British Journal of Cancer (2012) 107, 1660–1661

www.bjcancer.com

Letter to the Editor

Ionising radiation and occupational cancer in Britain

CR Muirhead*,[1] and R Haylock[2]

[1]Institute of Health and Society, Newcastle University, Baddiley-Clark Building, Richardson Road, Newcastle upon Tyne NE2 4AX, UK; [2]Epidemiology Department, Centre for Radiation Chemical and Environmental Hazards, Health Protection Agency, Chilton, Didcot, Oxon OX11 0RQ, UK

British Journal of Cancer (2012) **107,** 1660–1661. doi:10.1038/bjc.2012.446 www.bjcancer.com
Published online 2 October 2012

Sir,

We were very interested in the recent supplement of the journal on the topic of occupational cancer in Britain (volume 107, supplement 1). The authors of these papers are to be congratulated for having undertaken such a large and ambitious project. However, in the light of recent developments and some methodological issues, we have concerns about whether the impact of occupational exposure to ionising radiation (IR) has been assessed adequately.

List of cancer sites: Risks from IR exposure were calculated for leukaemia (excluding CLL), bone, liver and thyroid cancers, on the basis that the International Agency for Research on Cancer (IARC) had previously found sufficient evidence that IR is a cause of these cancers. However, a recent monograph from IARC has found sufficient evidence that IR is a cause of a wider range of cancers, such as those of the salivary gland, oesophagus, stomach, colon, skin (basal cell carcinoma), female breast, urinary bladder, kidney, brain and central nervous system (IARC, 2012). Although the full monograph was published only this year, a summary of the IARC Working Group's assessments was published in the open literature shortly after the Group met in 2009 (El Ghissassi *et al*, 2009). Furthermore, the report by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 2008) from which the authors extracted the IR risk estimates also contained risk estimates for many of the additional cancer sites identified in the recent IARC review. Consequently, as of 2009, there was a clear basis for extending the IR risk assessment to a much wider range of cancer sites. (As an aside, a more recent report has estimated IR risks for solid cancers, specifically for the UK population (AGIR, 2011); this might be of use in any future assessment of occupational cancer in Britain.)

Review of the literature: For those cancers for which risks from IR were assessed (Brown *et al*, 2012a, b; Brown and Rushton, 2012), the reviews of the relevant epidemiological literature were incomplete and tended to focus on SMRs rather than on trends in cancer risk with radiation exposure. The aforementioned UNSCEAR report provided a much more comprehensive review of the literature and should have been cited further, rather than solely for risk estimates. We are also surprised that, in view of the Health and Safety Executive (HSE) involvement in this project, no reference was made to the third analysis of the National Registry for Radiation Workers (NRRW), which was supported by the HSE and published in this journal in 2009 (Muirhead *et al*, 2009a). This analysis provides the most precise estimates to date of mortality and cancer risks following occupational radiation exposure, and strengthened the evidence for raised risks from these exposures.

Calculation of IR risks: Hutchings and Rushton (2012) have described how, to assess cancer risks for the target year of 2005, they considered risk exposure periods of 1956–1995 for solid tumours and of 1986–2005 for haematopoietic malignancies. However, in the case of IR, the UNSCEAR model for leukaemia (other than CLL) predicts a raised risk more than 20 years after exposure (UNSCEAR, 2008), so suggesting that exposures before 1985 should also have been taken into account. Furthermore, the basis of the IR exposures (other than those to aircrew) used here appears to be a report by the Central Index of Dose Information (CIDI) covering occupational radiation doses during the period 1990–1996 (HSE, 1998), together with more recent CIDI data. In a more detailed report on their methodology (HSE, 2012), Hutchings and Rushton explained that they estimated an average annual dose of 1.4 mSv among workers with an annual recorded dose of at least 0.1 mSv during 1986–2005 and – when assessing annual doses during 1956–1995 – assumed that the annual collective dose during 1990 and the number of exposed workers were the same as the corresponding values during the years 1956–1989. However, it is well known that average occupational doses from IR in the United Kingdom fell during the second part of the 20th century. For example, Table 2.12 in Muirhead *et al* (2009b) reported average annual doses of 4 mSv or more in the NRRW during the period 1955–1974 compared with 1.6 mSv in 1985–1989 and 0.9 mSv in 1990–1994. Regrettably, the impact of these past exposures does not appear to have been taken into account in the calculation of cancer risks. This may well explain why very few cancer cases were attributed to IR in this project, whereas the third NRRW analysis found an association between IR exposure and cancer among the UK radiation workers (Muirhead *et al*, 2009a, b).

