (HWE) in connection with the Hanford study, in particular the observation made by Gilbert and Marks\(^2\) and confirmed by Darby and Reissland\(^3\) that the SMRs for cancer and for all causes were significantly less than 100. He points out that in attributing the difference for cancer to inefficient rejection of cancer-prone workers in pre-employment checks, Kneale \textit{et al}\(^4\) embraced the conclusion that it is possible to identify those prone to cancer up to 20 years before diagnosis. In reply, Kneale and Stewart\(^5\) say that they have “no particular theory about how the HWE exerts its influence.” It should, however, be pointed out that the HWE has not been observed as such, rather it has been proposed as an explanation for the reduced SMR commonly observed in populations who have been selected for employment. It seems a reasonable explanation for some causes of death but not for cancer except for the first few years after selection.

Fox and Collier\(^6\) discussed the problem in some detail in the context of a survey of vinyl chloride workers. In this survey the SMR for all causes is significantly less than 100 but, except for deaths within five years of entering the industry, the SMRs for all cancers are not significantly different from 100. A related effect, the survivor effect, which selects for healthy workers because of their long service in the industry does show an influence on cancer, but if both past and present workers are in the survey, as is the case for the Hanford survey, then no net effect should be observed.

In a survey of women employed as instrument dial luminisers in the second world war\(^7\) an SMR of 79 for all causes was observed for deaths between 1961 and 1978. Since the occupation virtually ceased in the late 1950s and the numbers working later than say 1960 are very small it is clear that if the HWE is the explanation of such reduced SMRs the selection must be a powerful influence indeed. It is also notable that the SMR for all cancers was 108 in the same population, but when mortality from breast cancer was excluded (there was a significant excess of deaths from this cause observed in the population) the SMR was reduced to 91, significantly different from 100.

In fact Darby and Reissland\(^3\) are sceptical of attributing to the HWE all the deficit in deaths observed at Hanford, drawing attention to the possibility of incomplete tracing of deaths. Since death notification in the luminiser survey was received through the National Health Service Central Register, any significant underrecording of deaths in that instance is unlikely.

Perhaps the wider implication of these and other observations made by Mole\(^1\) concerning certification of death is for the scientific validity of surveys of occupational groups, particularly those in industries concerned with radiation such as the Hanford survey. The concern in radiological protection is now less with identifying gross hazards from radiation than with refining risk estimates. These have largely been obtained from populations exposed to doses and dose rates much higher than those experienced in industry over the past several decades. The problem is how they should be applied at the present occupational exposure levels. Because of legislation that effectively controls exposure of individuals to levels only a few times that from natural background and possibly less than that from medical uses of radiation, the “signal to noise ratio” will inevitably be small. Compounding this with the epidemiological problems of large and medically supervised working populations—for example, selective or more complete diagnosis of certain diseases and the possible HWE—is the sure recipe for endless controversy such as surrounds the Hanford survey. Such surveys perform the useful function of assuring the work force that the occupation under study carries with it no significantly great hazard, but I would contend that they do not, at present, serve a useful purpose in refining risk estimates except by placing an upper limit on risk. The present need is for a better understanding of the mechanisms by which cancer is induced in man by radiation so that the epidemiology of populations exposed to higher doses and dose rates may be more confidently interpreted.

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\textbf{References}

Hanford radiation study.

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