Medicine and Nuclear War: Preventing Proliferation and Achieving Abolition

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Preface

This initial edition of *Medicine and Nuclear War* was completed rapidly for circulation before the conference on "Nuclear Weapons: The Final Pandemic – Preventing Proliferation and Achieving Abolition" in London on October 3–4, 2007. Following the conference, a final edition of this monograph will be prepared by Lachlan Forrow, Victor W. Sidel, Jonathan E. Slutzman, and John Loretz, IPPNW Program Director. A summary of the conference and further material on the work by IPPNW and its affiliates and their medical student members on prevention of nuclear proliferation and achievement of abolition will be added. Suggestions for additions and corrections would be most welcome.

Medical personnel and medical organizations have played an important role in the efforts since 1945 to prevent the further use of nuclear weapons in war and to prevent their proliferation and achieve their abolition. This monograph updates and expands the article by Lachlan Forrow and Victor W. Sidel entitled "Medicine and Nuclear War: From Hiroshima to Mutual Assured Destruction to Abolition 2000" published in the *Journal of the American Medical Association* in 1998.[1] Much of the new material and analysis has been added by Jonathan E. Slutzman, a medical student of the Albert Einstein College of Medicine in the Bronx, New York, who has also managed the formatting of the text to printing.

The authors wish to thank the following individuals for their insight and comments on this monograph: Braden Allenby, Michael Christ, Felicity Hill, John Loretz, Jack Piachaud, and Gunnar Westberg. While these people certainly helped to bring this document to fruition, all responsibility for the final result lies with the authors.

The term "physicians" has different meanings in the United Kingdom, where it refers to medical doctors practicing internal medicine, and in the United States, where it refers to all medical doctors regardless of their medical specialties. The term will be used in this report in the way it is generally used in the United States.

Introduction

More than 60 years since nuclear explosions decimated the cities of Hiroshima and Nagasaki, the cities of the world have so far escaped any repeat of that unprecedented devastation. But today the world is at a crucial turning point, with many signs that we are at the threshold of a new era of possibly irreversible nuclear dangers. In the past decade, three new nuclear weapons states have emerged (India, North Korea, and Pakistan), joining the long-standing five acknowledged nuclear powers (China, France, Russia, United Kingdom, United States) as well as Israel (which has not acknowledged its arsenal). The 1968 Treaty on the Non-Proliferation of Nuclear Weapons, in which the non-nuclear weapons states agreed to forego nuclear weapons in exchange for a binding commitment of the nuclear weapons states to abolish their own arsenals over time, is under unprecedented stress. Authoritative voices have warned of the likelihood of the use of nuclear weapons by individuals or subnational groups (often termed "nuclear terrorism") in the near future if radical new steps are not immediately taken to dramatically increase the security of weapons and weapons-usable fissile materials.[2,3] Most ominous for the planet, though scarcely ever mentioned today, is that thousands of U.S. and Russian strategic nuclear weapons remain on hair-trigger alert, posing an utterly irresponsible and irrational threat not only to the very existence of those two nations, and to neighboring countries, but also, through global effects on climate, agriculture, and economies, to the survival of the majority of the world's people.

Twice before, massive, global grassroots protests, unusually powerful because they were rooted in careful medical and scientific documentation of the unparalleled threats posed by nuclear armaments, led to changes in nuclear weapons policies. In the late 1950s and early 1960s, protests against the atmospheric nuclear test explosions that were then poisoning the planet with radioactive fallout led to the Limited Nuclear Test Ban Treaty of 1963 that banned nuclear tests in the atmosphere, in space, or undersea. A crucial underpinning of these protests was the global education of citizens worldwide by doctors regarding the fangers of fallout. In the early 1980s, protests against the escalating threats by the U.S. and Soviet Union that they might attempt to fight and win a nuclear war led to the acknowledgment by President Reagan that "a nuclear war can never be won and must never be fought," [4] and to the passionately-expressed view of both Presidents Reagan and Mikhail Gorbachev that nuclear weapons should be abolished. In this, President Gorbachev acknowledged that once again doctors were crucial influences, writing in his book *Perestroika* that the work of International Physicians for the Prevention of Nuclear War

> commands great respect. For what they say and what they do is prompted by accurate knowledge and a passionate desire to warn humanity about the danger looming over it.
>
> In light of their arguments and the strictly scientific data which they possess, there seems to be no room left for politicking. And no serious politician has the right to disregard their conclusions.[5]

Both times, however, these outbursts of popular protest had only transitory impact on the overall nuclear danger. The Limited Test Ban

Treaty literally drove nuclear testing programs underground, and the rate of nuclear tests and weapons development actually increased. Despite the calming of the public rhetoric of the U.S. and Soviet Union in the 1980s, no fundamental change in their nuclear weapons policies ever took place, even with the end of the Cold War. As Nobel Peace laureate Dr. Albert Schweitzer, one of the most passionate and effective voices against nuclear weapons in the late 1950s and early 1960s, said: "Example is not the main thing in influencing others, it is the only thing." [6] As long as the U.S., Russia, and other nuclear weapons states insist that their own nuclear arsenals are essential for their security, others will inevitably seek similar arsenals.

Today, the world has a third and possibly final opportunity to end the threat of nuclear weapons definitively, before nuclear explosions again devastate cities, nations, or even the planet. The only real way this can be achieved is through a universal, verifiable, and enforceable treaty banning nuclear weapons from our world – a Nuclear Weapons Convention (NWC). Such a treaty has already been drafted, and has been accepted as an official UN document for international discussion. In April 2007, the 50th anniversary of Dr. Schweitzer's "Declaration of Conscience" that called on the people of the world to mobilize against atmospheric nuclear test explosions,[7] International Physicians for the Prevention of Nuclear War (IPPNW) launched a new global effort to abolish nuclear weapons through an NWC – the International Campaign to Abolish Nuclear Weapons (ICAN, "I Can Abolish Nuclear weapons").

This monograph is designed to provide the medical, scientific, and general policy background that physicians, other health professionals, and the general public need in order to advocate effectively for a Nuclear Weapons Convention. It reviews the extensive medical and scientific literature over the past six decades that has documented the medical dangers of the production, testing, and use of nuclear weapons. It also provides a brief review of nuclear weapons policy issues, and a framework for thinking about how to become involved in global efforts to achieve an NWC. While this study, in the interest of brevity, summarizes the experience in the United States and the United Kingdom, very important work has been done by physicians and medical students around the world. These efforts deserve and await more extensive reporting.

As described in more detail below, doctors played a crucial role in the activism of the 1950s, 1960s, and 1980s. Doctors are among the leaders of today's campaign to abolish nuclear weapons. But far, far more than physician involvement is needed if that campaign is to succeed. We therefore dedicate this monograph to all of our fellow citizens, from all sectors of society, and from all the nations of the world, who share our vision of a planet finally and permanently cured of the disease of nuclearism, and who with us will succeed in achieving it.

Nuclear bombing of Hiroshima and Nagasaki

Physicians first confronted the medical consequences of the use of nuclear weapons on August 6, 1945, when surviving medical personnel struggled to care for the massive casualties in the aftermath of the Hiroshima nuclear explosion:

> In a city of two hundred and forty-five thousand, nearly a hundred thousand people had been killed or doomed at one blow; a hundred thousand more

> were hurt. The people ... wept and cried, for Dr. Sasaki to hear, "Sensei! Doctor!".... Bewildered by the numbers, staggered by so much raw flesh, Dr. Sasaki lost all sense of profession and stopped working as a skillful surgeon and a sympathetic man; he became an automaton, mechanically wiping, daubing, winding, wiping, daubing, winding.[8]

Many of Dr. Sasaki's patients who survived the injuries caused by heat, fire, and blast soon developed the devastating features of acute radiation sickness: severe gastrointestinal problems, uncontrolled bleeding, hair loss, and extreme susceptibility to infection. With the city's medical facilities almost entirely destroyed, effective care was virtually impossible.[9]

Development of the nuclear bomb (called at that time an "atomic bomb") that caused the injuries with which Dr. Sasaki was suddenly confronted was initiated by a 1939 letter from Albert Einstein and Leo Szilard to President Franklin Delano Roosevelt warning that Nazi Germany might be able to produce nuclear weapons. The Einstein-Szilard letter ultimately led to formation of the $3 billion ($33 billion in 2007 dollars) Manhattan Project that developed and constructed three weapons,[10] each producing a nuclear explosion with a yield equivalent to about 10,000 to 20,000 tons (10 to 20 kilotons) of TNT. One of these bombs was used for a test in Alamogordo, New Mexico, on July 16, 1945, one to bomb the city of Hiroshima on August 6, and one to bomb the city of Nagasaki three days later, on August 9.

The work of the Manhattan Project, led by J. Robert Oppenheimer, included the establishment of headquarters and laboratories at Los Alamos, New Mexico, and of a nuclear reactor below the football field at the University of Chicago under the direction of Enrico Fermi, where the first controlled nuclear chain reaction took place. The physicists, engineers, and others working at Los Alamos devoted themselves to building the first nuclear weapons before such weapons could be built and possibly used by Nazi Germany. When Germany surrendered in April 1945 and no evidence of the successful development of nuclear weapons was found, Joseph Rotblat, a British physicist who had been recruited to work at Los Alamos, quit the project – the only member of the Manhattan Project to resign on moral grounds.

