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Casualties of War: The Short- and Long-Term Effects of the 1945 Atomic Bomb Attacks on Japan

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Lesson Plan

TITLE: Casualties of War: The Short- and Long-Term Effects of the 1945 Atomic Bomb Attacks on Japan

SUBJECT AREA: Social studies, mathematics, biology

OBJECTIVES: At the end of Part I of this module, the students should be able to:

- Describe the atomic bombs (A-bombs) that were dropped on Hiroshima and Nagasaki in 1945 and the extent of damage that they caused
- Understand the different ways in which exposure to a nuclear weapon can cause immediate and delayed health effects
- Understand the issues related to the measurement of radiation exposure in studies of A-bomb survivors
- Understand how confounding might complicate the interpretation of results regarding the association between A-bomb exposure and health outcomes
- Understand the issues related to the measurement of cancer outcomes in studies of A-bomb survivors
- Understand the different study designs available to epidemiologists and other scientists when studying the relation between a potentially harmful agent and a particular health outcome
- Define a natural experiment and understand why the bombings of Hiroshima and Nagasaki constitute a natural experiment
- Think critically about the ethical implications of using data from a man-made disaster like the A-bomb attack on Japan

At the end of Part II of this module, the students should have a broader understanding of the impacts of war, one that goes beyond immediate battlefield deaths and injuries. These impacts may include:

- Medical
- Economic
- Social
- Psychological

- Environmental
- Moral
- Spiritual
- Political

TIME FRAME: Two to three 50-minute lessons

PREREQUISITE KNOWLEDGE: None

MATERIALS NEEDED:

- **Part I:** Tables and charts (included as part of the module)
- **Part II:** Documentary resources (included at the end of this module):
 - 1. Maps
 - 2. Personal accounts
 - 3. Diaries
 - 4. Media reports
 - 5. Works of art
 - 6. Photographs
 - 7. Other archival material

PROCEDURE: Follow the enclosed lesson plan.

ASSESSMENT: Assign an essay to the students, as follows:

Write a short essay about some of the epidemiologic studies that have been set up to examine the effect of the destruction of the World Trade Center on September 11, 2001, on the health of New Yorkers. Discuss the ways the information gained in this "natural experiment" will be helpful in understanding the causes of certain health problems.

LINK TO STANDARDS:

National Social Studies Standards (www.ncss.org)

- 2. Social studies programs should include experiences that provide for the study of the ways human beings view themselves in and over time.
- 3. Social studies programs should include experiences that provide for the study of people, places, and environments.

- 5. Social studies programs should include experiences that provide for the study of interactions among individuals, groups, and institutions.
- 8. Social studies programs should include experiences that provide for the study of relationships among science, technology, and society.
- 9. Social studies programs should include experiences that provide for the study of global connections and interdependence.

Bibliography

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Teacher's Notes on World War II

Introduction

The years 1939–1945 were marked by a global conflict that involved the world's leading countries. Although numerous countries were involved in World War I, the nature of World War II expanded involvement of nations around the world and consequently devastated many of them. The fighting of World War I was contained mostly on European soil, but World War II saw battles not only in Europe but also in Africa and large parts of Asia. The global effort of World War II caused an aftermath of financial and social damage for many of the countries that were involved in the conflict.

A general overview of events and countries involved is contained in the following timeline:

Please see timeline included in the instructional unit (pp. 34–45) or reference the following Web site:

http://www.stg.brown.edu/projects/WWII_Women/NewTimeline.html

Activity 1

Have students review the timeline. Ask them to identify, on an individual basis, the key events in the war in their opinion. As a class, discuss the choices and create a class list of 10–15 key events. Ask students to explain their choices.

Key events will vary based on student choice.

Activity 2

Ask students to revisit the timeline and discuss the key events and battles that brought World War II to an end.

Key events will vary based on student choice. If no student lists the dropping of the atomic bomb at Hiroshima and Nagasaki, add this to the list for purposes of discussion.

Assessing the Aftermath of World War II

Question 1. Briefly brainstorm the aftermath or legacies of any war. Are there any positive legacies that you can think of? What are the economic costs felt after a war for any country involved?

Military, weapons, support for allies, unemployment, reconstruction, technological innovation.

Question 2. What are the potential human costs of any war? In other words, what price does the average citizen have to pay in the face of war?

Fear of loss of family members, change in security, change in job market, loved ones leaving for military service, fear for safety of children, change in education, loss of income during military service.

Inform students that they will now examine the human costs of a specific act of World War II, the dropping of the atomic bombs.

Part I: The Bombing of Hiroshima and Nagasaki

The Bombs

In August 1945 the United States dropped atomic bombs (A-bombs) on the Japanese cities of Hiroshima and Nagasaki. The bomb used on the city of Hiroshima, which had an estimated population of 330,000, was dropped on August 6, 1945. The bomb (code name Little Boy) contained 140 pounds of uranium 235 and released energy equivalent to 12.5 kilotons of trinitrotoluene (TNT). The maximum temperature at the moment of explosion was several million degrees centigrade. The fireball that formed in the first millisecond after the explosion reached a temperature of 300,000 degrees centigrade. The top of the atomic cloud reached an altitude of 17,000 meters.

The bomb exploded over the center of the city, completely leveling two square miles. The intense heat generated by the explosion caused fires as far as two miles from ground zero. The map below shows the distribution of damage to the city, and Table 1 presents the proportion of Hiroshima's population killed or injured as a direct result of the blast.



Source: Map from http://www.atomicarchive.com/Maps/HiroshimaMap.shtml

Table 1. Population of Hiroshima Killed or Injured by the AtomicBomb, by Distance from Ground Zero

Distance from Ground Zero (km)	Killed	Injured	Population
0-0.99	86%	10%	31,200
1.0-2.49	27%	37%	144,800
2.5-5.0	2%	25%	80,300
Total	27%	30%	256,300

The bomb on Nagasaki (code name Fat Man) was dropped on August 9, 1945. It contained plutonium with energy equivalent to 20 kilotons of TNT. Although the bomb dropped on Nagasaki was more powerful than that dropped on Hiroshima, damage to the city was less extensive. This is because the bomb was dropped about two miles off target and because of the geography of the Nagasaki area. The map below shows the distribution of damage to the city, and Table 2 presents the proportion of Nagasaki's population killed or injured as a direct result of the blast.



Source: Map from http://www.atomicarchive.com/Maps/NagasakiMap.shtml

Table 2. Population of Nagasaki Killed or Injured by the AtomicBomb, by Distance from Ground Zero

Distance from Ground Zero (km)	Killed	Injured	Population
0-0.99	88%	6%	30,900
1.0-2.49	34%	29%	27,700
2.5-5.0	11%	10%	115,200
Total	22%	12%	173,800

Most damage caused by a nuclear weapon comes from the explosive blast. The blast causes a shock wave of air to radiate outward, producing changes in air pressure that can crush objects and high winds that can knock objects down. Direct radiation occurs at the time of the explosion. Although it can be very intense, its range is limited. Approximately 35% of the energy from a nuclear explosion is in the form of an intense burst of heat. Skin burns caused by the intense heat can occur as far as five miles from the blast. When an A-bomb is detonated, the blast creates a large crater. Some of the material that was in the crater is carried up into the air. This material is made radioactive by the explosion and returns to the earth as radioactive fallout. Particles may be carried by the wind for long distances, depending on weather conditions, before falling to the ground. In Hiroshima and Nagasaki, death and injury were caused by both the immediate (blast, heat, direct radiation) and delayed (fallout) effects of the A-bomb attacks.

