NUCLEAR WAR
A PUBLIC HEALTH CONCERN

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC HEALTH

INTRODUCTION

Is nuclear war a proper concern of the Massachusetts Department of Public Health? The answer lies in the very nature and organization of public health in Massachusetts. Addressing the first meeting of the newly established Massachusetts Board of Health on September 15, 1869, Dr. Henry Bowditch, Chairman, told his colleagues: "Our work is for the future as well as for the present, and at this very opening of our labors we should try to place ourselves above the region of merely local or temporary excitement or of partisan warfare, in order that we may act wisely and for the ultimate good of the whole people".

Today, the Department of Public Health faces a far greater challenge than the one that confronted the fledgling Board of Health -- how to avoid the unthinkable,catastrophic consequences of a nuclear war. As the nuclear arms race continues to pile up weapons that possess a destructive force over one million times that of the bomb exploded over Hiroshima, the possibility of a nuclear accident or attack hangs dangerously over the population.

According to the most highly qualified members of the international scientific and medical community, the effects of a nuclear attack on a concentrated area like the Commonwealth of Massachusetts would have devastating medical and public-health consequences, resulting in millions of fatalities and injuries, and unimaginable horror. Human existence as we now understand it could disappear.

In the face of this indescribable disaster, the Department of Public Health, which is mandated "to maintain, protect and improve the health and well-being of the people," has taken the position that the very idea of a nuclear war is totally unacceptable. To carry out its mandated objectives, the Department has followed the basic concept of public health - prevention of the occurrence of disease and injury. No longer are the elimination of unsanitary conditions and the spread of communicable diseases the only concerns of public health workers. The danger facing all people - not only the people of the Commonwealth - is far greater and more complex. In keeping with the principle of public health, the Department has, therefore, determined that prevention is essential to avoid what would surely be the "last epidemic" of nuclear war.

To that end, the Department has begun a campaign of education to inform public health professionals and the people of Massachusetts of the enormous medical, social, and economic consequences of a nuclear war. This brochure seeks to present simply and clearly what the public health effects of a nuclear attack on Massachusetts would mean. The Department will cooperate with local boards of health, other concerned public health professionals, and lay groups to create an informed public able to assist in our preventive efforts.

Bailus Walker, Jr., Ph.D., M.P.H.
Commissioner

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NUCLEAR WEAPONS: A DESIGN FOR DESTRUCTION

The nuclear fission bombs dropped on Hiroshima and Nagasaki represented a thousandfold increase in destructive power over all previously developed weaponry. The fusion bombs now stockpiled by the United States, the Soviet Union, and other nations represent a destructive power many times greater than the bomb that fell on Hiroshima. The technology for delivering bombs has also advanced dramatically since World War II. Recently designed planes now carry 12 or more nuclear-tipped short-range missiles in addition to bombs. These missiles can be directed accurately for up to 100 miles. Both the United States and the Soviet Union have arsenals of sea-based missiles, as well as hundreds of land-based intercontinental ballistic missiles.

The largest nuclear weapon, a 20-megaton intercontinental ballistic missile, is five times more powerful than all the bombs dropped by the United States in Viet Nam, and 1,500 times more powerful than the ones used on Hiroshima and Nagasaki. Each of the bombs dropped over the Japanese cities had an explosive power equivalent to 13,000 tons of TNT. A single megaton is equivalent to 1 million tons of TNT, and has a destructive power more than 70 times that which destroyed Hiroshima. A 20 - megaton bomb, therefore, has the destructive force of 20 million tons of TNT, enough to wipe out not only individual cities but many cities and towns within a wide radius.

In a 1962 article in the *New England Journal of Medicine,* a group of physicians and physicists described, for the first time, the medical consequences of a blast from a 20-megaton bomb exploded on the ground. Destruction would occur through blast, thermal, and radiation effects.

The blast, if it exploded on the ground, would create a crater a half-mile in diameter and demolish everything standing within a four-mile radius. If a 20-megaton bomb exploded in the air, it would almost double the area destroyed. All buildings and basement shelters, with the possible ex-

ception of heavily reinforced concrete structures, would be destroyed within a 16-mile radius of a ground blast.

All persons in that area would be killed immediately by lung damage alone. Most buildings, including hosptials, would be damaged beyond repair for a radius of 15 miles from the center of the blast. The direct effects on humans are three basic types: blast-produced overpressures including eardrum and lung rupture; injury from flying glass, masonry, and other projectiles; and injury from being hurled by the blast.

Serious thermal (heat) effects would be experienced by persons as far away as 40 miles from the blast. In a blast, the second flash of thermal energy, released in an infrared pulse containing nearly 35 percent of the bomb's energy, would burn the skin of persons and ignite clothing up to 21 miles away, and could blind persons who looked at the fireball from as far as 40 miles. Persons near the center of the blast would be vaporized by the extreme heat.