Many of those working at Los Alamos advised that a nuclear weapon should not be used to bomb a Japanese city, but should rather be detonated on an uninhabited island as a demonstration to Japan and the public of the power of the weapon and the futility and danger to Japan of continuing the war. Despite the fact that initial negotiations for the surrender of Japan had begun, the bombs were used on Japanese cities. The official reason given for their use was that it prevented an invasion of Japan that could have cost the lives of thousands of servicemen.[a]

The 12.5-kiloton bomb detonated in the air over Hiroshima decimated the city and created ground temperatures that reached about 7,000 degrees Celsius. Of the 76,000 buildings in the city, 92% were destroyed or damaged. There were more than 100,000 deaths and approximately 75,000 injuries among a population of nearly 250,000. Of the 298 physicians in the

[a]Later criticism of this use included the view that the bombs might not have been used had the targets been Caucasian rather than Asian and that the bombs were used geopolitically to attempt to end the war before the Soviet Union declared war against Japan.

city, 270 were dead or injured and 1,564 of 1,780 nurses died or were injured.[9]

The 21-kiloton bomb detonated in the air over Nagasaki three days later leveled 6.7 square kilometers (2.6 square miles). There were 75,000 immediate deaths and 75,000 injuries, with destruction of medical facilities and personnel and health consequences for the population of the city that were similar to those of Hiroshima.[9b]

As physicians in Japan and throughout the world subsequently learned, the "atomic bombs" detonated at Alamogordo, Hiroshima, and Nagasaki were based on the principle of nuclear fission. Atoms of fissile materials, such as the isotope of uranium (^{235}U) used in the bomb detonated over Hiroshima or of plutonium (^{239}Pu) used in the bomb over Nagasaki, when struck by neutrons split into smaller fragments with the release of neutrons that can cause additional atoms to be split. The fission of these atoms into smaller fragments leads to a minute loss of mass, which is converted into a massive amount of energy as Einstein had predicted in his conversion formula, $E = mc^2$.

The physical effects of nuclear weapons include a heat (thermal) wave, a blast wave, an electromagnetic pulse, the release of ionizing radiation, and the production of various isotopes, many of them radioactive. Specifically, the effects of a 10- to 20-kiloton nuclear weapon detonated at an altitude of 1 km include:

- At the center of the blast (ground zero or hypocenter) the overpressures are greater than 138 kiloPascals (kPa) (20 pounds per square inch (psi)), sufficient to destroy all but the skeletons of reinforced concrete structures.
- At approximately 1.0 km (0.6 miles) from the center of the blast, the overpressures are about 69 kPa (10 psi), sufficient to destroy all wood and brick-built structures.
- The blast not only destroys buildings but turns bricks, lumber, furniture, cars, and people into missiles. Overpressures on the order of 3 to 14 kPa (0.5 to 2 psi), which would prevail within 1.3–2.2 km (0.8–1.4 mi) of the hypocenter of a 1-kiloton blast, will turn a window into a thousand particles of glass traveling in excess of 160 km per hour (100 mi per hour).
- The earth below the hypocenter of the blast reaches approximately 7,000 degrees Celsius with a thermal wave transmitting up to 100 calories per square centimeter on the ground of the hypocenter and up to 2 cal/cm^2 on the ground 3.5 km (2.2 mi) away. Wood is charred up to 3.0 km (1.9 mi) away, and naked skin is burned up to 3.5 km (2.2 mi) away.
- After an initial phase of winds rushing out from the center of the blast, air rushes back vigorously, fanning the fires produced by the direct thermal radiation, creating a firestorm.
- In a densely populated area, immediate injuries include tens of thousands of burns, with many of them third degree. These occur on top of thousands of crush injuries due to collapsed buildings and blast-induced "missile" impact on human bodies. Hospital beds and medical supplies in the immediate area will have been destroyed and personnel

[b] While the effects on Hiroshima and its citizens have been meticulously and rigorously documented, those of Nagasaki have been somewhat less rigorously documented.

killed or disabled, resulting in few, if any, local medical resources being available.

- Many victims will suffer from ruptured organs (particularly lungs), penetrating trauma (due to the objects that were turned into missiles), fractured skulls, and compound fractures, both from physical objects striking people and from people themselves having been turned into missiles until they struck any hard object.
- A significant number of people would be deafened due to ruptured eardrums.
- Many people would be blinded. The initial flash of light at the start of a detonation bleaches retinal pigments causing flash blindness for up to 40 minutes. Much more seriously, viewing the fireball with the naked eye can cause more permanent damage, including retinal burns and scars in the visual field.

Additionally, nuclear detonations at higher altitudes (greater than 10 km or 6.2 mi) cause the release of an electromagnetic pulse (EMP), which would affect virtually all electrical and electronic equipment within line of sight of the detonation.

Radiation exposure would result from the initial radiation flux of neutrons and gamma rays and from the fallout of the radioisotopes produced by the detonation. In the immediate area of the nuclear explosion, the extent of radiation injury will be irrelevant since people will have been killed by the direct thermal and blast effects. Radiation poses a particular problem for rescuers attempting to assess the severity of injuries since there is no way, especially in the initial period, to know whether a person has received a moderate exposure and might survive with adequate care or has received a large exposure and will die regardless of what treatment is offered.

The combinations of the diverse injuries (burns, crush injuries, ruptured organs, fractures, extensive blood loss, and radiation exposure) would multiply the likelihood that injuries would be fatal.

A 2002 study published in the *British Medical Journal* estimated the casualites from a 12.5-kiloton nuclear explosion at ground level near the port area of New York City. The model projected 262,000 people would be killed, including 52,000 immediately and the remainder succumbing to radiation injuries. Caring for survivors would also be difficult, if not impossible, with the loss of 1,000 hospital beds in the blast and another 8,700 available beds in areas of high radiation exposure.[11] While an airburst would result in more physical destruction, a terrorist detonation would most likely be at ground level, generating greater radioactive fallout.

Post-Hiroshima Nuclear Weapons History and Medical Involvement

Widespread joy over the ending of World War II was tempered by profound disquiet over the awesome destructive power unleashed by the splitting of the atom. President Truman's initial reaction to news from Hiroshima – "This is the greatest thing in history!"[12] – evolved into doubts that humanity and nuclear weapons could safely co-exist. A "Trilateral Declaration" by the U.S., U.K., and Canada in November 1945 stated, "No system of safeguards that can be devised will, of itself, provide an effective guarantee against the production of atomic weapons bent on aggression."[13] A United Nations General As-

sembly resolution in 1946 called for a UN commission to prepare recommendations "for the elimination from national armaments of atomic weapons and of all other major weapons adaptable to mass destruction." [14]

A "scientists' movement" published the 1946 best-seller *One World or None*, and a top-level U.S. government committee urged a UN-enforced verifiable global ban on all nuclear weapons, stating that "Only if the dangerous aspects of atomic energy are taken out of national hands . . . is there any reasonable prospect of devising safeguards against the use of atomic energy for atomic bombs." [14,15] In June 1946, the Soviet Union rejected the U.S.-proposed "Baruch Plan," insisting upon U.S. destruction of its own nuclear arsenal (two warheads in November 1946) as a precondition for further steps. [14] The U.S. refused, and efforts to achieve abolition of nuclear weapons faded. [15–17]

In the absence of a global abolition regime, the U.S. embraced the position of the Manhattan Project military director, General Leslie Groves: "If there are to be atomic weapons in the world, we must have the best, the biggest and the most." [15] Government officials in nuclear weapons states regularly minimized dangers of radiation. [12,18] General Groves even testified before the U.S. Congress that radiation poisoning was "a very pleasant way to die." [15]

In 1950, the U.S. Federal Civil Defense Administration (FCDA) disseminated 16 million copies of a booklet titled "Survival Under Atomic Attack," with widespread media support. [15] Organized medicine joined as an active partner in civil defense planning. The American Medical Association, the U.S. Atomic Energy Commission, and the FCDA together brought physicians to leading medical schools for intensive training about organizing civil defense efforts in their home areas, and articles in the *Journal of the American Medical Association* (*JAMA*) and the *New England Journal of Medicine* (*NEJM*) advised physicians on how to prepare for a nuclear attack. [15,19–23]

Development of Thermonuclear Weapons

Spurred in part by the first Soviet test of a fission-based bomb in 1949, and despite opposition by J. Robert Oppenheimer and other physicists who had worked on development of nuclear fission bombs in the Manhattan Project, construction of bombs based on nuclear fusion (thermonuclear or hydrogen bombs) began at the order of President Truman in 1951. Weapons based on nuclear fusion involve forcing together atoms of two isotopes of hydrogen (deuterium and tritium) to form an unstable atom of helium, which then decays to an atom of stable helium. This loss of a tiny amount of matter generates even more energy than a fission bomb. Under the direction of Edward Teller, hydrogen bombs with yields of over 10 million tons (10 megatons) of TNT were produced, a yield almost one thousand times greater than the Hiroshima and Nagasaki bombs. The first explosive test took place in the Marshall Islands in the South Pacific on November 1, 1952. In March 1954, radioactive fallout from the test explosion of a U.S. hydrogen bomb at the Bikini Atoll caused severe radiation sickness to the crew of the Japanese fishing vessel Lucky Dragon 85 miles away, killing one crewman. [18] The Soviet Union conducted its own test of a true hydrogen bomb in 1955.[c]

Britain (1952), France (1960), and China (1964) soon conducted their own successful nu-

[c] In 1953, the Soviet Union tested a fusion-boosted fission bomb that was not infinitely scalable, which a true hydrogen bomb would be.

clear test explosions. Each nation argued that if others were to have nuclear weapons then they must also.[14]

Public opposition to nuclear testing and to the stockpiling of nuclear weapons mounted rapidly. The Russell-Einstein Manifesto was issued in London on July 9, 1955. The signers included 11 eminent scientists and academics, including Albert Einstein shortly before his death on April 18, 1955, censored physicist Joseph Rotblat, and Nobel laureate Linus Pauling. In 1957, Canadian industrialist Cyrus Eaton sponsored a conference called for in the manifesto in the town of Pugwash, Nova Scotia, to discuss prevention of a nuclear arms race, which led to the Pugwash Conferences on Science and World Affairs. Pauling, already a Nobel laureate in chemistry, was awarded the 1962 Nobel Peace Prize and Rotblat and the Pugwash Conferences were awarded the 1995 Nobel Peace Prize. Other medical voices that were heard included those of Dr. David Bradley and 1952 Nobel Peace laureate Dr. Albert Schweitzer.[15,18,24] On April 23, 1957, Dr. Schweitzer issued a "Declaration of Conscience," written at his hospital in Africa and read by the Chair of the Nobel Committee over Radio Oslo.[7] Broadcast in more than 50 countries in multiple languages, this appeal called on the people of the world to mobilize in opposition to the atmospheric nuclear test explosions that were then poisoning the planet. Large scale demonstrations followed, especially in Europe. In April 1958, Dr. Schweitzer issued three more appeals, now calling for the abolition of nuclear weapons.