Studying the Immediate and Delayed Health Effects of the Bombs

Tables 1 and 2 show the deaths that occurred in the two cities immediately after the blasts. Deaths caused by the blasts continued to occur in the months following the bombings. These deaths were mainly due to radiation, burns and mechanical injuries such as fractures. It has been estimated that between 150,000 and 200,000 people died before the end of 1945 in Hiroshima and Nagasaki as a direct result of the bombings. These deaths are referred to as acute deaths.

Question 3. Among people who survived the bomb, many had serious injuries and impairments, such as blindness. Do you think the survivors might have suffered other negative health effects from their exposure to the bombing? What kind of health effects do you think there might have been?

Try to get the students to think about long-term physical health effects, such as cancer in the survivors and birth defects in survivors' offspring, as well as psychologic reactions to trauma.

Soon after the end of the war, the U.S. government and the Japanese National Institute of Health established the Atomic Bomb Casualty Commission to conduct follow-up studies on the survivors of the atomic bombs. In 1975 responsibility for these studies was taken over by the Radiation Effects Research Foundation, an independent institution funded by the U.S. and Japanese governments.

In 1950 a national census was conducted in Japan, and 284,000 survivors of the A-bombs were identified. A survivor was defined as someone who was in Hiroshima or Nagasaki at the time of the bombs. A sample of the survivors was selected, and this group has been followed for studies of life span, pathology, adult health and in utero exposure. About 20,000 of the survivors have undergone a detailed medical examination every two years since 1958. In addition, the offspring of some of the survivors are being followed for studies of mortality, biochemical genetics and cytogenetics.

Question 4. The studies described above included only survivors identified in the 1950 census, five years after the bombings. Can you name one advantage and one disadvantage of using the 1950 census as a way to identify survivors?

Advantage: The census allowed a complete enumeration of the population so that all survivors living in Japan at the time of the census could be identified. Disadvantage: Because the census was done five years after the bombings, people who survived the bombs but who died or left Japan during the five-year interval would not have been included. The group of people who survived and were included in the census may not be representative of all survivors with respect to their health outcomes. It is possible, for example, that those who survived until 1950 were healthier than those who survived the bomb but died before 1950.

In many types of epidemiologic studies, the relationship between a possibly harmful exposure and a particular disease or health outcome is studied. In these studies, the epidemiologist observes whether disease occurs more commonly among individuals who have the exposure or factor than among those who do not. One example of an exposure–disease association that has been studied extensively by epidemiologists is the relationship between cigarette smoking and lung cancer. Epidemiologic studies have consistently found that lung cancer and many other health conditions are much more common among cigarette smokers than among those who do not smoke cigarettes.

Question 5. Can you think of some other exposure-disease associations that have been studied by epidemiologists?

There are countless examples. Here are just a few:

- High-cholesterol diet and heart disease
- Lack of exercise and heart disease
- Cigarette smoking and heart disease
- High blood pressure and heart disease
- Being African American and sickle cell anemia
- Overcrowded living conditions and tuberculosis
- Infection with the human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS)
- Obesity and diabetes

Question 6. In the case of Hiroshima and Nagasaki, the exposure was radiation from the A-bombs. Do you think it is possible to measure exactly how much radiation each survivor had been exposed to?

It is impossible to measure, retrospectively, the precise amount of radiation each survivor had experienced.

Earlier we said that epidemiologists often conduct studies to observe whether disease occurs more commonly among individuals who have been exposed to a possibly harmful agent than among individuals who have not been exposed. In some of the early studies of the effects of exposure to the A-bombs, researchers defined the unexposed group as people who normally resided in Hiroshima or Nagasaki but were not in the city at the time of the bomb.

Question 7. Can you name one advantage and one disadvantage of this way of defining the unexposed group?

Advantage: It was fairly easy to identify people who correspond to this definition of "unexposed." Disadvantage: The characteristics of people who were not in the city at the time of the bomb may be different from the characteristics of people who were in the city. This may result in a biased comparison of exposed and unexposed persons.

Question 8. Suppose that persons who were in the city were, on average, older than people who were out of the city at the time of the blast. If this were the case, what might you observe if you compared the cancer rates of those who were and were not in the city at the time of the bomb?

The cancer rate in the exposed would be inflated because of their relatively higher age and because older people have a higher risk of most cancers. Thus the observed difference in cancer rates between the exposed and unexposed groups would be larger than if the two groups were equivalent in terms of age. The epidemiologic term for this phenomenon is confounding. In this example, the association between exposure and cancer is confounded by age. The exposed people are older, and their higher age exaggerates the magnitude of the association between exposure and cancer.

For some other follow-up studies on the health of survivors, persons were classified according to their distance from ground zero at the time of the blast, using the following categories:

- 0-1,999 meters
- 2,000-2,499 meters
- 2,500-9,999 meters
- 10,000 meters or more

An advantage of this approach to measuring exposure was that it was fairly easy to establish the distance of the survivor from ground zero, based on the survivor's reported location at the time of the blast and using detailed maps of the cities.

Question 9. What are some disadvantages of this approach to measuring exposure?

There are factors other than distance that would affect the degree of exposure. All other things being equal, persons who were outdoors would have greater exposure than those who were indoors. Among those who were outdoors, those who were not shielded by buildings or other structures would have more exposure. Among those who were indoors, those who were in buildings whose materials and structural elements provided less shielding would have greater exposure.

A more sophisticated method for estimating the amount of radiation to which A-bomb survivors were exposed was based on (1) mathematical models that take into account the amount and energy of radiation released from the bombs and (2) information about location and shielding obtained by interview from survivors five or more years after the bombing. An advantage of this approach is that information was available about the amount and energy of radiation released from the bombs and shielding of the survivors, whereas precise information about the actual degree of radiation exposure was not available.

Question 10. What are some disadvantages of measuring exposure in this way?

Mathematical models are based on assumptions that may not be well founded. Estimates of the radiation released from bombs may not be accurate. Information obtained by interview from survivors five or more years after the bombing may not be reliable.

Cancer was one of the long-term health effects that scientists were interested in studying in relation to radiation exposure. There are two major ways of quantifying cancer risk. The first is cancer mortality, that is, the proportion of the population who die of cancer over a given period

of time. The second is cancer incidence, that is, the frequency with which new cases of cancer appear in a population over a given period of time.

Question 11. What are some advantages and disadvantages of cancer mortality and cancer incidence as measures of cancer risk?

Information about cancer mortality is likely to be accurate and complete. There may be errors in attributing cause of death, but this is less likely for cancer than for some other diseases. Mortality information is often available through routinely gathered vital statistics. However, cancer mortality is an indirect measure of disease risk because it is dependent both on getting cancer and on dying of cancer. For example, if many people get a particular type of cancer but few people die of it, mortality for that type of cancer will be low. Cancer incidence is a direct measure of disease risk and does not depend on how many people die of the disease. However, it is usually much more difficult to get accurate and complete information on incidence than on mortality.

Cancer is a disease with a long latent period. (Latent period refers to the interval between exposure to an agent that causes the disease and the appearance of manifestations of the disease.) Thus scientists who wished to study the effects of exposure to the A-bomb blasts on cancer risk needed to follow survivors for many years. During the follow-up period it was necessary to identify all new cases of cancer that arose in the survivor group. This type of ongoing epidemiologic activity is referred to as **surveillance.** Surveillance of cancer incidence among survivors of the A-bombs was accomplished by setting up cancer registries in Hiroshima (in 1957) and in Nagasaki (in 1958).

