

An Unexpected Mortality Increase in the US Follows Arrival of Radioactive Plume from Fukushima, Is there a Correlation?

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The multiple nuclear meltdowns at the Fukushima plants beginning on March 11, 2011, are releasing large amounts of airborne radioactivity that has spread throughout Japan and to other nations; thus, studies of contamination and health hazards are merited. In the United States, Fukushima fallout arrived just six days after the earthquake, tsunami, and meltdowns. Some samples of radioactivity in precipitation, air, water, and milk, taken by the U.S. government, showed levels hundreds of times above normal; however, the small number of samples prohibits any credible analysis of temporal trends and spatial comparisons.

U.S. health officials report weekly deaths by age in 122 cities, about 25 to 35 percent of the national total. Deaths rose 4.46 percent from 2010 to 2011 in the 14 weeks after the arrival of Japanese fallout, compared with a 2.34 percent increase in the prior 14 weeks. The number of infant deaths after Fukushima rose 1.80 percent, compared with a previous 8.37 percent decrease. Projecting these figures for the entire United States yields 13,983 total deaths and 822 infant deaths in excess of the expected.

These preliminary data need to be followed up, especially in the light of similar preliminary U.S. mortality findings for the four months after Chernobyl fallout arrived in 1986, which approximated final figures. We recently reported on an unusual rise in infant deaths in the northwestern United States for the 10-week period following the arrival of the airborne radioactive plume from the meltdowns at the Fukushima plants in northern Japan. This result suggested that radiation from Japan may have harmed Americans, thus meriting more research.

This result suggested that radiation from Japan may have harmed Americans, thus meriting more research. We noted in the report that the results were preliminary, and the importance of updating the analysis as more health status data become available (1). Shortly after the report was issued, officials from British Columbia, Canada, proximate to the northwestern United States, announced that 21 residents had died of sudden infant death syndrome (SIDS) in the first half of 2011, compared with 16 SIDS deaths in all of the prior year. Moreover, the number of deaths from SIDS rose from 1 to 10 in the months of March, April, May, and June 2011, after Fukushima fallout arrived, compared with the same period in 2010 (2).

While officials could not offer any explanation for the abrupt increase, it coincides with our

findings in the Pacific Northwest. Any comparison of potential effects of radiation exposure must attempt to examine the dose-response relationship of the exposure of a population. In the United States, the principal source of dose data (i.e., environmental radiation levels) is the U.S. Environmental Protection Agency (EPA).

Health data are the responsibility of the U.S. Centers for Disease Control and Prevention (CDC), which provides weekly reports on mortality in 122 U.S. cities. These are preliminary data, but are the most useful at a date so soon after an event such as Fukushima. The goal of this report is to evaluate any potential changes in U.S. mortality resulting from exposure to the Fukushima plume, using EPA and CDC data.

BACKGROUND: POST-CHERNOBYL HEALTH TRENDS

A quarter of a century before the Fukushima disasters, the meltdown at Chernobyl and the presence of environmental fallout presented a similar challenge for researchers to assess any adverse health effects. The discussion that began after the April 26, 1986, meltdown is still very much a current one, with varying estimates. A recent conference concluded that 9,000 persons worldwide survived with or died from cancer (3), while a compendium of more than 5,000 research papers put the excess death toll (from cancer and all other causes) at 985,000 (4). In the United States, Chernobyl fallout was detected in the environment just nine days after the meltdown. Gould and Sternglass (5) used EPA measurements of environmental radiation post-Chernobyl (6) and found elevated levels of radioactivity in air, water, and milk. For example, EPA data indicate that from May 13 to June 23, 1986, U.S. milk had 5.6 and 3.6 times more iodine-131 and cesium-137 than were recorded in May-June of 1985 (see Appendix Table 1, p. 60).

In some cities, especially those in the harder-hit Pacific Northwest, average concentrations were as much as 28 times the norms, while some individual samples were much higher. Gould and Sternglass (5) also studied preliminary mortality data, to analyze any potential impact from fallout. Using a 10 percent sample of all U.S. death certificates, they found that during the four months after Chernobyl (May-August 1986), total deaths in the United States rose 6.0 percent over the similar period in 1985 (see Appendix Table 2) (7; estimated deaths based on a 10% sample of death certificates, minus the New England states, for which data were incomplete at the time).

Eventually, final figures showed an increase of 2.3 percent, which exceeded the 0.2 percent decline in the first four months of the year (8). The number of excess deaths, or the difference between the actual and expected death totals, is 16,573.

To date, the cause of this unusual pattern remains unknown, and no research testing hypotheses for causes other than Chernobyl has been published. This difference has a very high degree of statistical significance; there is a less than 1 in 109 probability that it occurred by random chance. The change in deaths for infants was also analyzed. Preliminary data showed an increase of 3.1 percent in U.S. infant deaths in the first four months after Chernobyl, 1985 versus 1986.

The final increase was 0.1 percent, compared with a 2.3 percent decline in the four months before Chernobyl. The 1985-1986 differences in infant death rates were -2.9 percent (January-April) and +0.4 percent (May-August).

These gaps amounted to excess infant deaths of 306 and 424, and differences were

significant at $p < 0.08$ and $p < 0.055$. The stillbirth, neonatal, and prenatal mortality increased in England and Wales within 11 months after Chernobyl's initial release (9, 10), and in Germany (11). In two Ukrainian districts with increased levels of cesium-137 ground contamination, there was a significant increase in stillbirths (12).

U.S. publications offered evidence that Americans may have suffered harm from Chernobyl, especially damage to fetuses and infants. Reports covered elevated levels of various radiation-related disorders, including newborn hypothyroidism (13), infant leukemia (14), and thyroid cancer among children (15). Gould and Sternglass (5) showed that trends using preliminary data were rough approximations of the final data. Because of the lengthy delay in generating final statistics—2011 data will probably not be published on the CDC website until 2014—we believe that analyzing preliminary health data at this time is a useful exercise that can approximate final mortality patterns and help guide future research on the effects of fallout from the Fukushima meltdowns.

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RESULTS U.S.

Total Deaths

During weeks 12 to 25, total deaths in 119 U.S. cities increased from 148,395 (2010) to 155,015 (2011), or 4.46 percent. This was nearly double the 2.34 percent rise in total deaths (142,006 to 145,324) in 104 cities for the prior 14 weeks, significant at $p < 0.000001$ (Table 2). This difference between actual and expected changes of +2.12 percentage points (+4.46% - 2.34%) translates to 3,286 "excess" deaths ($155,015 \times 0.0212$) nationwide.

Assuming a total of 2,450,000 U.S. deaths will occur in 2011 (47,115 per week), then 23.5 percent of deaths are reported ($155,015/14 = 11,073$, or 23.5% of 47,115).

Dividing 3,286 by 23.5 percent yields a projected 13,983 excess U.S. deaths in weeks 12 to 25 of 2011.

After March 19, 2011, total deaths were higher than a year earlier in 11 of the 14 weeks, with a 7.5 percent or greater increase in four of the weeks.

The greatest rise occurred in weeks 12 to 20, with a 5.37 percent increase (96,900 to 102,108). In weeks 21 to 25, the increase was a considerably lower 2.74 percent (51,495 to 52,907).

Whether this pattern will continue into the future or is temporary is not yet known.

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