

Camp Lejeune Health Studies

Mortality study of civilian employees exposed to contaminated drinking water at USMC Base Camp Lejeune: A retrospective cohort study

Study Purpose

The purpose of the study was to determine whether potential exposures to the drinking water contaminants at Camp Lejeune are associated with increased risk of death from specific cancers and other chronic diseases among those who were employed at the base. The contaminants included trichloroethylene (TCE), tetrachloroethylene (also known as perchloroethylene or PCE), benzene, and two contaminants that are formed when TCE or PCE degrade in ground water: 1,2-dichloroethylene and vinyl chloride.

What Was Studied

The study evaluated specific causes of death in 4,647 full-time workers who were employed at Camp Lejeune during 1973-1985¹. We also evaluated a comparison group of 4,690 full-time workers who were employed at Camp Pendleton during 1973-1985 but were not employed at Camp Lejeune during this period. The Camp Pendleton workers were not exposed to contaminated drinking water.

Cause of death data from 1979-2008 were used to study the Camp Lejeune and Camp Pendleton cohorts. Information on causes of death was obtained from the National Death Index (NDI) of the National Center for Health Statistics. The study included all underlying causes of death that other studies have shown to be associated with one or more of the chemicals found in the drinking water at Camp Lejeune. Causes of death were selected based on literature reviews conducted by the U.S. Environmental Protection Agency (EPA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), and Agency for Toxic Substances and Disease Registry (ATSDR).

The causes of death that were studied include:

- Amyotrophic lateral sclerosis (ALS)
- Cancers of the bladder, brain, cervix, colon, esophagus, female breast, kidney, larynx, liver, lung, oral cavity, pancreas, prostate, rectum, and soft tissue
- Hematopoietic cancers
 - Hodgkin's Lymphoma
 - Leukemias
 - Multiple myeloma
 - Non-Hodgkin's lymphoma
- Non-cancerous kidney diseases
- Non-cancerous liver diseases
- Multiple sclerosis
- Parkinson's disease

¹Continuous quarterly information on DOD employment from the Defense Manpower Data Center began with the second quarter of 1973. The most heavily contaminated wells at Camp Lejeune were shut down in 1985.

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The study also included three causes of death known to be caused by cigarette smoking but not known to be associated with the drinking water contaminants: cardiovascular disease, chronic obstructive pulmonary disease (COPD), and stomach cancer. These causes of death were included to assess the possible impact of smoking on the findings because we did not have information on smoking status for study subjects.

Features of this Study

The study looked at the Camp Lejeune civilian workers and a comparison civilian worker population from Camp Pendleton. Camp Pendleton did not have a contaminated drinking water supply.

The cumulative exposure of each Camp Lejeune worker was based on the workplace location, duration of employment, and the monthly average estimates of the contaminants in the drinking water serving the workplace. Monthly contaminant levels in the drinking water were estimated by modeling the movement of the contaminants from the source of pollution through the ground water and into the water distribution system.

Key Results

During 1979-2008, there were 654 deaths in the Camp Lejeune group of civilian workers and 869 deaths in the Camp Pendleton group. The median ages in 2008 for the Camp Lejeune and Camp Pendleton cohorts were 58 years and 60 years, respectively.

Compared with the Camp Pendleton workers, the Camp Lejeune workers had higher mortality rates for the following causes of death:

- Cancers of the female breast, kidney, lung, oral cavity, prostate, and rectum
- Kidney diseases
- Leukemias
- Multiple myeloma
- Parkinson's disease

The higher rates of cancers of the kidney, prostate and rectum, leukemias, and Parkinson's disease were mainly among the Camp Lejeune civilian workers with higher cumulative exposures to the contaminants.

When those with higher exposures at Camp Lejeune were compared to those with lower exposures at Camp Lejeune, higher cumulative exposures to the contaminants were associated with increased risks for cancers of the kidney, esophagus, prostate, and rectum, leukemias, and Parkinson's disease.

The findings for the smoking-related causes of death, such as stomach cancer, cardiovascular disease, and chronic obstructive pulmonary disease suggested that smoking would have only a minor impact on any association between cause of death and exposure to the drinking water contaminants at Camp Lejeune.

Conclusion

The study found elevated risks in the Camp Lejeune civilian workers for several causes of death, including kidney cancer, leukemia's, prostate cancer, rectal cancer and Parkinson's disease. Because only 14% of the Camp Lejeune group had died by the end of the study, the numbers of cause-specific deaths were small, resulting in wide confidence intervals. Wide confidence intervals indicate considerable uncertainty about the actual risk (it could be higher or lower). Note: ATSDR recently published a mortality study of Marines and Navy personnel at Camp Lejeune. Several cancers with elevated risk in that study were also elevated among the civilian employees: cancers of the kidney, prostate, lung and rectum, leukemias, and multiple myeloma: <http://www.atsdr.cdc.gov/sites/lejeune/mortalitystudy.html>.