Question 12. What is the most important factor to consider when deciding whether a cancer registry is an effective method of surveillance?

The most important factor is the completeness of case ascertainment. If only a fraction of the cancer cases is identified through the cancer registry, effective surveillance cannot be accomplished.

The Hiroshima and Nagasaki cancer registries are based on information from various sources: physicians, hospitals, radiology clinics, pathology laboratories, surgical records and death certificates.

Question 13. Why is it important for a cancer registry to obtain information from a variety of sources?

Different cancer types in different patients are diagnosed in different ways. Some cancers are diagnosed by X-ray or other radiologic imaging technique. Some are diagnosed by pathologic examination of biopsy material, which may be obtained by a surgical procedure. Using a wide variety of sources ensures the most complete ascertainment of cases.

Table 3 shows the cancer incidence in Hiroshima and Nagasaki in 1977–1979.

Location	Incidence Rate per 100 000
Male:	
Hiroshima	239.6
Nagasaki	257.6
All of Japan	209.4
Female:	
Hiroshima	162.3
Nagasaki	175.9
All of Japan	138.5

Table 3. Average Annual Age-Adjusted Cancer Incidence Rate (per 100,000), by Location and Gender, 1977–1979

Question 14. Look closely at Table 3. What do you observe about the incidence of cancer? **Compared with the entire population of Japan, the incidence of cancer was higher both in Hiroshima and in Nagasaki. This was true for both men and women. The rate of cancer was higher for Nagasaki than Hiroshima, for both men and women. The rate of cancer was higher for men than for women in all locations.**

The results in Table 3 are adjusted for age. **Age adjustment** is a mathematical technique that makes the disease incidence of two populations comparable to each other. The technique takes the observed disease incidence in two or more groups and adjusts them to reflect the disease incidence that would exist if the populations being compared had the same age distribution.

Question 15. Why do you think the cancer incidence rates shown in Table 3 were adjusted for age?

Age adjustment was used so that the cancer incidence rates would be comparable. If unadjusted rates had been used, differences in cancer incidence might have been the result of differences in the age structures of the populations being compared.

Question 16. The epidemiologists who did this study were interested in the impact of the A-bomb in Hiroshima and Nagasaki on cancer rates. Why do you think they included the incidence rates for all of Japan in Table 3?

To estimate the impact of the A-bombs on cancer rates, it is necessary to compare the rates in Hiroshima and Nagasaki with the rates that would be expected if there had

been no A-bomb. The rates for all of Japan served as the reference standard, indicating what rates would be expected if there had been no A-bomb. A better reference standard might have been the Japanese population other than those in Hiroshima and Nagasaki, as it would exclude those exposed to the A-bombs.

Question 17. It appears that the age-adjusted cancer rates in Hiroshima and Nagasaki were higher than those for all of Japan. Can you think of at least two reasons why this might be so?

One reason is that cancer rates were in fact higher in Hiroshima and Nagasaki because of the bomb. Other possible reasons are related to methodologic factors. For example, it may be that there was more intensive surveillance of cancers in the cities that had been affected by the A-bombs. Doctors in those cities may have been more diligent about reporting cancers than in other parts of Japan. They may have been more likely than doctors in other parts of Japan to give a diagnosis of cancer in cases that were doubtful.

Comparing cancer rates in Hiroshima and Nagasaki with those in all of Japan is a fairly crude way to assess the impact of the A-bomb on cancer. A more refined way is to examine cancer frequency as a function of the degree of radiation exposure. The following table shows the number of cancer cases in Nagasaki, according to the estimated dose of radiation (in rads) experienced by the survivor during the bombing.

Radiation Dose (rads)	Number of Cancer Cases
0	274
1-9	455
10-49	262
50–99	107
100 or more	314
Not in city	404
Unknown	54

Table 4. Number of Cancer Cases, by Radiation Dose, Nagasaki, 1959–1978

Question 18. Examine Table 4. What does this table tell you about the relation between radiation dose and the risk of cancer?

There is no information in this table about the risk of cancer. All that is given is the number of cases. To be informative, the table would also need to show the total number of people (not just the ones who got cancer) in each radiation dose category.

Table 5 shows the incidence (per 100,000) of lung cancer by radiation dose. Look carefully at the table.

Radiation Dose (rads)	Incidence of Lung Cancer (per 100,000)
0	34.3
1–49	36.9
50–99	41.1
100–199	70.7
200 or more	72.1

Table 5. Incidence of Lung Cancer (per 100,000), Adjusted for City, Sex and Age, 1950–1980

Question 19. Why is the incidence in Table 5 presented per 100,000? How do you think these incidence estimates were obtained? How does this presentation differ from that in Table 4?

Presenting the incidence per 100,000 (or per any other unit, for that matter) is a way of taking into account the total number of people in the categories of radiation exposure. It is a way of making the numbers comparable to each other. The incidence estimates in Table 5 were obtained by dividing the number of lung cancer cases in each radiation dose category (numerator) by the total number of people in that category (denominator). Table 4, on the other hand, shows only the numerators, that is, the number of cancer cases. When only numerators are available, it is impossible to judge which category has the highest risk because we do not what proportion of people got cancer.

Question 20. Look carefully at the results in Table 5. Explain what you observe about the relationship between radiation exposure and lung cancer.

It appears that there is a fairly strong association between radiation exposure and lung cancer because the incidence of lung cancer is higher among the exposed than the unexposed, and there is a gradient of increasing lung cancer incidence with increasing radiation dose. **Question 21.** What other information would you like to have before concluding from Table 5 that radiation exposure causes lung cancer?

It is possible that people in the different exposure categories had different characteristics and it was these characteristics, not the radiation, that resulted in an apparent association between radiation and lung cancer. For example, suppose that people with high levels of exposure were also more likely to be smokers. It is known (although it was not known at the time of World War II) that smokers have higher lung cancer rates than nonsmokers. Thus, it may be that the apparently higher lung cancer rates in the higher exposure categories are due to the overrepresentation of smokers in these categories.

Atomic Bombing of Japanese Cities: A Natural Experiment

Epidemiologists often participate in the investigation of possibly harmful substances and exposures. The goal of such investigations is to determine whether a particular exposure is associated with some negative health outcome. Epidemiologists have studied the link between cigarette smoking and lung cancer, oral contraceptives and stroke, electromagnetic energy and childhood cancer, air pollution and asthma, and countless other such associations.

Scientists who study a potentially harmful substance in the laboratory are able to conduct experiments in which cell samples, tissue samples or animals are exposed to the substance of interest while identical cell samples, tissue samples or animals are not exposed. The experimental subjects are maintained under identical laboratory conditions and observed. The frequency of the outcome is compared in the exposed and unexposed cells, tissues or animals. Although such experiments, if properly conducted, yield valid results, the results may have only limited applicability to humans.

In the idealized experiment among humans, one would select people who do not have the disease or health condition of interest and then randomly allocate each of them to one of two groups. In one group, all study subjects are exposed to the agent of interest while, in the other group, no study subjects are exposed. In such a study, chance is the only factor that determines whether a person is exposed or not, and so it can be assumed that the two groups are comparable in all ways except exposure. One would then follow the two groups, record all disease events and compare the rate of disease in the two groups. Studies such as this are called **randomized controlled trials**.