The Medical Association for the Prevention of War (MAPW) was formed in the U.K. in 1951 as a response to the increasing threat of world war brought on by the Korean War and the risk of atomic warfare.[25] MAPW opposed all war and its program reflected the pacifist position of its founders. In 1958, the Campaign for Nuclear Disarmament was formed with broad civil support, dedicated to informing the public of the nuclear threat and urging unilateral nuclear disarmament. In the 1960s, a campaign of civil disobedience emerged from this, which included the imprisonment of philosopher Bertrand Russell.

By the early 1960s, U.S. and Soviet arsenals had grown to approximately 30,000 and 4,000 warheads respectively, with a combined explosive force of nearly four tons of TNT for every man, woman, and child on the planet.[26] In 1961, President Kennedy called for a massive U.S. fallout shelter program and *Life* magazine ran a lengthy article assuring readers that 97 out of 100 Americans would survive a nuclear war if only they built bomb shelters. Black and yellow "Fallout Shelter" signs were posted on public buildings and "duck and cover" drills were conducted throughout U.S. school systems.[15,18,27]

Medicine Confronts Nuclear Weapons, the Cold War, and Mutual Assured Destruction

The relationship of the medical profession to nuclear weapons policy changed abruptly in 1962. After the release of information on the physical effects of thermonuclear bombs and testimony in 1959 before the Joint Congressional Committee on Atomic Energy about a possible "limited" thermonuclear attack on the United States, a group of Boston physicians led by Dr. Bernard Lown and including Drs. Jack Geiger, David Nathan, and Victor Sidel analyzed the medical consequences of such an attack. The analysis demonstrated with precise scientific rigor the ways in which medical consequences would be far more horrific than the consequences of the Hiroshima and Nagasaki bombs. The series of papers, "The Medical Consequences of Thermonu-

clear War,"[28–32] published by this group, identified as the "Special Study Section of Physicians for Social Responsibility," occupied an entire issue of the *New England Journal of Medicine* and led to inquiries about Physicians for Social Responsibility (PSR) from hundreds of physicians in the United States and other countries.

The analysis documented in meticulous scientific detail the medical effects of even a "limited" attack on the U.S. involving thermonuclear explosions. Severe traumatic injuries and massive burns, combined with life-threatening radiation exposure, would kill 1,300,000 people in the Boston area alone on the first day, with another 1,250,000 injured. With widespread destruction of health care facilities, approximately 1,000,000 of these injured would die. The authors concluded that attempted responses by health professionals after nuclear weapons had exploded would be almost entirely futile and that proposed civil defense efforts offered little benefit. The articles and an accompanying editorial[33] argued that physicians, because of their special knowledge of the medical effects of these weapons and because of their special responsibility to protect the health of their patients and their communities, had a special responsibility to help prevent the use of nuclear weapons. The articles gained worldwide attention and PSR grew rapidly. In October 1962, the Cuban Missile Crisis brought the world to the brink of actual nuclear war.[34] Public concern about nuclear weapons rose to new heights.

During the early 1960s, atmospheric testing of nuclear weapons continued, despite the protests of Dr. Schweitzer and others. Collection of deciduous teeth of children, in which PSR participated, documented increasing levels of ^{90}Sr, a component of radioactive fallout, in those teeth of children in the U.S. and Europe.[35–37] Doctors and others demonstrated that after each atmospheric test, radioactive ^{131}I appeared on the grass on which cattle grazed, was in the milk drunk by children, and was concentrated in the thyroid glands of children. These rigorously documented threats to health supported steadily growing grassroots international protests and in 1963 the United States, the United Kingdom, and the Soviet Union signed the Limited Test Ban Treaty (LTBT), banning nuclear test explosions in the atmosphere, in space, or undersea.

In actuality, the pace of nuclear test explosions afterward increased, with more than one thousand additional tests over the next two decades.[38] The nuclear arms race had not slowed, it had simply disappeared from public view. It had, literally, gone underground.[15]

After the 1963 Limited Nuclear Test Ban Treaty entered into force, many of those most actively and passionately protesting nuclear weapons turned their attention to concerns about the Vietnam War.[15] The U.S.-Soviet nuclear confrontation appeared to have settled into an uneasy era of "nuclear deterrence" through "mutual assured destruction."[39] "MAD" turned out to be quite different from a steady equilibrium state: from 1970 to 1984, the Soviet strategic nuclear arsenal increased from 1,400 warheads to 7,900, while that of the United States increased from 2,200 to 7,400.[40] Furthermore, the underground testing programs permitted by the LTBT led to the development of progressively lighter and more compact hydrogen bombs. These made possible the creation of multiple independently-targeted re-entry vehicles (MIRVs), through which up to 16 warheads could be delivered with great accuracy by a single ballistic missile. MIRVs in turn raised the specter of a possible disarming "first strike" and sparked increased reliance on extremely danger-

ous hair-trigger, "use them or lose them" launch-on-warning policies.[41,42]

The Soviet invasion of Afghanistan in 1979, President Carter's subsequent decision to withdraw the SALT II treaty from the U.S. Senate ratification process, and NATO plans to place Pershing II and cruise missiles in Europe as "theater nuclear weapons" combined to re-ignite public opposition to nuclear weapons. Of greatest concern was growing evidence of superpower plans for nuclear war.

In 1976, U.S. Secretary of Defense James Schlesinger and others warned that the Soviet Union was determined to be able to fight and prevail in a nuclear war and urged a large scale expansion of U.S. nuclear forces and expanded civil defense preparations.[43–45] In an influential 1980 article titled "Victory is Possible," future Reagan Defense Department adviser Colin Gray wrote that "the United States must possess the ability to wage nuclear war rationally .... Once the defeat of the Soviet state is established as a war aim, ... an intelligent U.S. offensive strategy, wedded to homeland defense, should reduce U.S. casualties to approximately 20 million ...."[46]

Concerned by these developments, in 1980 Dr. Bernard Lown of the U.S. and Dr. Evgueni Chazov, a renowned cardiologist and Deputy Minister of Health of the U.S.S.R., joined with other colleagues in founding International Physicians for the Prevention of Nuclear War (IPPNW). IPPNW physicians disseminated updated information about the medical effects of nuclear explosions in the West and in the Soviet Union, consistently underscoring the near-total inability of the medical profession to provide effective care in the aftermath of a nuclear attack.[47–54] Insisting that physicians and others could and must transcend all other political or national differences to work together for mutual survival, IPPNW grew rapidly, with affiliate organizations in over 60 countries, and gained support from prominent leaders of medicine worldwide.[55–63]

In the same week that IPPNW held its first World Congress at Airlie House, Virginia, in March 1981, Richard Pipes, President Reagan's senior adviser on the Soviet Union, warned publicly that Soviet leaders would "have to choose between peacefully changing their Communist system ... or going to war."[64] The following year, Reagan proposed a $4.3 billion civil defense program centering on "crisis relocation" of America's urban population. The U.S. Federal Emergency Management Agency (FEMA) estimated that with effective evacuation over a period of four to seven days, proper sheltering, and other civil defense measures, 80% of the U.S. population could survive a large-scale nuclear attack.[64] In 1984, PSR (IPPNW-USA) published *The Counterfeit Ark*, a point-by-point technical refutation of the claimed effectiveness of FEMA's U.S. civil defense plans, combined with a moral condemnation of nuclear war-fighting plans: "To accept the survival of 80% of the U.S. population as a reasonable policy goal is also to accept as reasonable the deaths of 45 million people."[65] FEMA's plans were soon widely discredited.

