

## INTRODUCTION

“Cluster Busters: A Game of Disease Mystery Solving” is designed to introduce students to epidemiology, risk assessment and toxicology as they apply to disease clusters potentially induced by environmental toxins. “Cluster Busters” encourages logical thinking and problem solving and also enhances student knowledge of research techniques, statistics, and toxicology. The game has three disease cluster scenarios, which are based on actual cancer or disease cluster investigations. Details and locations of the investigations have been modified to better suit the game. References are included with each scenario.

The cases are:

1. The Case of Ms. Ima Well                      Colon Cancer
2. The Case of Dr. Wanda B. Better            Infant Lung Hemorrhage

The “Cluster Buster” format follows a common disease cluster response protocol used by many state health departments in the United States. The protocol guides students in the preliminary investigation process used to determine the validity of a disease cluster and consists of eight steps: 1. Describe the cluster; 2. Verify the cases; 3. Assess the risk; 4. Statistically analyze disease rates; 5. Examine potential exposures; 6. Determine if the disease is biologically plausible; 7. Determine the cluster significance; and 8. Report the results.

The game typically requires 3-5 hours, though it can easily be shortened or extended (refer to the “Teacher Reference Sheet” for suggestions on how to lengthen or shorten the game). In its full-length version, the game is appropriate for high school students; however, activities can be modified to work at the middle school level.

## ABOUT DISEASE CLUSTERS

Many Americans have raised concerns about exposures to unknown environmental contaminants and their potential health impacts. Reporting potential disease clusters is one avenue for citizens to voice their concerns. In fact, many of the cluster reports come from persons who are either sick themselves or have ill friends or family members (Devier et al. 1990)<sup>1</sup>. Thus, many of the reports are initiated during times when personal stress and fear are prevalent.

State health agencies receive approximately 1500 cancer cluster investigation requests per year (Greenberg and Wartenberg 1991)<sup>2</sup>. These numbers far exceed the agency's time available to conduct detailed investigations for each case and, most of the time, the reported disease cluster is not an actual cluster (i.e. the disease rate for the reported "cluster" is the same as the national average).

However, state health agencies do not want to overlook or neglect a real disease cluster. They want to be able to take appropriate action to protect the people who are directly affected and a true disease cluster can provide useful information to protect people elsewhere. To better manage the large number of cases, most agencies use a prioritization system that identifies the most serious and probable disease clusters (Greenberg and Wartenberg 1991)<sup>2</sup>. The system typically consists of several phases including a "preliminary review," "disposition of cancer inquiries," and then a full "investigation". The "preliminary review" consists of gathering and verifying information, obtaining cancer incidence and/or death rates, determining environmental risk factors, and determining biological plausibility between the risk factors and the disease. The "disposition of cancer inquiries" involves a review of all the data by a committee comprised of epidemiologists, physicians, environmental health specialists, local health officials, and a statistician. The committee ultimately decides whether the "cluster" merits an expensive, time consuming investigation (Devier et al. 1990)<sup>1</sup>.

Disease clusters are defined spatially and temporally. This means that clusters occur within a defined geographical region and within a specific time frame. The "strength" of the cluster depends on several factors including: 1) The disease rate; 2) The type of disease; and 3) The demographics of the affected population. A true cluster must have a disease rate that is statistically significantly greater than the disease rate of the general population. Of course, the larger the difference between cluster disease rate and the average disease rate the greater the certainty of a cluster. The type of disease is also an important consideration when deciding whether to investigate a cluster. For example, a general cancer cluster report (one with multiple types of cancer) typically does not merit further investigation because "cancer" is not a single illness from a single cause. Each type of cancer is unique and distinct, like tuberculosis (*Mycobacterium tuberculosis*) is very different from Legionnaire's Disease (*Legionella pneumophila*) even though both

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<sup>1</sup> Devier, J., Brownson, R., Bagby, J., Carlson, G., and Crellin, J. A public health response to cancer clusters in Missouri. *American Journal of Epidemiology* 132 Supplement (1): S23-S31, 1990.

<sup>2</sup> Greenberg, M. and Wartenberg, D. Communicating to an alarmed community about cancer clusters: A fifty state survey. *Journal of Community Health* 16 (2): 71-82, 1991.

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are bacterial infections. Also, “cancer” is very common. In fact, one in four deaths is caused by cancer (American Cancer society: <http://www.cancer.org/>). If a specific cancer type, like cancer of the pancreas, was reported as a potential cluster then the investigation would be given higher priority.

The demographics of the affected population is also used to prioritize investigations. The victims’ ages, gender, and health, employment, and residential histories are all taken into account. Using cancer as an example, a cluster that occurs in a young population will be given higher priority. This is because cancer is rare in young people, especially children. Health and employment histories of the cancer victims are also important. For example, if a lung cancer cluster was reported for a specific workplace, but most of the affected employees smoked, you cannot, with any confidence, determine if an agent in the workplace or the cigarettes caused the cancer.

Determining the legitimacy of a disease cluster can be a very challenging task. Rarely is anything in these types of investigations clear-cut, especially with cancer. Because cancers generally take so long to develop, epidemiologists have to identify an exposure that occurred 10-20 years ago. Even if a potential exposure is identified, health scientists may not know if the person’s affliction is a direct result of a specific chemical. This is because there are only a limited number of toxicological studies compared to the number of chemicals in this world.

For more information on disease clusters you can refer to these websites:

#### Epidemiology: The Science of People - Subsection: Cancer Clusters

By Martha L. Walter and Michael A. Kamrin and Delores J.Katz

Posted Apr. 23, 1996 / Revised Feb. 7, 2000/Accessed July 30, 2002

Sources: A Journalist's Handbook on Environmental Risk Assessment

[http://www.facsnet.org/tools/ref\\_tutor/risk/ch4epidem.php3#clusters](http://www.facsnet.org/tools/ref_tutor/risk/ch4epidem.php3#clusters)

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Accessed July 30, 2002

[http://www.iet.msu.edu/Tox\\_for\\_Public/epidem.htm#top](http://www.iet.msu.edu/Tox_for_Public/epidem.htm#top)