Question 22. Is it possible to conduct a randomized controlled trial of a potentially harmful substance in humans? Why or why not?

It would not be ethical or feasible to randomize people to one of two groups and force them either to be exposed or to be unexposed. Ethical considerations would prevent investigators from subjecting people in the exposed group to potential harm.

When epidemiologists study the effect of potentially harmful substances, they have neither controlled laboratory experiments nor randomized controlled trials at their disposal. Instead, epidemiologists often use cohort studies or case-control studies as ways of assessing whether a particular agent is associated with a disease. In **cohort studies** a group of people who are exposed and a group of people who are unexposed to the agent are followed over time, and the rate of disease occurrence in the two groups is compared. In **case-control studies** a group of people with the disease of interest and a group of people without the disease are compared with respect to the frequency of previous exposure to the agent. Interpretation of the results of such studies is limited by the fact that the groups may not be comparable. People who are exposed may differ from people who are not exposed in other factors that affect the risk of getting the disease. For example, when comparing asbestos miners with people who are not asbestos miners are more likely to be smokers, as smoking is a risk factor for lung cancer.

When natural disasters or man-made catastrophes occur, epidemiologists are provided with the opportunity to study situations that would be impossible to study under normal conditions. When there is such a disaster, people can be observed and followed over time after being exposed to potentially harmful substances. Such studies are often referred to as **natural experiments.** In a natural experiment people are not randomized to exposure or nonexposure as they would be in a randomized controlled trial. Nevertheless, in a natural experiment the usual selection factors that complicate many studies of the association of exposure and illness may be reduced or absent. Also, it is often possible to study the effect of the exposure on a wide range of people under a wide range of exposure conditions.

The dropping of atomic bombs on Hiroshima and Nagasaki constitutes a natural experiment, resulting in the largest and longest prospective human epidemiologic study ever undertaken. Because the entire population of the two cities was exposed, it was possible to study men, women and children of all ages, as well as unborn children. Because different survivors experienced different amounts of exposure (depending on where they were at the time of the blast), it was possible to study the extent to which health effects were dependent on radiation dose. Although there was a wide range of exposure among the survivors, the immediate mortality rate among those with the highest exposures was high, so that it turned out that most survivors have been exposed to low doses of radiation. Therefore, epidemiologic studies of the A-bomb survivors have been crucial to understanding the effect of low doses of ionizing radiation such as may be encountered in occupational settings. Because exposure occurred at a single fixed point in time, it was possible to quantify the latent period for various cancers. Also, most survivors' radiation exposure was quite evenly distributed throughout the body, so the effects of whole-body irradiation could be studied. This is in contrast to studies of persons receiving therapeutic in irradiation, in which exposure is usually to a single organ. Because a large number of people were exposed, epidemiologists were able to evaluate whether certain subgroups were more susceptible than others to the effects of radiation exposure. For example, it was found that people who were younger at the time of exposure were more susceptible to certain kinds of cancer than those who were older.

The long-term epidemiologic studies of the A-bomb survivors have helped to establish the role of ionizing radiation in causing cancer and to elucidate the biological mechanisms of cancer causation. These studies have helped government regulatory agencies (such as the Environmental Protection Agency and the Occupational Safety and Health Agency) set limits for safe exposure. These safety regulations help to protect the many people who are potentially exposed to ionizing radiation through medical uses, radiation-emitting products, employment in certain industries, accidents, nuclear weapons and natural sources.

Question 23. Can you think of any other natural experiments? What epidemiologic knowledge do you think could be gained by studying the health of people involved in these natural experiments?

There are countless examples. Here are just a few:

- Different distribution of water source (some contaminated by sewage) and its effect on cholera in London in the nineteenth century
- Use of Agent Orange during the Vietnam War and its possible effect on cancer and reproductive health
- Nuclear power plant accidents (e.g., Chernobyl, Three Mile Island) and their possible effect on cancer and other diseases
- Bhopal industrial accident and its possible effect on lungs, eyes and nervous system
- Stress caused by major earthquakes and its effect on cardiovascular disease
- Destruction of the World Trade Center on September 11, 2001, and its possible effects on the psychologic and physical health of New Yorkers

The A-bombs dropped on Hiroshima and Nagasaki caused unimaginable suffering. There may be ethical implications to conducting epidemiologic studies on the survivors of the blasts. It could be argued that the data from these studies are soaked with the blood of the victims and that using the data makes us accomplices in the victims' suffering. Others would argue that it would be unethical *not* to use the data if such use could prevent death and suffering in the future.

Question 24. What do you think about the ethical arguments for and against using data obtained on survivors of disasters such as the bombings of Hiroshima and Nagasaki? Do you think you would feel the same if you or your family members were victims or survivors of the bombings?

Part II: Casualties of War, Document Investigation

Introduction

We will begin by reviewing the ideas from the previous day's discussions.

Question 25. Let's review the possible costs of war again. What are the economic costs of war for any country involved?

Military, weapons, support for allies, unemployment.

Question 26. Let's review again the potential human costs for any war. In other words, what price does the average citizen have to pay in the face of war?

Fear of loss of family members, change in security, change in job market, loved ones leaving for military service, fear for safety of children, change in education.

Question 27. Can you think of other categories that should be considered in assessing the costs of war?

Spiritual, environmental (changes in land), cultural (arts that are produced in response to war), social, psychologic, moral, foreign policy, etc.; economic advancement due to technological innovations spurred by the war.

We will now use the knowledge gained in investigating the long- and short-term health effects of the A-bomb on the population of Hiroshima and Nagasaki for today's class activity. Building on what you learned in your investigation of these health effects, you will use information about Japan to expand the definition of casualties of war.

Review the following general information about World War II casualties.

Costs, Casualties and Other Data

World War II spread death and devastation throughout most of the world to an extent never before experienced. It is beyond the scope of this lesson to attempt to express in terms of money the value of property and livelihoods destroyed. The resulting sums reach astronomical figures.

Military Casualties

Probably the best documented and most meaningful figures are the battle casualties. Those for the United States, Great Britain and the Commonwealth nations are accurate. Those for other nations, Allied or Axis, vary in reliability. Chinese figures are largely estimates because of the

lack of documentation, information on Soviet losses has been given only grudgingly and in very general terms, and many records of the Axis nations were lost when those countries were overrun.

Civilian Casualties

Casualties among civilians were much less accurately recorded than military losses. In part this was unavoidable because of the population shifts that took place as civilians fled before invading armies, because of the continual air attacks on major industrial centers, or because civilians were sent to Germany or the Soviet Union for forced labor.

Question 28. What factors are missing from this overview of casualties of World War II?

Casualties in countries other than Europe, Soviet Union, China, and Japan. Long-term health effects, particularly from the atomic bomb.

Question 29. What factors do you think of when you hear the word casualty? **Answers will vary. Students will probably say death or injuries.**

Activity

Ask students to imagine that they are consultants who are members of an international, interdisciplinary committee set up by the Foundation for World Peace to advise the Foundation director on a possible revision of its definition of casualties of war. Assume that the Foundation's current method of assessing the impact of war is based on the method used during World War I, in which only the numbers of battlefield deaths and injuries are considered in the calculation.