In striking contrast to its partnership in government civil defense planning in the 1950s, the 1980s opposition of U.S. physicians to preparations for nuclear war was strong and decisive. The AMA Board of Trustees passed a landmark resolution, stating: "Available data reveal that there is no adequate medical response to a nuclear holocaust." The resolution concluded that the AMA should "inform the President and the Congress of the medical consequences of nuclear war so that policy decisions can be

made with adequate factual information."[66] For many years, *JAMA* devoted the first issue of each August, in commemoration of the anniversary of Hiroshima and Nagasaki, to articles related to nuclear weapons and related subjects of war, conflict, and human rights.[55] In response to the decision to deploy U.S. cruise missiles in Britain, the Medical Campaign Against Nuclear Weapons (MCANW) was formed in the U.K. in 1981, and published "The Medical Consequences of Nuclear Weapons." Other national medical organizations, such as the British Medical Association (BMA), published detailed studies about the inadequacies of medical care after nuclear attack, but like the AMA refrained during the Cold War from making specific policy recommendations regarding how nuclear war might best be prevented.[67,68]

As the 1980s progressed, scholarly reports by the World Health Organization (WHO), the Institute of Medicine (IOM) of the U.S. National Academy of Sciences, and others described previously unsuspected dangers of nuclear warfare.[69–71] Scientists warned that a superpower nuclear war might cause a "nuclear winter" that could threaten the extinction of the human species,[72] leading Jonathan Schell to reflect in *The Fate of the Earth* about the unprecedented grave medical and moral challenges of the nuclear weapons era.[73] Even the more modest temperature drop predicted by subsequent calculations would cause serious disruptions of agriculture.[74] Mass starvation and illness resulting from disruption of agricultural, transportation, industrial, and health care systems would cause between one and four billion deaths worldwide.[75] A recent study showed that even a regional-scale nuclear conflict, such as one between India and Pakistan, could result in approximately 21 million deaths and significant climate effects, including reduction of the growing season almost globally.[76] The prevention of nuclear war thus became a matter of urgent and shared importance for every nation on earth – nuclear or non-nuclear, rich or poor, north or south.

Awarding the 1985 Nobel Peace Prize to IPPNW, the Nobel Committee honored physicians for "spreading authoritative information and ... creating an awareness of the catastrophic consequences of atomic warfare. This in turn contributes to an increase in the pressure of public opposition to the proliferation of nuclear weapons ...."[77,78] Mikhail Gorbachev stressed the unique effectiveness of IPPNW regarding nuclear weapons: "In light of their arguments and the strictly scientific data which they possess, there seems to be no room left for politicking."[5]

In 1985 President Reagan and Mikhail Gorbachev jointly proclaimed that "a nuclear war cannot be won and must never be fought."[5] On January 15, 1986, Gorbachev proposed a fifteen-year plan for the stage-by-stage elimination of nuclear weapons by the end of the twentieth century. At their summit meeting in Reykjavik in October 1986, Gorbachev and Reagan seriously discussed nuclear abolition, but a tentative agreement to eliminate all strategic offensive weapons within five years fell apart when Reagan would not agree to permanent adherence to the Anti-Ballistic Missile (ABM) treaty, since that would foreclose plans for his Strategic Defense Initiative ("Star Wars").[5d]

[d]While Reagan did not subsequently publicly push for nuclear abolition, his Secretary of State George Shultz later reported that Reagan had become a committed nuclear abolitionist, considering nuclear weapons "totally irrational, totally inhumane, good for nothing but killing, [and] possibly destructive of life on earth and civilization."[79]

Life Cycle Assessment of Nuclear Weapons

Most studies and reviews of nuclear weapons and their effects have focused almost exclusively on what would happen if they were used. Notably, though, this represents only one phase in the life cycle of nuclear weapons. It is true that in the event a nuclear weapon is deployed (detonated), the sum of its effects would collapse into the use phase, with the impacts from all other phases becoming *de minimis*. Thankfully no nuclear weapons have been used since the atomic bombings of Hiroshima and Nagasaki. This does not mean that their impacts have not been felt.

The existence of radioactivity and the health effects of ionizing radiation have been known for over a century, thanks to the work and sacrifice of Henri Becquerel and Marie and Pierre Curie. These direct health effects of radioactivity are a typical starting point for assessing the impacts of nuclear weapons and their production, but they are certainly not the only concern.

Life cycle assessment (LCA) is a tool used primarily to estimate the complete environmental and health impacts of a product or process from "cradle to grave." The purpose is to be able to understand the direct and indirect impacts of all aspects of a product's life, including raw material acquisition, manufacture, finishing, transport, use, and disposal. Applying the LCA rubric to nuclear weapons results in the need to review

1. uranium mining, milling, conversion, and enrichment,
2. plutonium production and separation,
3. nuclear fuel transport,
4. other raw material production,
5. weapon assembly,
6. weapon transport,
7. weapon storage,
8. weapon testing,
9. weapon maintenance and refurbishment,
10. weapon use,
11. weapon disassembly and disposal, including recycling or disposal of all component parts,
12. production, transport, and storage security, and
13. many other aspects, including all the indirect impacts associated with the above items (*i.e.*, energy to run equipment, manufacture of task-specific machinery, construction of weapon delivery systems, etc.).

Completion of a rigorous LCA of nuclear weapons has not actually been done, primarily due to the security issues involved and the complex coupling of material flows between civilian and military nuclear programs. (An LCA would require knowledge of production methods in order to assess direct and indirect impacts of those particular processes, including individual chemicals involved.) A book-length analysis by Makhijani et al. [80] and published under the auspices of IPPNW and The Institute for Energy and Environmental Research provides the most comprehensive available study of the health and environmental aspects of nuclear weapons development but falls far short of a complete LCA.

Nuclear weapons present hazards in virtually all areas of their life cycle. Production and testing have their own impacts. The U.S. National Cancer Institute estimated that the release of ^{131}I in fallout from U.S. nuclear test

explosions was by itself responsible for 49,000 excess cases of thyroid cancer among American citizens.[81] A 1991 IPPNW study estimated that the ^{90}Sr, ^{137}Cs, ^{14}C, and ^{239}Pu released worldwide in all nuclear test explosions would be responsible for 430,000 cancer deaths by the year 2000.[82] Makhijani et al.[80] summarized additional widespread health and environmental effects of nuclear weapons production with massive contamination of land by radioactive materials and toxic chemicals.

Epidemiological studies in the last eight years have indicated serious health effects on individuals exposed as a result of nuclear weapons testing and manufacture.[83–90] A reevaluation of the relationship between Nevada Test Site fallout and thyroid disease showed a greater than previously thought excess risk for thyroiditis at a rate of 4.9 per Gy of exposure.[89e] In addition, mortality and morbidity of United Kingdom and New Zealand military personnel involved in nuclear tests in the 1950s and 1960s was found to be worse than those who were not involved.[83] Radioactive material releases from the Mayak nuclear weapons facility in Russia contaminated the region surrounding the Techa River and led to an additional risk of leukemias (excluding chronic lymphoid) of 4.6 times the background risk per Gy of exposure.[88]

A small study of female nuclear weapons workers in the United States showed significantly higher odds of death from dementia.[85] Although this was a single small cohort, it did establish a basis of association and could lead to research attempting to confirm the conclusion. Other studies have shown an increase in risk of developing leukemia (excluding chronic lymphocytic) associated with low doses of ionizing radiation such as those received by nuclear weapons workers.[90–93] Current U.S. government rules regarding compensation of former nuclear weapons workers who develop cancer disqualify any worker with chronic lymphocytic leukemia (CLL), claiming that CLL is not radiation-induced. One study, however, indicates that it is possible, if not probable, that even CLL can be caused by ionizing radiation.[86] Non-cancer effects of plutonium exposure have also been found, with a significantly greater incidence of pulmonary fibrosis among plutonium-exposed workers compared to unexposed workers.[87]

One study of the molecular genetic effects of densely ionizing radiation found that, in contrast to chemical mutagens, x-rays, or endogenous aging processes, α particles and neutrons produce much more intrachromosomal rearrangements and deletions, and that these changes tend to be stable (*i.e.*, are passed to successive cellular generations). More than half of all cells in former plutonium workers were estimated to contain detectable intrachromosomal aberrations.[84] The health effects of these abnormalities are uncertain, and additional research is needed to answer that question.

Mental health may also be impacted by fear of nuclear war. A five-year follow-up study in Finland showed a significant risk of common mental health disorders associated with a self-reported fear of nuclear war.[94] This study, however, could not distinguish between fear of nuclear war having a causal relationship with mental disorders as opposed to being a risk indicator.

Impacts are not limited to human health, as the natural environment also suffers from nuclear weapons production. From 1945 to 1990, the

[e]The Gray (Gy) is the SI unit of absorbed radiation dose. It is equal to one Joule per kilogram of target mass. For x- and γ-rays, one Gy equals one Sievert (Sv).

United States produced approximately 70,000 nuclear weapons; other nations also produced many of these weapons. Production of nuclear weapons has led to major environmental contamination.[95] For example, the area around Chelyabinsk in Russia has been heavily contaminated with radioactive materials from the nuclear-weapons production facility in that area. The level of ambient radiation in and near the Techa River has been documented as high as 28 times the normal background radiation level. Leakage of radioactive materials from storage of wastes from nuclear-weapons production at Hanford, along the Columbia River in Washington State, has led to extensive radioactive contamination.[96] Open-air testing of nuclear weapons by the United States, the Soviet Union, and other countries in the 1950s and early 1960s resulted in environmental contamination, with increased rates of leukemia and other cancers among populations who were downwind from these tests.[82,89]

Disassembly and disposal of nuclear weapons has also led to environmental contamination. The primary site for the disassembly of U.S. nuclear weapons is the Pantex Plant, located 17 miles northeast of Amarillo in the Texas panhandle. Overall, the United States has dismantled about 60,000 nuclear warheads since the 1940s. More than 12,000 plutonium pits (hollow shells of plutonium encased in steel or other metal that are essential components of nuclear weapons) are stored in containers at Pantex. Plutonium, an element first produced in Manhattan Project reactors in 1942, has a half-life of 24,000 years.[f]

These studies do not even minimally address the remaining life cycle aspects of nuclear weapons, namely raw materials acquisition, transport at all points in the supply chain, and storage. Additionally, these studies do not fully assess and quantify the direct and indirect effects. It is likely that these areas carry additional environmental and human health impacts that are not yet fully quantified.