We should stress that had full account been taken of the range of cancers that can be induced by IR and of the impact of past occupational exposures to IR, the number of cancers attributed to these exposures would still have been small. Furthermore, cancer risks from occupational IR will likely fall in the future, reflecting the deceases in IR doses in recent decades. However, we believe that this project has underestimated the cancer risk at the start of the 21st century due to occupational IR exposure.

*Correspondence: Dr CR Muirhead;
E-mail: colin.muirhead@newcastle.ac.uk
Published online 2 October 2012

REFERENCES

AGIR (2011) Risk of solid cancers following radiation exposure: estimates for the UK population. Report of the independent Advisory Group on Ionising Radiation. *Doc HPA RCE-19* 1–258. http://www.hpa.org.uk/

Brown T, Darnton A, Fortunato L, Rushton L (2012a) Occupational cancer in Britain – respiratory cancer sites: larynx, lung and mesothelioma. *Br J Cancer* **107**(Suppl 1): S56–S70

Brown T, Rushton L (2012) Occupational cancer in Britain – haematopoietic malignancies: leukaemia, multiple myeloma, non-Hodgkins lymphoma. *Br J Cancer* **107**(Suppl 1): S41–S48

Brown T, Young C, Rushton L (2012b) Occupational cancer in Britain – remaining cancer sites: brain, bone, soft tissue sarcoma and thyroid. *Br J Cancer* **107**(Suppl 1): S85–S91

El Ghissassi F, Baan R, Straif K, Grosse Y, Secretan B, Bouvard V, Benbrahim-Tallaa L, Guha N, Freeman C, Galichet L, Cogliano V (2009) A review of human carcinogens – part D: radiation. *Lancet Oncol* **10**: 751–752

HSE (1998) Occupational exposure to ionising radiation 1990–1996. Analysis of doses reported to the Health and Safety Executive's Central Index of Dose Information. Health and Safety Executive. http://www.hse.gov.uk/pubns/cidi2.pdf

HSE (2012) The burden of occupational cancer in Great Britain: Technical report: Methodology: RR927. Health and Safety Executive. http://www.hse.gov.uk/research/

Hutchings SJ, Rushton L (2012) Occupational cancer in Britain – statistical methodology. *Br J Cancer* **107**(Suppl 1): S8–S17

IARC (2012) A review of human carcinogens: radiation. *IARC Monogr Eval Carcinog Risks Hum* **100D**: 1–352. http://monographs.iarc.fr/ENG/Monographs/vol100D/index.php

Muirhead CR, O'Hagan JA, Haylock RGE, Phillipson MA, Willcock T, Berridge GLC, Zhang W (2009a) Mortality and cancer incidence following occupational radiation exposure: third analysis of the National Registry for Radiation Workers. *Br J Cancer* **100**: 206–212

Muirhead CR, O'Hagan JA, Haylock RGE, Phillipson MA, Willcock T, Berridge GLC, Zhang W (2009b) Third Analysis of the National Registry for Radiation Workers: Occupational Exposure to Ionising Radiation in Relation to Mortality and Cancer Incidence. Health Protection Agency, HPA-RPD-062. http://www.hpa.org.uk/

United Nations Scientific Committee on the Effects of Atomic Radiation (2008) *Effects of Ionising Radiation: UNSCEAR 2006*. Vol. 1, Report to the General Assembly, Annex A. http://www.unscear.org/