- Break students into several groups of three to five students. Distribute a copy of the documentary resource material to each group.
- Tell students that they should analyze the material contained in the documents with the goal of preparing a definition of the casualties of war. Start the exercise with students by looking at Document 1 on the handout sheet. Review and compare with the students the two definitions of casualties.
- Allow the students time to review the rest of the documents.

Question 30. What similarities do you see in these two definitions of casualties? **Both deal with military members being killed or injured.**

Question 31. What differences do you see between the two definitions?

Although the military definition includes categories beyond death and injury, it does not include the population outside of military personnel. The general definition by Encarta[®] allows civilians and others affected by war to be included in the count.

Question 32. What groups of people does the Center for Army Lessons Learned definition exclude?

Civilians. It is unclear whether military personnel of the opponent are included.

Question 33. Based on your understanding of people who were affected by the A-bomb, what additions to the definition of casualties can you think of?

Long-term effects of war should be included, as well as effects on all persons, civilian and military.

Allow the students time to review the other documents and answer the questions. Have the groups share their revised definitions of war.

Documentary Resource Material

We will not participate in an exercise that will use Japan as a means of expanding the definition of casualties of war.

Imagine that you and your group members are members of an international, interdisciplinary committee set up by the Foundation for World Peace to advice the Foundation director on a possible revision of its definition of casualties of war. Assume that the Foundation's current method of assessing the impact of war is based on the method used during World War I, in which only the numbers of battlefield deaths and injuries are considered in the calculation.

Your job today is to assess the various impacts of war based on the following documents dealing with the atomic bombing of Hiroshima and Nagasaki. Answer each of the questions following the documents. Use your conclusions from these answers in redefining or expanding the definition of casualties of war. As a group, come up with a final revised definition of casualties of war. Your final definition should include references to documents that can support your ideas. The documents are contained in the documentary resource material handout.

Definition of Casualties

1. Any person who is lost to the organization by having been declared dead, wounded, injured, diseased, interned, captured, retained, missing, missing in action, besieged, or detained.

Source: Center for Army Lessons Learned. Available at: http://call.army.mil/products/thesaur-frame.asp

- 2. a) accident victim: somebody who is seriously injured or killed in an accident
 - b) military injured or dead soldier: a member of the armed forces who is killed or injured during combat
 - c) victim: something or somebody destroyed or suffering as an indirect result of a particular event or circumstances

Source: www.Encarta.com

In both Hiroshima and Nagasaki the tremendous scale of the disaster largely destroyed the cities as entities. Even the worst of all other previous bombing attacks on Germany and Japan . . . were not comparable to the paralyzing effect of the atomic bombs. In addition to the huge number of persons who were killed or injured so that their services in rehabilitation were not available, a panic flight of the population took place from both cities immediately following the atomic explosions. No significant reconstruction or repair work was accomplished because of the slow return of the population; at the end of November 1945 each of the cities had only about 140,000 people. Although the ending of the war almost immediately after the atomic bombings removed much of the incentive of the Japanese people toward immediate reconstruction of their losses, their paralysis was still remarkable. Even the clearance of wreckage and the burning of the many bodies trapped in it were not well organized some weeks after the bombings. As the British Mission has stated, "the impression which both cities make is of having sunk, in an instant and without a struggle, to the most primitive level."

Source: The Avalon Project at Yale Law School. Available at: http://www.yale.edu/lawweb/avalon/abomb/mp24.htm

Question 34. How did the bombing affect the progression toward reconstruction? What can the major destruction of people and infrastructure do to a city in economic and other terms?

The immense effect of the atomic bomb slowed work that might otherwise have helped the people of Hiroshima and Nagasaki to rebuild their cities.

The Atomic Bomb Dome



This is the "preserved" building that was destroyed by the A-bomb. The building was located directly beneath the center of explosion. Today it is the symbol of the A-bomb and of Hiroshima.

Source: http://en.wikipedia.org/wiki/Image:A-bomb_dome.jpg

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"A bright light filled the plane," wrote Lt. Col. Paul Tibbets, the pilot of the Enola Gay, the B-29 that dropped the first atomic bomb. "We turned back to look at Hiroshima. The city was hidden by that awful cloud . . . boiling up, mushrooming." For a moment, no one spoke. Then everyone was talking. "Look at that! Look at that! Look at that!" exclaimed the co-pilot, Robert Lewis, pounding on Tibbets's shoulder. Lewis said he could taste atomic fission; it tasted like lead. Then he turned away to write in his journal. "My God," he asked himself, "what have we done?" (Special report, "Hiroshima: August 6, 1945.")

Note: Paul Tibbets was Colonel, not "Lt. Colonel," when he was the pilot of the Enola Gay.

Source: Hiroshima: August 6, 1945. Newsweek. July 24, 1995.

Nagasaki Nightmare



"The mother has died, sheltering her two babies, whose clutching fingers have cut into their mother's flesh."—Anonymous

Source: Nagasaki Nightmare. Available at: http://web.archive.org/web/20011021025051/http://burn.ucsd.edu/atom39.htm

A hundred thousand people were killed by the atomic bomb, and these six were among the survivors. They still wonder why they lived when so many others died. Each of them counts many small items of chance or volition—a step taken in time, a decision to go indoors, catching one streetcar instead of the next—that spared him ...

Source: John Hersey, Hiroshima, New York, Vintage Books, 1989, page 2.

The blast of pressure from the atomic bombs differed from that of ordinary high explosive bombs in three main ways:

A. Downward thrust. Because the explosions were well up in the air, much of the damage resulted from a downward pressure. This pressure of course most largely affected flat roofs. Some telegraph and other poles immediately below the explosion remained upright while those at greater distances from the center of damage, being more largely exposed to a horizontal thrust from the blast pressure waves, were overturned or tilted. Trees underneath the explosion remained upright but had their branches broken downward.

B. Mass distortion of buildings. An ordinary bomb can damage only a part of a large building, which may then collapse further under the action of gravity. But the blast wave from an atomic bomb is so large that it can engulf whole buildings, no matter how great their size, pushing them over as though a giant hand had given them a shove.

C. Long duration of the positive pressure pulse and consequent small effect of the negative pressure, or suction, phase. In any explosion, the positive pressure exerted by the blast lasts for a definite period of time (usually a small fraction of a second) and is then followed by a somewhat longer period of negative pressure, or suction. The negative pressure is always much weaker than the positive, but in ordinary explosions the short duration of the positive pulse results in many structures not having time to fail in that phase, while they are able to fail under the more extended, though weaker, negative pressure. But the duration of the positive pulse is approximately proportional to the 1/3 power of the size of the explosive charge. Thus, if the relation held true throughout the range in question, a 10-ton T.N.T. explosion would have a positive pulse only about 1/14th as long as that of a 20,000-ton explosion. Consequently, the atomic explosions had positive pulses so much longer than those of ordinary explosives that nearly all failures probably occurred during this phase, and very little damage could be attributed to the suction which followed.

There has been great difficulty in estimating the total casualties in the Japanese cities as a result of the atomic bombing. The extensive destruction of civil installations (hospitals, fire and police departments, and government agencies), the state of utter confusion immediately following the explosion, as well as the uncertainty regarding the actual population before the bombing, contribute to the difficulty of making estimates of casualties. The Japanese periodic censuses are not complete. Finally, the great fires that raged in each city totally consumed many bodies.