Current Status of Nuclear Weapons

With the euphoria that accompanied the 1989 fall of the Berlin Wall and the end of the Cold War, public anti-nuclear concerns again dissipated rapidly, exactly as had happened after the LTBT in 1963. At the same time, in the U.K., MAPW and MCANW merged to form Medact in 1992, addressing the related barriers to health of war, nuclear weapons, and the environmental damage they cause. Again, however, dangers from nuclear weapons continue.

Despite some reductions, approximately 27,600 nuclear warheads remain in today's arsenals.[97] Although nuclear weapons are often alleged to be a relatively inexpensive source of military strength, a 1995 Brookings Institute study concluded that between 1940 and 1995 the cost of the U.S. nuclear arsenal was approximately $4 trillion, roughly the same as the entire U.S. national debt at the time.[10,98] During the Cold War, the U.S. spent, on average, $4.2 billion per year on nuclear weapons activities, while in 2004, however, the National Nuclear Security Administration (NNSA)[g] spent $6.9

[f] Plans are underway to produce as many as 80 new pits annually at Los Alamos National Laboratory. The Bush administration has proposed building a modern pit facility capable of producing 250 to 900 pits annually by 2018 as part of the Reliable Replacement Warhead and Complex 2030 programs.[95]

[g] NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for developing, constructing, maintaining, and disassembling nuclear weapons. The agency also is charged with nonproliferation tasks including securing weapons-grade materials

billion (adjusted for inflation).[99h]

Astonishingly, dangerous Cold War launch-on-warning procedures also remain in place, with many warheads still on high-alert and ready to launch within minutes. An April 1998 study reported that the risk of "accidental" nuclear war was increasing, as a result of deterioration in Russian computer and radar systems. The study estimated that an "accidental" or unauthorized nuclear attack by even a single Russian submarine would likely cause at least 6.8 million immediate U.S. deaths in urban firestorms, even though concrete steps to eliminate that danger are available.[100]

The world is in a state of both horizontal and vertical proliferation. Horizontal proliferation is the acquisition of nuclear weapons, or the fissile materials and the technology to make them, by nation-states or by non-state groups or individuals that did not previously have them. Examples include the acquisition or development of nuclear weapons by North Korea, India, Pakistan, and allegedly Iran. Vertical proliferation is the expansion or improvement of an existing nuclear power's arsenal by increasing the number, type, or reliability of its nuclear warheads or the number, types, reliability, or range of the missiles, submarines, or planes designed to deliver nuclear weapons.

The May 1998 series of Indian and Pakistani nuclear test explosions sparked fears both of a South Asian nuclear war and of an unraveling of global efforts to prevent nuclear proliferation and to implement the Comprehensive Nuclear Test Ban Treaty (CTBT). For the first time in 15 years, one year after the nuclear tests, both countries mobilized large military forces. Reiterating its opposition to the perpetuation of "nuclear apartheid," under which the five permanent members of the UN hold tightly to their own nuclear arsenals while denying them to all others, India has repeatedly called for a serious global commitment to nuclear abolition.[101,102] Physicians in both countries have also led campaigns to prevent a nuclear war in the region, attempting to build public opinion against nuclear weapons and in favor of directing funding to education, sanitation, and other essential services.[103]

Risks of horizontal proliferation also include the possibility of nuclear terrorism by subnational groups.[11,104–106] An authoritative book has concluded that "With the end of the Cold War ... the risk of a nuclear detonation on American soil has increased .... [T]he leakage of weapons-usable nuclear materials from the former Soviet Union is already occurring and could easily get worse in frequency and magnitude .... [N]o reality of the post-Cold War international environment constitutes a more direct threat [to U.S. security]...."[106] The U.S. National Intelligence Estimate judges that al-Qa'ida will continue to attempt to procure nuclear weapons or weapons-grade nuclear materials and then use those capabilities.[107] Other terrorist organizations are also feared to be trying to acquire nuclear weapons. With reduced controls over nuclear sites and materials in the former Soviet Union and increased desire to obtain weapons of mass destruction by terrorists and rogue states,

overseas and with providing nuclear power for naval vessels. NNSA spending does not include costs incurred by other agencies, including the Department of Defense, for deployment of nuclear weapons.

[h]Figures for total nuclear weapon expenditures between 1940 and 1995 include additional programmatic costs that were not included in the Paine[99] study. As a result, the two sets of figures are not directly comparable, except to say that the $4.2 billion and $6.9 billion per year figures represent a subset of activities covered by the $4 trillion figure.

it is likely that the threat of a nuclear detonation slaughtering tens of thousands of residents of an urban area has only increased in recent years.[11]

In addition to traditional nuclear weapons that rely on nuclear fission or fusion, nuclear materials can be used to produce other dangerous weapons.[i] "Dirty bombs" release radioactive materials without a nuclear explosion. They can take the form of conventional explosives mixed with radioactive materials or of an attack on a nuclear power plant that scatters radioactive materials. Dirty bombs are technologically easier to construct and require a smaller quantity of radioactive material, which makes them potentially more likely to be employed in a terrorist attack.

At the same time, there are signs that the United States is leading the way toward a new vertical proliferation regime. In its 2002 Nuclear Posture Review, the U.S. Department of Defense outlined plans to develop and deploy small nuclear weapons ("mini-nukes") and nuclear earth-penetrating weapons ("bunker busters") that would blur the line between nuclear weapons stockpiled for "deterrence" against nuclear attack (the so-called "mutual assured destruction" strategy) and nuclear weapons available for actual use in "war-fighting." The report expressed the expectation that the U.S. would reduce operationally deployed nuclear warheads to 1,700 to 2,200, but also said that the resumption of nuclear testing may be required to make new weapons and ensure the reliability of existing systems.[109] The Bush Administration has proposed establishment of a "Reliable Replacement Warhead" program to be based in a new "Complex 2030," but both these programs and further work on small nuclear weapons and on nuclear earth-penetrating missiles were delayed in 2007, at least temporarily, by the refusal of U.S. congressional committees to allocate financing for their development. The U.S. Secretaries of Energy, Defense, and State issued a statement in July 2007 that reiterated the administration's plans for maintaining a nuclear deterrent of 1,700 to 2,200 operationally-deployed warheads and implementing the Reliable Replacement Warhead program to ensure extensive service lives.[110]

The United Kingdom is also planning to invest £1 billion to update its Atomic Weapons Establishment at Aldermaston, and up to £20 billion to maintain its Trident warhead stockpile and replace one or more of its four nuclear-armed Vanguard Class submarines, each of which can carry Trident D5 nuclear missiles. Russia has announced plans to maintain or improve its nuclear arsenals and delivery systems, and Pakistan may be expanding its nuclear program.

The *Bulletin of the Atomic Scientists* cited "a renewed U.S. emphasis on the military utility of nuclear weapons" in addition to North Korea, Iran, and global nuclear material security when they moved the "Doomsday Clock" to 5 minutes to midnight – the closest to "Doomsday" it has been since 1984.[111,112]

[i] Some consider depleted uranium (DU) to be a type of nuclear weapon. DU is uranium from which the isotope usable for nuclear weapons or as fuel rods for nuclear power plants (^{235}U) has been removed, and is used militarily as a material for armor and in armor-piercing ammunition. DU is not a nuclear weapon and presents less of a radioactive threat outside of the body than naturally occurring uranium. A 2001 review concluded "that at any conceivable level of uptake depleted uranium will have no appreciable radiological or chemical carcinogenic potential" and that "the only chemical toxic effect expected would be reversible damage to the kidney."[108] Others, however, have pointed to the inhalation of gaseous DU and the lodging of particles in the lungs and other tissues as unique hazards related to DU weapons that have been inadequately studied.

Current Nuclear Weapons Treaties, Calls for Prevention of Proliferation, and Achieving Abolition

Unlike the implementation of treaties banning chemical weapons and biological weapons, there is no comprehensive treaty banning the use or mandating the destruction of nuclear weapons. Instead, a series of overlapping incomplete treaties have been negotiated. The Limited Test Ban Treaty (LTBT) of 1963, promoted in part by concerns about radioactive environmental contamination, banned nuclear tests in the atmosphere, underwater, and in outer space.[j] As described above, the LTBT was the first international agreement that attempted to control the testing of nuclear weapons and was signed by the United States, the United Kingdom, and the Soviet Union. The LTBT was initiated by President John F. Kennedy when evidence was presented on fallout of radioisotopes after each explosive nuclear test in the atmosphere. Collection of deciduous teeth in the United States demonstrated the deposition of ^{90}Sr in teeth and surveys of pasture land on which cattle grazed demonstrated the presence of ^{131}I, which appeared in the milk of cows and goats and was concentrated in the thyroid glands of children who drank the milk. The U.S. National Cancer Institute in 1997 published a study on the risk of development of thyroid cancer from the ^{131}I fallout from the nearly 100 atmospheric nuclear bomb tests during the 1950s and the 1960s; it estimated that 17,200 new cases of thyroid cancer would develop annually, or about 1.2 million thyroid cancers over a 70-year span.[69]

[j] India conducted an atmospheric nuclear explosive test in 1974, but those in other countries, including the 1998 tests by India and Pakistan, have been conducted underground or by simulation.[70]

The expansion of the LTBT, the Comprehensive Nuclear Test Ban Treaty (CTBT), a key step towards nuclear disarmament and preventing proliferation that would ban all explosive testing of nuclear weapons, including those underground, was opened for signature in 1996 and has not yet entered into force. While it bans nuclear explosions, for either military or civilian purposes, it does not ban computer simulations and "subcritical" tests, which some nations rely on to maintain the option of developing new nuclear weapons.[k] As of 2007, the CTBT had been signed by 177 nations and ratified by 139. Entry into force requires ratification by the 44 nuclear-capable nations, of which 34 had ratified it by mid-2007. The ten remaining nuclear-capable nations are China, Colombia, North Korea, Egypt, India, Indonesia, Iran, Israel, Pakistan, and the United States.

