LETTERS TO THE EDITOR

Response to 'More on the risk of cancer among nuclear workers'

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Response to ‘More on the risk of cancer among nuclear workers’

In his Editorial to the March issue of this journal (Wakeford 2009), Dr Wakeford summarises the findings of the third analysis of the data from the UK National Registry for Radiation Workers, NRRW-3 (Muirhead et al 2009). This analysis marks a major step forward from the second analysis published ten years previously (Muirhead et al 1999) as the size of the cohort has risen to nearly 175,000 workers and the period of study extended by nearly ten years. It also has the advantage over the 15-nation IARC study in that workers who had been monitored for exposure to internal emitters or who might have received significant doses of neutrons were not excluded from the analysis. Wakeford therefore concludes that these findings represent an important milestone in our understanding of the risks posed by low doses and low dose-rates of radiation.

It is impossible to disagree with the general tone of Wakeford’s comments. However there is one key point on which there could well be dissension. He writes: ‘The findings of NRRW-3 add to the scientific evidence that low doses and/or low dose-rates of radiation do indeed increase the risk of cancer, albeit that the increased risk is small...but the study should give pause for thought among those who argue for a threshold dose (or even for a hormetic effect of low doses).’ It is therefore instructive to examine the data carefully to see whether this comment is really justified.

The new analysis confirms the findings of the previous one that the standardised mortality ratio (SMR) was a little over 80% for workers in the National Registry. This fact, following common practice, is attributed to the ‘healthy worker effect’. However, the evidence against this concept can be found in the paper by Berrington and her colleagues (Berrington et al 2001), which has already been discussed at some length by the present writer in this journal (Simmons 2004). Briefly, they compared the SMRs of radiologists with three different groups of males: (i) the general population, (ii) those in social class I, (iii) other medical practitioners. Causes of death were broken down into three categories: (a) all causes, (b) all cancers, (c) all non-cancers. For all three groups the SMR for those who first registered with a radiological society after 1920 was very much less than 100 for deaths from all causes and deaths from non-cancers. Looking specifically at deaths from cancers, the SMR for these radiologists in comparison with group (ii) males was 82; only in comparison with group (iii) males did it reach 104. This value was largely driven by those who first registered in the period 1921–35 when they could well have been receiving doses of the order of 1Gy/year (Braestrup 1958). The idea that a ‘healthy worker effect’ exists in this context surely cannot be considered seriously; a similar point was made in a letter (Daunt 2002) which commented on these results. Another letter (Cameron 2002) suggested that they demonstrate a highly beneficial effect of radiation at moderate doses, although a subsequent letter by the original authors (Doll et al 2005) challenged these views. There should therefore be no reason to invoke the ‘healthy worker effect’ to explain the data in NRRW-3.

Let us now consider the trends in mortality with external radiation dose (Muirhead et al 2009). Figure 1 of that paper shows the relative risk of mortality from leukaemia as a function of dose. Of the seven points plotted, five are effectively on the RR = 1 line and only two significantly above. Their figure 2 shows the RR for mortality for all malignant neoplasms...
excluding leukaemia, in which four points appear to be above the unit line. If, however, we
look at their figure 3, which strips out the contribution of lung and pleural cancer, we see that
now only the two points at the very highest doses lie significantly above the unit line.

These plots are very similar to the corresponding ones in the earlier analysis (Muirhead et al 1999),
but the new data do at least remove the anomaly seen in the previous ones whereby
the RR at the highest doses are significantly less than unity.

A different way of looking at these results can be found in supplementary table S2 of the
paper, which gives the trend for mortality with dose by cause of death. Taking first all malignant
neoplasms excluding lung, pleura and leukaemia, the ratio of the observed/expected number of
deaths (O/E) does not significantly exceed unity for doses below 200mSv. The same is true for
leukaemia if chronic lymphatic leukaemia is excluded. Trends of ERR/Sv vary enormously
from one organ to another, including some negative values. Even with the much larger number
of workers considered in the new analysis, confidence intervals are very wide in many cases,
a fact which should make one wary of being too dogmatic about interpreting these results.

The data presented by Muirhead and his colleagues are consistent with the analysis carried
out by Heidenreich et al based on a study of the atomic bomb survivors (Heidenreich et al
1997). They plotted O/E ratios both for mortality and for incidence as a function of ‘class’.
Each class consisted of a range of doses, but without significant overlap of doses between
classes. Their plots clearly showed that the lowest class for which a significant increase in
both mortality and incidence could be demonstrated was in the range 200–500 mSv.

The considerations outlined above should surely cast a serious doubt over Dr Wakeford’s
assertion that the findings of NRRW-3 add to the scientific evidence that low doses and/or
low dose-rates do indeed increase the risk of cancer. In reality, they could equally well give
pause for thought among those who argue against a threshold. The more contentious issue
of a hormetic effect would take us into extended arguments, and will not be pursued here.

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