The number of total casualties has been estimated at various times since the bombings with wide discrepancies. The Manhattan Engineer District's best available figures are:

City	Cause of Death	Percent of Total
Hiroshima	Burns	60%
	Falling debris	30
	Other	10
Nagasaki	Burns	95%
	Falling debris	.9
	Flying glass	.7
	Other	3.4

Table D. Cause of Immediate Deaths

Source: The Avalon Project at Yale Law School, Chapter 10. Available at: http://www.yale.edu/lawweb/avalon/ abomb/mp10.htm

Have students read the note entitled, "Observations of a Sixth Grader" by Tadataka Kuribayashi. This writing is about a young boy's A-Bomb experience which exemplifies the bomb's effect on family life. It can be downloaded at http://www.csi.ad.jp/ABOMB/RERF/setb-4.html

Hiroshima's Hypocenter Seen from the Sky



With Aioi Bridge between them, the Hiroshima Chamber of Commerce and Industry (A-bomb Dome) and Honkawa Elementary School remain standing in ruin. (Photo by U.S. Army)

The Center of the City After the Bombing



Nothing is left standing except ferroconcrete buildings. Only rows of streets show that this once was the busiest section. (Photo by U.S. Army)

Source: Hiroshima A-Bomb Photo Museum. Available at: http://www.nvccom.co.jp/abomb/indexe.html

Questions for Discussion

- 1. What are the moral implications of the atomic bomb?
- 2. What were the advantages and disadvantages that the atomic bomb presented to modern warfare?
- 3. Why did the fire bombing of Tokyo just weeks earlier that killed over 120,000 civilians not receive the same moral criticism that the atomic bomb received?
- 4. One newspaper critic stated after the dropping of the bomb, "Yesterday we clinched victory in the Pacific, but we sowed the whirlwind." What did he mean by this?
- 5. What are the effects of the atomic bomb on family life and structure? On the economy? On culture? On foreign policy?

A Timeline of WWII (1939–1945)

1938

April 10

Having annexed Austria in March, Germany's Adolph Hitler calls a plebiscite which shows that more than 99 percent of Austrians favor union with Germany's Third Reich.

June 15

The U.S. Congress passes the Fair Labor Standards Act, the first national effort to legislate a minimum hourly wage (25 cents) and a ceiling on the number of working hours (44 per week).

September 30

The Munich Pact is signed. The British and French allow Hitler to annex the Sudetenland, a 16,000-square-mile area of Czechoslovakia with a largely German-speaking population. British Prime Minister Neville Chamberlain (1869–1940) says this will satisfy Germany and bring "peace for our time . . . peace with honor."

November 9

The largest pogrom in German history takes place, as Jewish shop windows are smashed, and the shops, as well as homes and synagogues, are looted, destroyed and burned. Between 20,000 and 30,000 Jews are taken to concentration camps.

1939

January 16

Physicists Lise Meitner and Otto R. Frisch describe the process by which a neutron causes the disintegration of the uranium nucleus into "two nuclei of roughly equal size." They call this process "nuclear fission."

March 14

After annexing the Sudetenland, Germany invades the rest of Czechoslovakia, while Italy launches an invasion of Albania (see <u>map</u>).

March 28

The Spanish Civil War ends, as Madrid falls to the forces of Francisco Franco.

August 23

Nazi Germany and Soviet Russia sign a mutual non-aggression pact. The agreement is signed by German foreign minister Joachim von Ribbentrop and Josef Stalin's commissar of foreign affairs, V. M. Molotov.

September 1

German troops and aircraft attack Poland. Soviet troops will invade Poland from the east on September 17, and Poland will surrender to the Germans on September 27.

September 3

After Hitler ignores their demand for German withdrawal from Poland, and as the British ship *Athenia* is sunk by German U-boats off the coast of Ireland, Great Britain and France formally declare war on Germany.

September 17

American aviation hero Charles A. Lindbergh makes his first anti-intervention radio speech. The U.S. non-intervention movement is supported not just by Lindbergh, but by former president Herbert Hoover, Theodore Roosevelt, Jr., Henry Ford, Lindbergh and a number of senators and congressmen as well.

September 28

Poland is partitioned between Nazi Germany and Soviet Russia.

November 4

Although President Roosevelt has declared American neutrality in the war in Europe, a Neutrality Act is signed that allows the U.S. to send arms and other aid to Britain and France.

November 30

Soviet troops invade Finland.

December 16

In Washington, the National Women's Party meets and urges the Congress to act on an Equal Rights Amendment.

1940

January 30

The U.S. government issues its first Social Security checks, totaling just over \$75,000. March 18

Mussolini and Hitler announce Italy's formal alliance with Germany against England and France.

May 7

British Prime Minister Neville Chamberlain resigns in disgrace. He will be replaced by Winston Churchill on May 10.

May 10

The German *Blitzkrieg* ("lightning war") begins, as Rotterdam and other Dutch cities are attacked from the air. By the end of the month, the Dutch armies will have surrendered, Belgium will have surrendered, and the evacuation of British and French troops from Dunkirk will be underway.

June 10

Italy declares war on Britain and France, and U.S. President Roosevelt announces a shift from neutrality to "non-belligerency," meaning more active support for the Allies against the Axis.

June 14

German troops enter Paris and, as a French appeal for U.S. aid is declined, the French fortress at Verdun falls to the Germans.

June 28

In the U.S., the Alien Registration Act (the Smith Act) passed by Congress requires aliens to register and be fingerprinted; the Act makes it illegal to advocate the overthrow of the U.S. government.

July 9

As German air attacks over Britain intensify, the British Royal Air Force begins night bombing of German targets.

August 17

Germany declares a blockade of British waters, and begins a bombing campaign which, by September, will be killing hundreds each day. In November, German air raids will kill more than 4,500 Britons.

September 27

Germany, Italy and Japan enter into a 10-year military and economic alliance that comes to be known as the "Axis." Hungary and Romania will join the Axis in November.

October 29

Conscription begins in the U.S. It is the first military draft to occur during peacetime in American history.

November 5

Franklin D. Roosevelt is elected to an unprecedented third term as president, with 54 percent of the popular vote. He defeats Republican Wendell L. Willke.

1941

January 6

Contrary to widespread isolationist sentiment, President Roosevelt recommends a "Land-Lease" program that will provide U.S. aid to the Allies.

April 6

Greece and Yugoslavia are invaded by German troops.

April 16

Britain receives its first American "Lend-Lease" aid shipments of food. By December, millions of tons of food will have arrived from the U.S.

May 31

British troops arrive in Iraq and will prevent Axis sympathizers from taking over the government there. In early June, British and Free French troops will invade Syria and Lebanon to prevent those countries from being taken over by the Germany.

June 22

German troops invade Soviet Russia, breaking the "nonaggression" pact signed in 1939. Two days later, President Roosevelt promises U.S. aid to Russia.

June 25

President Roosevelt creates a U.S. Fair Employment Practice Committee (FEPC), after a march by 50,000 black Americans is threatened by A. Philip Randolph to protest unfair labor practices in the government and the war industry.

June 28

Vannevar Bush is named director of the Office of Scientific Research and Development (OSRD), which has just been created by President Roosevelt.

August 9

Secret meetings between President Roosevelt and Prime Minister Churchill begin off the coast of Newfoundland. They will result in the Atlantic Charter, which contains eight points of agreement on the aims of the war.

September 11

President Roosevelt issues an order that German or Italian ships sighted in U.S. waters will be attacked immediately.