ABM Treaty

In 1972, the Treaty on the Limitation of Anti-Ballistic Missile Systems between the United States and Soviet Union was signed in Moscow. It was ratified by the U.S. Senate and entered into force soon afterward. The ABM Treaty, by limiting defensive systems that would otherwise spur an offensive arms race, had been seen as the foundation for the strategic nuclear arms reduction treaties. The United States and the Soviet Union signed a protocol to the treaty, which entered into force in 1976, that reduced the number of ABM deployment areas from two to one – deployed either around each party's national capital area or at a single ICBM deployment area. The Soviet Union deployed an ABM system around Moscow, but the United

[k] A subcritical test is one using a mass of fissile material that is not sufficient to sustain a chain reaction.

States elected not to deploy an ABM system around Washington, D.C., and, in 1976, deactivated its site at Grand Forks, North Dakota, around a Minuteman ICBM launch area. The treaty had subsequently been extensively modified by amendment and various common understandings and protocols. In order to permit work on a national missile defense system, President Bush announced in late 2001 that the United States would withdraw from the ABM Treaty within six months and gave formal notice, stating that it "hinders our government's ability to develop ways to protect our people from future terrorist or rogue-state missile attacks." [113]

U.S. withdrawal from the Anti Ballistic Missile (ABM) Treaty on June 13, 2002, was one of the most important examples of another type of vertical proliferation. The treaty, which had been in effect since 1972, kept both the United States and the Soviet Union (and then Russia) from developing national missile defense systems. It was designed to permit both nations to have confidence that they did not need to stockpile additional nuclear missiles or more powerful nuclear missiles to overcome new missile defense systems. After the withdrawal of the United States from the treaty and the announcement of plans by the U.S. to deploy ten interceptor missiles in Poland and a radar system for missile defense in the Czech Republic, Russia tested a new multiple-warhead intercontinental ballistic missile (ICBM). In one of the tests, a prototype of a new ICBM, the RS-24, was fired from a mobile launcher at the Plesetsk launch site in northwestern Russia; its test warhead landed on a target 3,400 miles away on the Kamchatka Peninsula in the far eastern part of the country. Russia also tested a new cruise missile based on the existing short-range Iskander missile. The new cruise missile, R-500, will have a range of up to 310 miles, the limit under a Soviet-era treaty that banned intermediate-range missiles. Russian President Vladimir Putin and other officials have called that treaty outdated but have not said Russia would opt out of it.

President Putin described the tests as part of the Russian response to the planned deployment of new U.S. military bases and missile defense sites in eastern Europe and warned that the planned U.S. missile shield for Europe could initiate a new arms race and turn the region into a "powder keg." Russia contends that the new system threatens the strategic balance of forces in Europe by weakening Russia's ability to retaliate against an offensive strike. Deploying a new missile capable of carrying multiple nuclear warheads could allow Russia, it claimed, to maintain nuclear parity with the United States despite having to gradually decommission Soviet-built ICBMs. President Putin also warned that Russia could take "retaliatory steps" in aiming nuclear weapons at U.S. military bases in Europe. President Bush denied that missile defenses in Europe pose a threat to Russia. On June 5, 2007, China joined Russia in warning that the U.S. plan to build a missile defense system in Europe could set off a new arms race. The Chinese Foreign Minister said the U.S. system may "give rise to a proliferation problem."

Non-Proliferation Treaty and Proliferation Today

The Treaty on the Non-Proliferation of Nuclear Weapons (the "Non-Proliferation Treaty" or NPT) was opened for signature in 1968 and entered into force in 1970. The five nuclear-weapon states recognized under the NPT – China, France, Russia, the United Kingdom, and the United States – are parties to the

treaty, and it obligates them not to transfer nuclear weapons, other nuclear explosive devices, or their technology to any non-nuclear weapon state. Non-nuclear weapon state parties undertake not to acquire or produce nuclear weapons or nuclear explosive devices. They are required also to accept safeguards to detect diversions of nuclear materials from peaceful activities, such as power generation, to the production of nuclear weapons or other nuclear explosive devices. This must be done in accordance with an individual safeguards agreement, concluded between each non-nuclear weapon state party and the IAEA. Under these agreements, all nuclear materials in peaceful civil facilities under the jurisdiction of the state must be declared to the IAEA, whose inspectors have routine access to the facilities for periodic monitoring and inspections. If information from routine inspections is not sufficient to fulfill its responsibilities, the IAEA may consult with the state regarding special inspections within or outside declared facilities. In exchange for the non-nuclear weapons states' commitment not to develop or otherwise acquire nuclear weapons, the NPT commits the nuclear-weapon states to good-faith negotiations on nuclear disarmament.

The treaty entered into force in 1970. China and France acceded to it in 1992. In 1996, Belarus joined Ukraine and Kazakhstan in removing and transferring to the Russian Federation the last of the remaining former Soviet nuclear weapons located within their territories, and each of these nations has become a state party to the NPT, as a non-nuclear weapon state. In 1997, Brazil became a state party to the NPT.

The NPT is the most widely-accepted arms control agreement. By mid-2007, a total of 188 state parties (nations) had ratified the treaty. With the accession of Cuba in 2002, Israel, India, and Pakistan were the only major nations that were not members of the NPT until North Korea withdrew in 2003. India and Pakistan acquired nuclear weapons capability during the 1990s, while remaining outside the NPT. Israel retains a significant nuclear weapons capability, estimated at 80 to 200 weapons, also outside the NPT. North Korea has acquired a small number of nuclear weapons and Iran may be attempting to do the same.[114]

State party governmental transfers of nuclear weapon technology or unsafeguarded nuclear materials to any non-nuclear weapon state are prohibited under the NPT. In 1994, the United States and North Korea signed an "Agreed Framework," bringing North Korea into full compliance with its non-proliferation obligations under the NPT. North Korea affirmed its NPT member status and committed to allow implementation of its IAEA safeguards agreement. In 2003, North Korea withdrew from the NPT, but as of mid-2007 negotiations to bring North Korea back into compliance have been continuing.[115]

Every five years since 1970 the state parties have held a review conference to assess implementation of the treaty. In accordance with the NPT, more than 170 countries attended the 1995 NPT Review and Extension Conference in New York. Three decisions and one resolution emanated from the conference. First, the NPT was extended for an indefinite duration and without conditions. Second, Principles and Objectives for Nuclear Non-Proliferation and Disarmament were worked out to guide the parties to the treaty in the next phase of its implementation. Third, an enhanced review process was established for future review conferences. Finally, a resolution endorsed the establishment of a zone free of weapons of mass destruction in the Middle East. The review conference in 2000

identified and approved practical steps towards the total elimination of nuclear arsenals (see Appendix I). A 13-point plan that lists "practical steps" for implementing Article VI of the NPT was adopted at the 2000 Review Conference. The plan includes both bilateral and multilateral negotiations, methods to control transfer of fissile material, and ways to proceed toward nuclear disarmament. But there has been little progress in implementing these "practical steps" that had been agreed to five years before or in progress toward ending reliance on nuclear weapons by the nuclear-weapons states.[116–118]

The 2005 review failed as a result of political issues. Subsequently the U.S. and India entered into an agreement that would permit the U.S. to sell fuel and nuclear technology to India. The agreement requires legislative approval by the Congress, which in July 2006 had still not approved. Some analysts contend that the agreement would undermine the NPT by providing benefits that are currently reserved for state parties to the NPT, which India has not joined. This was widely condemned as yet another dangerous weakening of the NPT. The next NPT Review Conference is scheduled for 2010.

Some non-nuclear weapon states have been able to obtain sensitive technology or equipment from private parties in states that are not state parties to the NPT. One example is the sharing of nuclear weapons secrets by Abdul Qadeer Khan, respected as "the father of the Pakistani nuclear weapons program," who has confessed to sharing nuclear technology with Iran, Libya, and North Korea. Over the past decade, serious international concerns have arisen over the nuclear weapons development programs of Iran and North Korea, which, if they exist, are in direct contravention of their obligations under the NPT and in breach of their obligations under IAEA Safeguards Agreements.

Iran was found to be in noncompliance with its safeguard arrangements by the IAEA Board of Governors for misdeameanors of the past when Iran was seeking weapons, meeting with the Khan network, and had various nuclear isotopes in the country from China. Iran insists that its nuclear development program is designed for production of power rather than for production of fissile material for nuclear weapons.