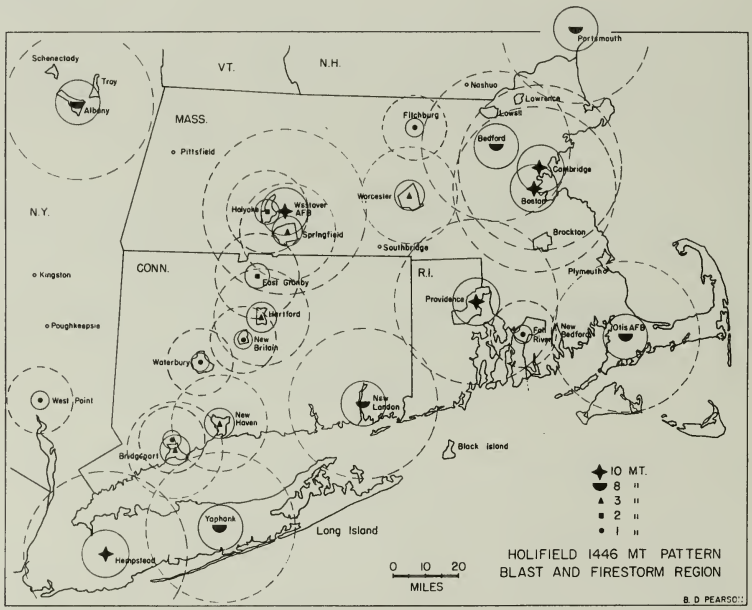
The explosion would create a huge pressure wave followed by winds greater than 1,000 miles per hour. The wind would create a low pressure area filled in by a rush of surrounding air, which would fan fires started by the blast to create a huge fire storm. It is estimated that nearly three million people would be killed by direct blast and thermal effects of a single 20-megaton ground blast in a metropolitan area.

The radiation effects of such a blast would also be major hazards for people at great distances from the blast site. The radius of the area affected by short-and long-term radiation depends upon wind currents and other influences on fallout patterns. It is generally assumed, however, that people in the 4,000 square miles surrounding a 20-megaton blast would receive at least 450 rems of radiation within 48 hours of the blast. This amount given as a short-term dose would result in the death of about half of a healthy young adult population. An even higher proportion of children, the elderly, and those with chronic diseases would die from this level of radiation.

HIGH RISK AREAS IN MASSACHUSETTS

The scope and the nature of a nuclear interchange are difficult to predict. The build-up of world tension may be gradual, with initial attacks directed at military targets. A broader attack could also involve population centers, such as Greater Boston, and industrial targets. Massachusetts, which has dense population centers in Boston, Worcester, Springfield and Lowell, and a concentration of high technology industries along Route 128, would be a high risk area. With both a high population density and major governmental and industrial sites, the Greater Boston Area would be a likely target in the event of an attack.

The map below shows target areas of a hypothetical nuclear attack on Massachusetts and adjoining New England states.*



Southern New England Target Area of the Hypothetical Nuclear Attack, with Bomb Sizes Assumed at Specific Military and Industrial Targets.

Circles indicate radiuses of possible destruction, not including additive effects of overlap. Inner solid circles are areas of severe blast damage to strong structures and complete collapse of frame houses. Outer dashed circles represent limits of some mechanical damage, ignition of fires in easily combustible materials and possible extent of fire storm.

Source: The medical consequences of thermonuclear war.

*Reprinted by permission of the *New England Journal of Medicine*, 1962; 266:1130

PUBLIC HEALTH EFFECTS OF A NUCLEAR ATTACK ON MASSACHUSETTS

Using a hypothetical example, the group of concerned physicians and physicists estimated in 1962 the number of casualties from a nuclear attack on Massachusetts. The example assumed an attack on the three major population centers in the state - Boston, Worcester, and Springfield. Extrapolating from the 1962 calculations and assuming 20-megaton surface blasts in the three cities, one can estimate that a total of 1,345,287 immediate fatalities would result in the three areas from the effects of the blasts alone, and an additional 1,950,666 fatalities from thermal effects. The number of injured would approach 2,218,000. In other words, 57 percent of the state's population would be killed by such an attack and 39 percent would be injured. The death rate would mount even higher in the weeks following the attack.

In 1976, 8,888 of the state's 11,283 physicians and 29,128 of the 42,566 registered nurses lived in the areas around Boston, Worcester, and Springfield. In a population attack on these three cities, approximately 80 percent of the physicians and 70 percent of the registered nurses in the state would be among those killed. In addition, 81 of the 127 acute-care hospitals in Massachusetts would be destroyed, a loss of 64 percent of the hospitals; and 65 percent (18,056 out of 27,991) of the acute-care beds would be damaged or destroyed. Under such circumstances, no effective medical response would be possible. It is arguable that there would be enough medical personnel available even to declare the casualities dead, let alone to attend the injured survivors.