September 29

German troops invading the Ukraine machine-gun to death between 50,000 and 96,000 Ukranians (of which at least 60 percent are Jews), in Babi Yar, a ravine about 30 miles outside of Kiev.

October 17

The *Kearny*, a U.S. destroyer, is torpedoed off the coast of Iceland by a German U-boat. On the 31st, the American destroyer *Reuben James* is sunk by a German U-boat, killing 100.

December 7

Just before 8 a.m., Honolulu time, 360 Japanese planes attack Pearl Harbor, the U.S. military base on the Hawaiian island of Oahu. The attack cripples the U.S. Pacific fleet, and kills more than 2,300 American soldiers, sailors, and civilians. The attack precedes Japan's formal declaration of war, which is delivered by the Japanese foreign minister to the U.S. embassy in Tokyo more than seven hours later.

The Providence Journal "War Edition" cover

Americans remembering Pearl Harbor

Roosevelt's fireside chat with the nation following the bombing

December 8

President Roosevelt addresses the U.S. Congress, saying that December 7 is "a date that will live in infamy." After a vote of 82-0 in the U.S. Senate, and 388-1 in the House, in

favor of declaring war on Japan, Roosevelt signs the declaration of war. (See <u>Roosevelt's</u> <u>famous address to Congress</u> requesting that war be declared.)

December 11

Germany and Italy declare war on the U.S. President Roosevelt calls an end to official U.S. neutrality in the war in Europe, declaring war on Germany and Italy. View <u>The Providence</u> <u>Journal cover, December 12th</u>.

1942

January 2

Japanese troops capture Manila.

January 10

Japanese troops invade the Dutch East Indies.

January 14

An order from President Roosevelt requires all aliens to register with the government. This is the beginning of a plan to move Japanese-Americans into internment camps in the belief that these people might aid the enemy.

February 2

Congress appropriates 26.5 billion dollars for the U.S. Navy, bringing total U.S. war costs since June of 1940 to more than 115 billion dollars.

February 15

Japanese troops capture Singapore.

February 19

Executive Order 9066 is signed by President Roosevelt, authorizing the transfer of more than 100,000 Japanese-Americans living in coastal Pacific areas to concentration camps in various inland states (and including inland areas of California). The interned Japanese-Americans lose an estimated 400 million dollars in property, as their homes and possessions are taken from them.

The Japanese-American internment experience.

April 9

The Philippines fall to Japanese troops.

April 28

Coastal "dimouts" go into effect along a fifteen-mile strip on the Eastern Seaboard, in response to German U-boat activity off the U.S. Atlantic coast.

May 14

The U.S. Congress establishes The Women's Auxiliary Army Corps (WAAC), under the direction of Oveta Culp Hobby, editor of the *Houston Post*.

May 15

Gasoline rationing goes into effect in the Eastern United States. Nationwide rationing will begin in September.

May 30

The first 1,000-bomber attack on German industrial targets is carried out by Britain's Royal Air Force, as the German city of Cologne is raided.

June 6

In reprisal for the May 29 assassination of German Deputy Gestapo chief and "Protector" of Czechoslovakia, Reinhard Heydrich, German troops attempt to execute every male in the Czech village of Lidice (Bohemia), and they then set fire to the village.

June 13

President Roosevelt authorizes the creation of the U.S. Office on War Information (OWI). The first director is Elmer Holmes Davis, a CBS commentator and novelist.

June 21

German field marshal Erwin Rommel and his troops capture Tobruk, in Libya.

June 28

The Federal Bureau of Investigation (FBI) captures eight German agents that have landed by U-boat on Long Island.

July 16

French police round up 30,000 Parisian Jews, and German troops bus them out of the city to concentration camps. Approximately 30 will survive.

July 30

The Women Accepted for Voluntary Emergency Services (WAVES) is authorized by the U.S. Congress.

August 19

Canadian commando troops attack the coastal French city of Dieppe, but German defenders abort the raid and 3,500 Canadians are lost.

August 22

The Battle of Stalingrad begins. The battle will claim the lives of 750,000 Russian soldiers, 400,000 German soldiers, nearly 200,000 Romanian soldiers, 130,000 Italian soldiers, and 120,000 Hungarian soldiers.

September 16

The Women's Airforce Service Pilots (WASPS) are established in the U.S. The armed forces will be supplied with more than 1000 auxiliary pilots through this organization.

November 7

A joint U.S.-British force of 400,000 troops, under the direction of General Eisenhower, begins landing at Casablanca, Oran and Algiers. They will successfully overtake the French garrisons there.

November 10

In response to Mahatma Gandhi's demand that India be granted independence from Britain immediately, Prime Minister Churchill, in a speech at Mansion House, says "I have not become the King's First Minister in order to preside over the liquidation of the British Empire."

December 1

In the U.S., coffee joins the list of rationed items.

December 2

At the University of Chicago's Staff Field, the first controlled, self-sustaining nuclear chain reaction is realized by a team of scientists working under the name of the "Manhattan Engineering District."

December 24

In Germany, the first surface-to-surface guided missile is launched in Peenemunde. The rocket has been designed by 30-year-old rocket engineer Wernher von Braun.

1943

January 11

President Roosevelt submits his budget to the U.S. Congress. 100 billion of the 109-billiondollar budget is identified with the war effort.

January 22

Forces representing Australia, New Zealand, Canada and the United States capture the southeastern tip of New Guinea from Japanese troops, in an attempt to protect Australia from a Japanese invasion.

January 23

British forces capture Tripoli.

February 7

In the U.S., shoe rationing begins, limiting civilians to three pairs of leather shoes per year. The ration in Britain is one pair per year.

February 8

Allied forces capture Guadalcanal, in the Solomon Islands, in heavy fighting.

February 16

Dr. Mildred Harnack-Fish, a German resistance fighter born in the U.S., and sentenced to death by the German government for her work in the Resistance, is beheaded at Berlin's Plotzensee Prison.

February 28

A group of wives of Jewish men gather in Berlin to stop the deportation of their husbands to concentration camps. The group of women will grow to 1,000 by March 8 and will succeed in forcing Joseph Goebbels to order the release of 1,500 men.

March 29

Meat rationing begins in the U.S., but the ration is 28 ounces per week, and meat production rises by approximately 50 percent.

April 1

In the U.S., meat, fats, canned goods, and cheese are now all rationed. Attempting to stem inflation, President Roosevelt freezes wages, salaries, and prices.

May 27

In the U.S., President Roosevelt issues an executive order forbidding racial discrimination by government contractors.

May 29

In the U.S., an issue of *The Saturday Evening Post* is published with a cover illustration by Norman Rockwell that introduces an American icon known as "Rosie the Riveter."

June 14

The U.S. Supreme Court rules, in *West Virginia Board of Education v. Bernette*, that a West Virginia state law that requires school children to salute the flag, on penalty of expulsion, is unconstitutional.

June 22

<u>Anti-black race riots in Detroit</u>, involving thousands, leave thirty-four people dead. A race riot in Harlem, New York City, will erupt on August 1.

July 5

The Battle of Kursk begins. Soviet troops will eventually defeat the Germans, after a week of heavy fighting and tens of thousands of casualties on both sides.

July 9

An invasion of Sicily begins by British paratroopers and American airborne troops.

September 9

Although the Allies have announced the unconditional surrender of Italy, German forces in Italy continue to oppose Allied troops. When the U.S. Fifth Army lands at Salerno, they sustain heavy losses.

November 6

Soviet troops retake Kiev.