World Court Rules Nuclear Weapons Violate International Law

Under the NPT, the nuclear weapon states assumed an obligation to pursue nuclear disarmament in good faith. In July 1996, the International Court of Justice handed down an Advisory Opinion on the request made by the General Assembly of the United Nations and by the World Health Organization on the legality of the use by a state of nuclear weapons in armed conflict. The court ruled unanimously that a threat or use of force by means of nuclear weapons (1) "that is contrary to Article 2, paragraph 4 of the United Nations Charter and that fails to meet all the requirements of Article 51 is unlawful"; and (2) "should also be compatible with the requirements of the international law applicable in armed conflict particularly those of the principles and rules of international humanitarian law, as well as with specific obligations under treaties and other undertakings which expressly deal with nuclear weapons." In a split decision, the court stated that "in view of the current state of International Law, and of the elements of fact at its disposal, the court cannot conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defense, in which the

very survival of a state would be a stake." Finally, the court ruled unanimously that "There exists an obligation to pursue in good faith and bring to a conclusion negotiations leading to nuclear disarmament in all its aspects under strict and effective international control." [119,120]

Abolition 2000

In December 1994, IPPNW united all of its anti-nuclear weapons activities within Abolition 2000, seeking a signed global agreement by the year 2000 committing the world to the permanent elimination of nuclear weapons within a specified timeframe.[121] In 1995, the German Medical Association called for nuclear abolition, followed by national medical organizations in Japan, Norway, Switzerland, and elsewhere.[122] In the U.S., the American College of Physicians, the American Public Health Association, and PSR (IPPNW-USA) all called for an abolition agreement by the year 2000.[123,124] In December 1996, the American Medical Association called for the abolition of all weapons of mass destruction: nuclear, chemical, and biological.[125]

In April 1995, a broad-based coalition of over 100 citizens' organizations united behind a more detailed 11-point Abolition 2000 statement. By early 1998, Abolition 2000 had grown to involve over 1,000 co-sponsoring citizens' organizations in 75 countries.[126] Building upon lessons learned from the first 50 years of unsuccessful efforts to achieve a definitive solution to the dangers of nuclear weapons, the Abolition 2000 campaign integrated global grassroots activities with legal initiatives and collaboration with military, political, and other world leaders, all aiming at a "final common pathway" of a global treaty banning nuclear weapons.

In July 1995, U.S. Air Force General Charles A. Homer, responsible for defending the United States and Canada against nuclear attack in his role as head of the U.S. North American Aerospace Defense Command, issued a public appeal for the abolition of nuclear weapons that was unprecedented for an active duty officer: "I want to get rid of them all. Think of the high moral ground we secure by having none .... It's kind of hard for us to say ... 'You are terrible people, you're developing a nuclear weapon' when the United States has thousands of them." [127]

In August 1996, the Canberra Commission on the Elimination of Nuclear Weapons, including military and political experts from all nuclear weapons states, outlined a series of concrete steps toward abolition that could begin immediately and concluded that: "The proposition that nuclear weapons can be retained in perpetuity and never used accidentally or by decision defies credibility. The only complete defence is the elimination of nuclear weapons and assurance that they will never be produced again." [128]

In December 1996, 60 generals and admirals from 17 nations, including General Horner, General Lee Butler (Director of the U.S. Strategic Command from 1991 to 1994, responsible for the entire U.S. strategic nuclear arsenal), and U.S. General Andrew J. Goodpaster (former Supreme Allied Commander of NATO forces in Europe) issued an unequivocal call for nuclear abolition: "We have been presented with a challenge of the highest possible historic importance: the creation of a nuclear weapons-free world. The end of the Cold War makes it possible. The dangers of proliferation, terrorism, and a new nuclear arms race render it necessary." [129]

In June 1997, the U.S. National Academy of Sciences report on *The Future of U.S. Nuclear Weapons Policy*, preferring the word "prohibi-

tion" to "abolition," concluded that: "The potential benefits of comprehensive nuclear disarmament are so attractive relative to the attendant risks and the opportunities presented by the end of the Cold War and a range of other international trends are so compelling that increased attention is now warranted to studying and fostering the conditions that would have to be met to make prohibition [of nuclear weapons] desirable and feasible."

Subsequently, Mikhail Gorbachev, Jimmy Carter, and 115 other political leaders from 46 nations added their support for nuclear abolition, stating that "the long-sought prospect of a world free of the apocalyptic threat of nuclear weapons is suddenly within reach" but warning that "it is also perishable." [130] Even former Cold War warriors, who long relied on the strategy of nuclear deterrence, have called for an end to proliferation and for a significant diminution in nuclear stockpiles. [79]

Medact has retained a strong anti-nuclear weapons campaign, working within IPPNW and directly in the U.K. with a variety of partners, being a founding member of the WMD Awareness Programme. [131] In 2006, Medact joined a coalition of British non-governmental organizations opposed to the renewal of Trident – the sole remaining strategic nuclear weapon system possessed by the U.K. after years of progressive disarmament. British doctors, medical students, and other health workers blockaded the nuclear submarine base in Faslane, Scotland, to protest the government's intent to spend as much as £75 billion on weapons production, infrastructure, and operation over a 30-year period. In a formal response to the Blair administration's white paper justifying Trident replacement, Medact asserted:

> The taboo against nuclear weapons rests on the fact that it is widely appreciated that their use will lead to large numbers of civilian deaths, both immediately and over time from radiation. It is completely mistaken to suggest that it is possible to build a nuclear weapon that could have any other result. There is a clear and present danger that the repeated assertion that new kinds of "smart" nuclear weapons can be used discriminately is being used to break down the taboo against their use, including in a pre-emptive strike against conventional forces. [132]

Medact argued further that replacing Trident with new, smaller, more flexible nuclear weapons would lower the threshold for their use "with dire consequences for proliferation," and would breach the U.K.'s Article VI obligations under the NPT. "At a time when our National Health Service is acutely short of funds, to embark on a programme that would divert massive resources and potentially create death and sickness on a massive scale is totally irresponsible," Medact concluded.

Through its affiliated journal, *Medicine Conflict and Survival*, Medact continues to publish on the nuclear threat.

Medicine, the Nuclear Weapons Convention, and ICAN

A Model Nuclear Weapons Convention (MNWC) – a convention to outlaw nuclear weapons worldwide, much like the conventions on biological and chemical weapons – was drafted in 1996 by an international consortium of lawyers, scientists, and disarmament experts

and was submitted by Costa Rica to the United Nations. It became a formal UN document, available in the six official UN languages for consideration and debate.[133] In 1997, the Lawyers' Committee on Nuclear Policy (part of the International Association of Lawyers Against Nuclear Arms, IALANA), the International Network of Engineers and Scientists Against Proliferation (INES), and IPPNW released the model convention at the United Nations as part of an international campaign to stimulate the commencement of negotiations on an international treaty to abolish nuclear weapons. In 1997, the United Nations General Assembly called for negotiations leading to the conclusion of a Nuclear Weapons Convention. The resolution, which was introduced by Malaysia, was adopted with 115 votes in favor, 22 against, and 32 abstentions. A resolution in favor of the convention was also introduced into the U.S. House of Representatives.

An important precedent for the MNWC was the Chemical Weapons Convention (CWC), which entered into force in 1997. The CWC established a timetable for the permanent elimination of all chemical weapons and specifies procedures for the unprecedentedly intrusive on-site inspections necessary to provide international confidence regarding treaty compliance. The Model Nuclear Weapons Convention would prohibit the development, testing, production, stockpiling, transfer, use, and threat of use of nuclear weapons. States possessing nuclear weapons would be required to destroy their arsenals according to a series of phases over 15 years. The convention would also prohibit the production of weapons-usable fissile material and require delivery vehicles to be destroyed or converted to make them non-nuclear capable. The proposed convention outlines a series of five phases for the elimination of nuclear weapons beginning with taking nuclear weapons off alert, removing weapons from deployment, removing nuclear warheads from their delivery vehicles, disabling the warheads, removing and disfiguring the "pits," and placing the fissile material under international control. In the initial phases the U.S. and Russia are required to make the deepest cuts in their nuclear arsenals.[134] The NWC is envisioned as a means of further strengthening the NPT regime.

In 1999, IALANA, INES, and IPPNW published *Security and Survival: The Case for a Nuclear Weapons Convention*, which included a copy of the MNWC. Responses to the 1997 and 1999 versions resulted in the preparation of a revised version of the MNWC. It was published in 2007 in a revision of *Security and Survival* entitled *Securing our Survival.*[134]

The Model Nuclear Weapons Convention has received extensive support at the United Nations. In December 2006 at the UN General Assembly, 125 governments – including nuclear-armed China, India, and Pakistan – called upon states to immediately fulfill their nuclear disarmament obligations by commencing multilateral negotiations leading to an early conclusion of a nuclear weapons convention prohibiting the development, production, testing, deployment, stockpiling, transfer, use, or threat of use of nuclear weapons and providing for their elimination. The updated text of the NMWC was submitted to the 2007 PrepCom for the NPT Review Conference, with the final document noting "support was voiced for the development of a nuclear weapons convention."

The International Campaign to Abolish Nuclear Weapons (ICAN) is a campaign launched by IPPNW in 2007 to urge negotiation of a nuclear weapons convention to ban the develop-

ment, possession, and use of nuclear weapons. The campaign focuses on the continued possession of nuclear weapons by a small minority of states, which risks the use of these weapons by design, accident, or terrorism, and are a continued instigation for others to develop nuclear weapons capabilities.

ICAN demands the abolition of nuclear weapons through negotiation of a nuclear weapons convention. The campaign additionally calls on nuclear weapon states to cease upgrading, modernizing, and testing new nuclear weapons. In order to reduce the probability of their use, ICAN stipulates that existing weapons be taken off high alert and that states commit themselves to a "no first-use" policy.

ICAN and the NWC have gathered support from all over the world. Examples include Mayor Akiba of Hiroshima, the Government of Malaysia, and the President of Mongolia.

The Medical Profession, Global Citizenry, and Nuclear Weapons: Preventing Proliferation and Achieving Abolition

Since the beginning of the George W. Bush Administration in 2001, new U.S. nuclear policies have been announced. These include abandonment of long-established disarmament and nonproliferation policies and the promulgation of new policies that include the potential use of nuclear weapons in response to production or use of nuclear, chemical, or biological weapons by others. New policies, as in the Nuclear Posture Review, represent a departure from U.S. policy of maintenance of stockpiles of nuclear weapons solely for deterrence of nuclear attack ("mutual assured destruction") and raise the possibility of use of nuclear weapons for war-fighting.