A second hypothetical example is of a more limited military attack on Hanscom Air Force Base in Bedford, northwest of Boston. Extrapolating from figures included in the study prepared by the Office of Technology Assessment of the Congress of the United States in 1979, one can project that a one-megaton surface burst on the air base would leave approximately 150,000 dead and 300,000 injured in the immediate aftermath of the attack.

Even the explosion from a one-megaton blast directed at this military target would result in property damage in an area 70 square miles. In addition to the destruction of hospitals in Boston, medical facilities in Lowell, Lynn, Cambridge, Watertown, and Concord would be damaged or completely destroyed.

The numbers of physicians in the entire state who might survive the two hypothetical attacks would be less than 2,400, a number far too small to care for the injured and the dying.

The only logical conclusion from these projections is that no effective medical or public health response to a nuclear attack on Massachusetts is possible.

LONG TERM EFFECTS OF A NUCLEAR ATTACK

The major immediate health effects of a nuclear explosion, as described above, would include blast injuries, such as wounds of soft tissues and fractures, thermal injuries including surface burns, retinal burns, and respiratory tract damage, radiation injuries, and psychiatric disturbances.

In the period after the attack, other medical problems would assume increasing importance. It is important to reiterate that the capacity to respond to both short- and long-term problems would be severely hampered by a greatly disrupted health-care system. Although all medical resources would be limited, a large proportion of the surviving population would be in need of intensive medical treatment. Medical facilities would be reduced, with a resultant acute shortage of hospital beds, diagnostic equipment, blood, drugs, instruments, electric power, communication facilities, and means of transport.

Millions of corpses would constitute an immediate public health hazard. Corpses in areas affected by high levels of radiation would probably remain untouched for weeks since it would be unsafe to dispose of them. Because bacteria and viruses multiply rapidly in dead flesh, decaying corpses would become a source of epidemic infections. In addition, bacteria and viruses in a radioactive environment could mutate to become even more virulent or lethal. Whereas bacteria, fungi, viruses and insects are highly resistant to radiation, human beings and domestic animals are not. Survivors would suffer weakened resistance to infection resulting from exposure to radiation, which affects the immune system in several different ways. Effects include a decreased ability to fight infection, a decreased effectiveness of immunizations, and an increased susceptibility to some toxic substances.

In addition to a weakened immune system response, survivors would suffer from other conditions that would further affect their ability to resist disease. These include malnutrition due to the disruption of the food supply system; severe emotional stress induced by loss of family and friends and general societal disruption; poor hygenic conditions resulting from contaminated water supplies; lack of housing, inadequate sewage treatment, and waste disposal.

All of these factors would lead to a high incidence of infectious and communicable diseases among the surviving populace, killing up to 25 percent of survivors. All of the public health advances in controlling these diseases would be wiped out. This increased risk would be intensified by depleted stocks of antibiotics, shortages of physicians, nurses, and other public health workers, such as sanitarians, radiation engineers, and epidemiologists, and the complete disorganization of services. Respiratory diseases such as pneumonia, tuberculosis, and influenza would spread rapidly in crowded shelters (if any were available). Diarrheal diseases would become widespread, as would infectious hepatitis. Rabies, tenanus, and plague would be threats to any evacuated populations. Nonimmunized infants would be particularly vulnerable to measles, whooping cough, and diphtheria.

Genetic changes can also be expected to occur after a nuclear explosion. In both Hiroshima and Nagasaki, infants exposed to radiation in utero were born with a great number of birth defects. The incidence of cystic fibrosis, diabetes, hemophilia and mental retardation would probably increase, and the spontaneous gene mutation rate might double. Over a longer period of time, residual radiation would increase the incidence of leukemia and other cancers. Additional effects would include decreased fertility, neonatal deaths, an increased incidence of cataracts, accelerated aging and a decrease in longevity.

Public health workers must recognize that the assessment of casualties and long-term effects of a postulated nuclear attack, as described above, may well be an underestimation. This presentation does not explore the ecological and social problems that would result. Survivors would find a completely disrupted economy, as well as a disrupted governmental apparatus. The systems of communication, transportaion, and energy, indeed society as we now know it - including its accumulated knowledge, art and culture - would cease to exist. The concept of community and mutual aid would undergo a fundamental change as groups struggled to survive. A public health response, under such circumstances, would be ineffective.

CONCLUSION

Despite the difficulties and uncertainties involved in predicting the scope of a nuclear attack, one fact stands out grimly. Whatever the extent of a nuclear attack, the effects on the public's health and on the system of care developed to preserve and protect it would be devastating. Both the physical and psychological effects on the survivors and the challenges they would face are difficult to imagine during the normal course of daily life.

The Department of Public Health has come to the realization that only the prevention of nuclear war will save us and our children from an unimaginable future horror. We hope that this document has helped to raise your awareness of the challenge before us.

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