December 17

President Roosevelt repeals the U.S. Chinese Exclusion Acts of 1882 and 1902, thus allowing Chinese residents of the United States to be eligible for citizenship. The new Chinese Act also allows for the immigration of up to 105 Chinese annually.

1944

January 20

Russian troops recapture Novgorod, and will retake Leningrad a week later. By early May, they will have recaptured Odessa and Sevastopol as well. Meanwhile the British Royal Air Force bombs Berlin with more than 2,300 tons of bombs.

March 24

335 Italians, at least 255 of whom are civilians, are shot by German troops in the Fosse Ardeantine caves outside of Rome. The massacre is ordered by S.S. Colonel Herbert Kappler, in response to the killing of 35 German soldiers.

April 3

In the case of *Smith v. Allwright*, the U.S. Supreme Court rules that an American cannot be denied the right to vote because of color.

May 3

In the U.S., meat rationing ends, except for certain select cuts.

June 6

"D-Day": The Allied invasion of Europe commences just after midnight, as more than 175,000 troops land at Normandy. The largest invasion force in history, it includes 4,000 invasion ships, 600 warships, and 10,000 planes.

June 10

More than 600 people are massacred by German troops in the French town of Oradoursur-Glane. While the men are shot immediately, the women and children are locked in a church, the altar of which is set on fire; those who try to escape the flames are shot.

June 12

German V1 remote-controlled rockets begin to hit London. By September, the "improved" V2 rockets will target London as well as Antwerp, killing and maiming thousands.

June 22

In the U.S., President Roosevelt signs the Servicemen's Readjustment Act that will provide funds for housing and education after the war. It is better known as the GI Bill of Rights.

July 3

The Russian city of Minsk is retaken by Russian troops, and 100,000 Germans are captured.

July 8

As a U.S. taking of Saipan becomes certain, hundreds of Japanese civilians commit suicide rather than surrender. Allied B-29 bombers can reach Tokyo from Saipan, thus the capture of the island will be a turning point in the Pacific war. The Tokyo government collapses within 2 weeks.

July 20

An assassination attempt on Adolph Hitler, planned by some of Hitler's generals, is unsuccessful.

August 4

In Amsterdam, Otto Frank and his family (including his daughter Anne, then 15) are captured by the Gestapo. Jewish, they have been in hiding for more than two years, kept by Miep and Jan Gies, but have been betrayed by someone familiar with their hiding place and are put on the last convoy of trucks to Auschwitz.

August 25

Paris is liberated by Allied French troops, after four years of German occupation.

October 20

Allied forces invade the Philippines. Belgrade is captured by Soviet Russian and Yugoslav partisan troops.

November 7

Franklin D. Roosevelt is elected to a fourth term as U.S. President, and Harry S. Truman becomes the Vice-President.

November 29

In passing the Federal Highway Act, the U.S. Congress establishes the U.S. National System of Interstate Highways that is planned to reach 182 of the 199 U.S. cities with populations above 50,000.

December 16

The Battle of the Bulge begins. It the last major German counteroffensive, as allied troops are pushed back in Belgium's Ardennes Forest. As Allied lines fall back, a "bulge" is created in the center of the line, giving the battle its familiar name (see <u>map</u>). Two weeks of intense fighting in brutal winter weather follow before the German offensive is stopped.

1945

January 26

Russian troops find fewer than 3,000 survivors when they liberate Auschwitz, the Nazi death camp in Poland. The German S.S. has moved many of the remaining prisoners to camps inside Germany. From 1939 to 1945, one third of the Jews living in the world will have died in German concentration and extermination camps.

February 4

U.S. troops invading the Philippines have received reenforcements, and a force led by General MacArthur enters Manila. The city will be completely retaken in less than three weeks.

February 13

British planes attack the German city of Dresden, bombing with phosphorus and high explosives; the firestorm created by the bombing kills an estimated 135,000.

March 9

U.S. B-24 bombers attack Tokyo, starting fires that will kill more than 120,000. h 16

March 16

On Iwo Jima, a month-long struggle comes to an end, as U.S. forces capture the 8-square-mile island. Possessing Japan's last line of radar defense to warn against American air attacks, Iwo Jima is a strategically significant prelude to the invasion of Okinawa.

April 11

U.S. troops reach the Elbe River (in Germany). They halt there and meet advancing Russian troops on April 25.

April 12

After suffering a massive cerebral hemorrhage, President Roosevelt dies. He is 63. Vice-President Harry S. Truman (1884–1972) is sworn in as President. <u>Providence Journal cover</u>.

April 21

U.S forces capture Nuremberg, and Russian forces reach the suburbs of Berlin.

April 28

At Lake Como, in Italy, Benito Mussolini and 12 of his former Cabinet officers are executed. German forces in Italy will surrender unconditionally on the 29th.

April 30

With Russian shells falling on Berlin, Hitler marries his mistress Eva Braun in his bombproof Berlin bunker. He then poisons her and kills himself. His remains are never recovered.

Cartoon from the Providence Journal

May 7

Germany surrenders unconditionally to General Eisenhower at Rheims, France, and to the Soviets in Berlin. President Truman pronounces the following day, May 8, V-E Day. The U.S., Russia, England, and France agree to split occupied Germany into eastern and western halves.

June 21

The Pacific island of Okinawa is captured by the Allies. Japan has lost 160,000 men in fighting on the island; more than 12,500 Americans have died on Okinawa as well.

July 17

U.S. air attacks on Tokyo continue, after planes have dropped leaflets threatening destruction from the air if the Japanese do not agree to unconditional surrender.

July 30

Torpedoes sink the U.S.S. Indianapolis in the Indian Ocean.

August 2

The Potsdam conference ends after more than two weeks of deliberations. Allied leaders have been discussing what should become of Germany.

August 6

The U.S. B-29 Superfortress, *Enola Gay*, drops an atomic bomb on the Japanese industrial city of Hiroshima. The city is leveled, and an estimated 100,000 people are killed immediately (another 100,000 will die later from radiation sickness and burns). On August 9, a second bomb will be dropped on the Japanese city of Nagasaki.

(Read <u>Eyewitness accounts of exposure to the A-bomb</u>—translated from the Japanese Documentary: Hiroshima Witness, produced by Hiroshima Peace Cultural Center and NHK, and located at: (http://www.atomicarchive.com/Docs/Hibakusha/).

August 10

The Japanese sue for peace after the bombings of Hiroshima and Nagasaki, and U.S. President Truman declares that August 14th will be V-J (Victory over Japan) Day. To date, nearly 55 million people have died in the Second World War, including 25 million in the Soviet Union, nearly 8 million in China, and more than 6 million in Poland.

August 19

In the U.S., rationing of gasoline and fuel oil comes to an end.

September 2

General MacArthur accepts the formal, unconditional surrender of Japan in a ceremony aboard the USS *Missouri* in Tokyo Bay.

November 23

Butter rationing comes to an end, and sugar is the only item that continues to be rationed in the U.S.

December 15

A new election law is passed in Japan, at the urgence of the occupying Allied forces, which gives Japanese women voting rights.

December 27

The International Bank for Reconstruction and Development is created. Of the more than 7 billion dollars contributed by 21 countries, the U.S. has subscribed more than 3 billion dollars to the World Bank.

Source: Brown University Scholarly Technical Group Web site. Available at: http://www.stg.brown.edu/projects/ WWII_Women/NewTimeline.html