But, the United States is not the only country in which vertical proliferation is taking place. There is evidence that the United Kingdom, Russia, France, China, Israel, India, and Pakistan are also engaged in expanding or strengthening their nuclear arsenals.

The specter of a non-state entity gaining nuclear capabilities only increases the urgency of eliminating nuclear weapons. Any international treaty to abolish these weapons would be difficult if not impossible to enforce among rogue, non-state, terrorist organizations.

The world appears to be at a crossroads with two options: either a continuation of the nuclear weapons era in some form, with permanent risks of proliferation, terrorism, and deliberate or accidental nuclear war, or global nuclear disarmament. How should the medical profession respond to today's challenges?

In the 1980s, Relman emphasized that the voice of the medical community would be most effective if the medical profession were united in its views.[60,61] A striking consensus has evolved in support of abolition as the only reliable long-term solution to the threat of nuclear weapons.

First, at crucial stages physicians have proven uniquely effective in ensuring that discussions of nuclear weapons policies are based in a vivid appreciation of the unparalleled destructive effects of nuclear explosions. Although it has been said that "a single death is a tragedy, a million is a statistic,"[135] physicians can help create and sustain a global culture in which nuclear weapons are universally seen as incompatible with the sense of reverence for life that underlies all medical work.[24]

Second, as is true of any dire health warning, engendering fear of nuclear war is not enough; concrete steps that individuals or groups can

take to mitigate the danger must be identified. If, however, these steps involve only partial solutions as was true both for the LTBT in 1963 and for the public renunciation in 1985 by Reagan and Gorbachev of plans to win a nuclear war, the dangers of nuclear arsenals are likely to resurface in new forms.

Third, today's global dangers of nuclear arsenals require truly global solutions. The Indian and Pakistani test explosions have confirmed beyond doubt that it is simply not plausible that the world can maintain a double standard, in which some nations insist that nuclear arsenals are vital to their own security while denying those same arsenals to others. A united global voice of medicine can play a powerful role in establishing for nuclear weapons the single global norm that applies to chemical and biological weapons: zero.

Finally, as was true in the period immediately following Hiroshima and Nagasaki, the current window of opportunity to build global support for nuclear abolition is almost certain to be brief.

Although the abolition of nuclear weapons today has stronger support than ever before,[136] dramatically increased efforts will be required of medical organizations throughout the world and millions of citizens if the massive burn, blast, and radiation casualties that Dr. Sasaki and his colleagues faced in August 1945, and the global devastation that today's thermonuclear arsenals threaten, are to be definitively prevented. A successful campaign by medical organizations worldwide in support of a verifiable and enforceable Nuclear Weapons Convention would be an extraordinary contribution to safeguarding health in the 21st century.

As Albert Schweitzer taught, "Example is not the main thing in influencing others; it is the only thing."[6] Nuclear abolition cannot be achieved without leadership by the U.S. and other nuclear weapons states, yet the U.S., Russia, and others have not yet seriously questioned their commitment to maintaining massive nuclear arsenals. Physicians and other citizens in these states thus have a special opportunity and responsibility to convince their elected leaders to make the abolition of nuclear weapons a major priority, as Article VI of the Nuclear Nonproliferation Treaty legally requires.[137]

Albert Einstein warned that "the explosive force of nuclear fission has changed everything except our modes of thinking and thus we drift toward unparalleled catastrophe. We shall require an entirely new pattern of thinking if mankind is to survive."[138] To this warning, Dr. Bernard Lown, who joined with his Russian colleague Dr. Evgueni Chazov in accepting the Nobel Peace Prize on behalf of IPPNW, has added, "The new way of thinking must be an awakening to our common origins, to our shared problems, as well as to our common fate. If we are to prevail, we must never delegate in the presence of challenge and never whisper in the presence of wrong."[139]

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Appendix I Thirteen-Point Plan for Implementing Article VI of the NPT Adopted at the 2000 NPT Review Conference

The Conference agrees on the following practical steps for the systematic and progressive efforts to implement article VI of the Treaty on the Non-Proliferation of Nuclear Weapons and paragraphs 3 and 4(c) of the 1995 Decision on Principles and Objectives for Nuclear Non-Proliferation and Disarmament:

1. The importance and urgency of signatures and ratifications, without delay and without conditions and in accordance with constitutional processes, to achieve the early entry into force of the Comprehensive Nuclear Test Ban Treaty.

2. A moratorium on nuclear weapon test explosions or any other nuclear explosions pending entry into force of that Treaty.

3. The necessity of negotiations in the Conference on Disarmament on a nondiscriminatory, multilateral and internationally and effectively verifiable treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices in accordance with the statement of the Special Coordinator in 1995 and the mandate contained therein, taking into consideration both nuclear disarmament and nuclear non-proliferation objectives. The Conference on Disarmament is urged to agree on a programme of work which includes the immediate commencement of negotiations on such a treaty with a view to their conclusion within five years.

4. The necessity of establishing in the Conference on Disarmament an appropriate subsidiary body with a mandate to deal with nuclear disarmament. The Conference on Disarmament is urged to agree on a programme of work which includes the immediate establishment of such a body.

5. The principle of irreversibility to apply to nuclear disarmament, nuclear and other related arms control and reduction measures.

6. An unequivocal undertaking by the nuclear-weapon States to accomplish the total elimination of their nuclear arsenals leading to nuclear disarmament, to which all States parties are committed under article VI.

7. The early entry into force and full implementation of START II and the conclusion of START III as soon as possible while preserving and strengthening the Treaty on the Limitation of Anti-Ballistic Missile Systems as a cornerstone of strategic stability and as a basis for further reductions of strategic offensive weapons, in accordance with its provisions.

8. The completion and implementation of the Trilateral Initiative between the United States of America, the Russian Federation and the International Atomic Energy Agency.

9. Steps by all the nuclear-weapon States leading to nuclear disarmament in a way that promotes international stability, and based on the principle of undiminished security for all:
    - Further efforts by the nuclear-weapon States to reduce their nuclear arsenals unilaterally;
    - Increased transparency by the nuclear-weapon States with regard to the nuclear weapons capabilities and the implementation of agreements pursuant to article VI and as a voluntary confidence-building measure to support further progress on nuclear disarmament;
    - The further reduction of non-strategic nuclear weapons, based on unilateral initiatives and as an integral part of the nuclear arms reduction and disarmament process;
    - Concrete agreed measures to further reduce the operational status of nuclear weapons systems;
    - A diminishing role for nuclear weapons in security policies to minimize the risk that these weapons will ever be used and to facilitate the process of their total elimination;
    - The engagement as soon as appropriate of all the nuclear-weapon States in the process leading to the total elimination of their nuclear weapons.
10. Arrangements by all nuclear-weapon States to place, as soon as practicable, fissile material designated by each of them as no longer required for military purposes under IAEA or other relevant international verification and arrangements for the disposition of such material for peaceful purposes, to ensure that such material remains permanently outside military programs.
11. Reaffirmation that the ultimate objective of the efforts of States in the disarmament process is general and complete disarmament under effective international control.
12. Regular reports, within the framework of the strengthened review process for the Non-Proliferation Treaty, by all States parties on the implementation of article VI and paragraph 4(c) of the 1995 Decision on "Principles and Objectives for Nuclear Non-Proliferation and Disarmament," and recalling the advisory opinion of the International Court of Justice of July 9, 1996.
13. The further development of the verification capabilities that will be required to provide assurance of compliance with nuclear disarmament agreements for the achievement and maintenance of a nuclear weapon-free world.

Appendix II The Role of Physicians and Other Health Workers in the Preservation and Promotion of Peace[140]

Recalling resolution WHA30.43, in which it is proclaimed that the attainment by all the peoples of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life is the main social target of governments and of WHO;

Reaffirming the statement in the Declaration of Alma-Ata to the effect that an acceptable level of health for all the peoples of the world by the year 2000 can be attained through fuller and better use of the world's resources, a considerable part of which is now spent on armaments and military conflicts, and that a genuine policy of independence, peace, détente and disarmament could and should release additional resources that could well be devoted to peaceful aims and in particular to the acceleration of social and economic development, of which primary health care is an essential part;

Noting resolutions 33/72 A, 33/91 E, 33/71 H and 33/66 B and other resolutions adopted in recent years by the United Nations General Assembly on the maintenance and strengthening of peace, extension of détente, averting of the threat of nuclear war, prohibition of the development of new types of weapons of mass destruction, banning of aggressive military conflicts, and attainment of the objectives of true disarmament;

Recalling also the contribution that WHO has already made to the strengthening of peace and cooperation between nations, notably resolution WHA15.51 on the role of the physician in the preservation and promotion of peace, resolution WHA20.54 on weapons of mass destruction, and resolutions WHA22.58 and WHA23.53 on prohibition of the production and stockpiling of chemical and bacteriological (biological) weapons;

1. Calls upon Member States to redouble their efforts towards the establishing, maintaining and strengthening of peace throughout the world, the consolidation of international détente and the attainment of disarmament, with a view to creating the conditions for a large-scale release of resources which could be used for the development of public health in the world;

2. Requests the Director-General to:

   (1) prepare a report on the further steps which WHO, as a United Nations specialized agency, would be able to take in the interests of international socioeconomic development, and also with the aim of assisting in the implementation of the United Nations resolutions on the strengthening of peace, détente and disarmament;

   (2) conduct a study for consideration by the Executive Board on the subject of the strengthening of WHO's cooperation with other organizations within the United Nations system in order to achieve the objective of health for all by the year 2000.

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