

Depleted Uranium and the Incidence of Leukemia in Italian Soldiers in Kosovo

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March 29, 2002

Lately, there have been a number of articles regarding the number of soldiers in Kosovo who have been diagnosed with leukemia. However, despite searching through the wire services, broadcast transcripts and newspapers, I have been unable to find a statistical analysis which answers whether the rate of leukemia for these soldiers is abnormally high or not. With some basic information, the matter is a simple statistical problem, and thus, I have tried to answer the issue with the best information I was able to find. The following provides the details in my answer. First are the facts and then are my calculations.

Facts:

- Men in the U.S. are diagnosed with leukemia at a rate of 8.3 per 100,000 individuals per year according to the American Cancer Society.¹
- The number of international soldiers in Kosovo is approximately 40,000-45,000.²
- The bombing campaign ended in June of 1999. Thus, the maximum amount of time an international soldier would have spent in Kosovo would be 1.5 years (July 1999 - January 2001).
- A UPI article “Depleted Uranium: France Denies Leukemia Link,” January 15, 2001) reports that there have been 22 cases of leukemia for soldiers who have been in Kosovo.³

¹This may in fact be an overestimate as the World Health Organization states that persons aged 20-45, such as those on active duty in Kosovo, are diagnosed at a rate of 5 per 100,000.

²The BBC has reported a figure of 40,000-45,000 in three different articles.

– “UN to start refugee return,” Monday, June 28, 1999,

– “Law and Order,” http://news.bbc.co.uk/hi/english/static/in_depth/europe/2000/uneasy_peace/law_order.stm

– “Nato’s incomplete victory,” Thursday, 16 March, 2000.

³The crucial excerpt from the UPI is as follows:

“Over the past few weeks, furor has been growing in Europe over the possible health risks of the uranium, following a series of reports of ill and dying soldiers who fought in the Kosovo campaign.

Problem: Are 22 cases abnormally high or can this number of cases be explained through the fact that people get leukemia any ways?

Technique: I tried to answer this by asking the question: given a randomly selected group of 45,000 men, what is the probability that there would at least 22 cases of leukemia in a year and a half.

Whether a randomly selected man is diagnosed with leukemia in a given time period is a “Bernoulli trial”⁴. Therefore, the probability that i men (out of a population of n men) are diagnosed with leukemia in a year and a half is given by the binomial distribution, $\binom{n}{i}p^i(1-p)^{n-i}$ where $n = 45,000$ and p is the probability that a randomly chosen man has a leukemia diagnosis in a year and a half (0.0001245).

Method #1: (an exact solution) The probability that there are 22 cases of leukemia in a year and half in 45,000 men (randomly selected) can be calculated by

$$1 - \sum_{i=0}^{21} \binom{n}{i} p^i (1-p)^{n-i}$$

I came up with a probability of about one in 8 million (7,966,856).

Method #2: (an approximation just to double-check) The mean and the standard deviation of the binomial distribution are np and $\sqrt{np(1-p)}$ which are approximately 5.6 cases and 2.36 cases. Therefore, 22 cases is about 6.9 standard deviations from the mean. This confirms the exact calculations which said basically that the event was extremely unlikely.

Conclusion: The probability that 45,000 randomly chosen men would get 22 cases of leukemia in 1.5 years is extremely unlikely. Therefore, with high probability, the soldiers do not constitute a randomly chosen sample, and the rate of leukemia is abnormally high enough to warrant further investigation.

Two possible Caveats:

1. At any given time in the last year and a half, I can say with some confidence that the number of international soldiers in Kosovo has been about 40,000. This does not mean that the total number of international soldiers who have been to Kosovo is 40,000. (In fact this is a lower limit.) What would be very useful would be to know the average length of stay (the tour of duty) for international soldiers in Kosovo. I wasn’t able to find this out.

The tally includes at least 18 soldiers who have died of leukemia, including seven Italians, five Belgians, two Dutch, two Spanish, a Portuguese and a Czech. More soldiers are stricken with the disease, including four in France.”

⁴The outcome is either yes or no. The trial is repeatable and independent for two randomly chosen men

2. The UPI article clearly states that the number of leukemia cases for soldiers in Kosovo is at least 22. It would be important to make sure that this figure is specifically for those in Kosovo and not all international soldiers who have been to the Balkans. I wasn't able to get any further numbers despite using lexis nexis to look through wire services, transcripts, and newspapers for the last month.

Comments

1. It is worth noting that this analysis doesn't necessarily identify depleted uranium or anything else as the cause of the leukemia. (Of course, this would be one hypothesis to investigate, and a reasonable one given the link between leukemia and radiation.) The analysis simply notes that the leukemia rates for soldiers who served in Kosovo appear highly abnormal.
2. It is also worth noting that there have been some articles⁵ published which conclude that the radioactive effects of depleted uranium in war are negligible and raise the risk of cancer only very slightly. While I sincerely hope that this is the case, I would add that these analyses are based on what we currently know about the side effects of depleted uranium, and therefore, any conclusions drawn may be based on incomplete information about the nature of this substance. That is to say, these analyses list possible ways in which exposure to depleted uranium could be unhealthy and then show for each way that the level of radiation would be too low to cause any significant hazard. My rebuttal is that there may be some yet unknown ways in which depleted uranium can cause cancers.

Lastly, I rest my conclusion on the statistical abnormality of the rate of leukemias for Italian soldiers. Unless the data is simply wrong, there is something highly unusual happening here.

⁵Steve Fetter and Frank von Hippel, "After the Dust Settles," *The Bulletin of Atomic Scientists*, November/December 1999, pg. 42-45