

In studying the association between radiation and AITD, it is necessary to analyze possible dose-response relationships using only the most objective diagnostic criteria for the end point of interest. Although we found no dose-response relationship between prevalence of AITD among atomic bomb survivors and mean or median thyroid doses (external exposure) of 0.449Sv and 0.087Sv, respectively, further study and analysis of dose-response relationships for other exposed cohorts is certainly needed.

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## Radiation Exposure and Thyroid Cancer

**To the Editor:** In his Editorial, Dr Boice<sup>1</sup> draws what we believe to be unsupportable conclusions about the relation between iodine 131 and thyroid disease. He states that the evidence for iodine 131 and thyroid cancer from the Chernobyl nuclear disaster is not straightforward due to the presence of other iodine isotopes that could have contributed to excess risk, yet there is strong evidence that isotopes other than iodine 131 delivered at most only a few percent of the total dose to the thyroid of exposed persons.<sup>2</sup> Boice alludes to possible interactions between radioiodine exposure and iodine deficiency but notes no evidence that iodine deficiency and potassium iodide act independently in modifying iodine 131-related thyroid cancer risk.<sup>2</sup>

Of the Hanford Thyroid Disease Study (HTDS),<sup>3</sup> Boice states that HTDS results indicate that childhood exposures to prolonged releases of pure iodine 131 are associated with a risk of radiation-induced thyroid cancer that is an order of magnitude lower than that reported for exposures to iodine 131 mixed with other short-lived radioiodines or for exposures to external sources of radiation. He also notes that the dose-response relationship reported for iodine 131 exposures from the Hanford nuclear site is 11-fold lower than that reported for children exposed to an acute dose of high-energy gamma radiation or to multiple (fractionated) treat-

ments using x-rays. We believe there are more plausible explanations for the HTDS findings.

The absence of statistically significant dose-response relationships and the low estimates of excess risk reported for the HTDS can be explained by the high uncertainty associated with the use of mathematical models to reconstruct iodine 131 releases, environmental transport, and thyroid doses for individual cohort members. This uncertainty arises from unknown degrees of systematic overestimation of dose, as well as random measurement errors. Although there have been published attempts to account for some of these uncertainties,<sup>4,5</sup> we regard these attempts as inadequate, in part because they addressed only certain error components and not others (eg, Berksonian but not classical or systematic errors). Incomplete accounting for the full effect of these problems would result in an overestimation of statistical power and inappropriately narrow interval estimates for the excess risk of disease.<sup>6</sup> It is our expectation that increasing the width of the uncertainty interval will demonstrate that the HTDS results are consistent with recent conclusions of the National Research Council BEIR VII Committee regarding radiation exposures and risk of thyroid cancer.<sup>7</sup>

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**In Reply:** Dr Hoffman and colleagues suggest that uncertainties in dose estimation were not adequately accounted for in the HTDS<sup>1</sup> and that the failure to detect increased risk of thyroid disease may be due to methodologic problems. They also question my summary of the evidence on the relationship between iodine 131 and thyroid disease, and the contribution of shorter-lived radioiodines to thyroid dose following the Chernobyl disaster.

Regarding the HTDS, Hoffman et al provide no supporting data to indicate that taking uncertainty measures into account would change the observed absence of radiation effect to an adverse relation. These issues have been well addressed in the peer-reviewed publications that they cited.

My interpretations of the evidence were consistent with those of other reviews. Contrary to the speculations of Hoffman et al, the National Research Council BEIR VII Committee states that “although the precise quantitative relationship between radiation dose from iodine 131 and development of thyroid neoplasia remains uncertain at this time, recent findings from studies around Chernobyl and Hanford provide important quantitative estimates of risk as a function of dose.”<sup>2</sup> Further, another National Research Council committee recently concluded that “the relative biological effectiveness of iodine 131 vs x-rays is still an open question.”<sup>3</sup> The relationship between iodine 131 and thyroid disease remains uncertain for a number of reasons, including the absence of an association between iodine 131 and thyroid cancer in studies of patients administered known doses of iodine 131 for diagnostic purposes, including more than 6000 children,<sup>4,5</sup> and the absence of an excess of any thyroid disease in the HTDS.<sup>1</sup>

The interpretation of the iodine 131 risk data from the Chernobyl studies indeed is not straightforward—not only because of the possible contribution of short-lived radioiodines, which have been reported to be as high as 30% to 50% among individuals evacuated from contaminated areas,<sup>6</sup> but also because of the effects of screening, dietary recall, and diets deficient in stable iodine.<sup>5</sup> Estimates of risk from one population may not be valid for other populations if characteristics differ considerably.<sup>3</sup>

The areas of highest exposure from Chernobyl fallout were also areas of dietary iodine deficiency and endemic goiter. Iodine deficiency increased the risk of iodine 131-related thyroid cancer by 3-fold in the most recent study.<sup>7</sup> Remarkably, potassium iodine supplements decreased the risk of iodine 131-related thyroid cancer when administered months after radioiodines had decayed and were no longer irradiating the thyroid. Restoring normal levels of stable iodine to the diet in areas of endemic goiter might have quelled the overactive thyroid gland so that any underlying damage from prior radioiodine exposures did not progress to cancer. It is plausible that the higher levels of thyroxine associated with iodine supplements decreased the level of thyroid stimulation (and subsequent cancer risk) by indirect inhibition of thyrotropin secretion. Such

observations, whether acting independently or not, add caution to interpreting the radiation risk coefficients reported from the Chernobyl studies.

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## Mental Health After Deployment to Iraq or Afghanistan

**To the Editor:** Dr Hoge and colleagues<sup>1</sup> have drawn attention to the potential struggles faced by US military personnel currently returning from war. We are concerned, however, that the data in this article will be erroneously interpreted as evidence for an epidemic of postdeployment psychiatric problems. The findings are actually reassuring with respect to psychiatric morbidity in the US military.

For example, the study reported that 1214 (0.5%) of 222 620 individuals serving in Operation Iraqi Freedom (OIF) were hospitalized for a mental disorder in the first year after deployment. This is a remarkably low prevalence, given that in peacetime approximately 1.4% of newly recruited personnel are hospitalized with a psychiatric diagnosis during their first year of service.<sup>2</sup> Although this difference may not be statistically significant, it is possible that the 1-year likelihood of a recruit incurring a psychiatric hospitalization during peacetime is greater than the likelihood of a service member being hospitalized for a war-related psychiatric disorder. Similarly, Hoge et al reported that 17 249 (7.6%) of 222 620 OIF veterans received an outpatient psychiatric diagnosis in the year following combat. This is not much higher than the 6% of military personnel who received an outpatient psychiatric diagnosis annually during the 1990s.<sup>3</sup> The difference might actually be due to an increased level of surveillance rather than combat exposure.