International Physicians for the Prevention of Nuclear War

Twelve Articles by Supporters of IPPNW

Reprinted from *The Lancet*
(July 23 - Oct 8, 1988)

IPPNW, 126 Rogers Street, Cambridge, MA 02142, USA

LOOKING BACK, SEEING AHEAD

BERNARD LOWN

Brigham and Women's Hospital, Boston, MA 02115, USA

"We are here because the world is moving inexorably toward the use of nuclear weapons The atomic age and space flight have crystallised as never before the enormous power of science and technology These developments have also brought humankind to a bifurcation—one road of unlimited opportunity for improving the quality of life, the other of unmitigated misery, devastation and death In the throes of decision is the question whether humankind has a future".[1] These seemingly extravagant words, delivered in March, 1981, ushered in the first congress of the International Physicians for the Prevention of Nuclear War (IPPNW). 72 physicians from 10 countries met at Airlie House, a pastoral retreat outside Washington, DC, to discuss responsibilities of the medical profession in preventing nuclear war Eight years later it is worth taking stock In this short period the movement has achieved a Nobel peace prize (1985) and now has 200 000 members. At the Eighth IPPNW Congress in Montreal in 1988, 2200 people from 70 countries crowded the colloquia, symposia, teaching retreats, and intimate discussion groups.

BACKGROUND

In 1961 a small group of doctors, calling themselves the Physicians for Social Responsibility (PSR), examined the medical consequences of a multi-megaton nuclear attack on Boston.[2] They concluded that no modern society could survive a full-scale nuclear attack; that civil defence preparations might foster illusions but would not mitigate any of the dreadful consequences; that the many thousands of burned, injured, and irradiated victims would overwhelm whatever medical resources remained intact; that however thorough the analysis, the full consequences would remain unknowable, especially the ecological damage (impact on climate and the food chain, for example); and that prevention was the only available remedy

The passage of a quarter of a century has not controverted these conclusions The discovery of the nuclear winter suggests that no part of the world will be spared.[3] The nuclear disasters at Chernobyl and Three Mile Island, the industrial catastrophe at Bhopal, and the tragedy of the space shuttle Challenger have been sober reminders of the fallibility of the works of man The odds for a meltdown at Chernobyl were estimated to be one every 10 000 years[4]—at the time of the accident the plant had been in operation for 3 years The detonation of just 1 of the 18 000 strategic nuclear weapons ready for instant use would be many thousand times more devasting than the accident in the Ukraine By the laws of probability an annual risk of nuclear war of 1% becomes 40% when projected over the expected lifespan of today's young people It is a statistical certainty that hair-trigger readiness cannot endure permanently and that although the world has so far been spared catastrophe, such good fortune cannot endure indefinitely.

PHYSICIAN INVOLVEMENT

The medical profession has played a prominent part in educating the public on the threat of nuclear war.[5] At present, however, only about 7% of the 3 million physicians worldwide are involved in IPPNW activities. This lack of involvement is largely due to inadequate appreciation of the danger and the link between the nuclear threat and the historic commitment of the medical profession to safeguard life and health

Even if nuclear war is prevented, preparations for war are exerting adverse effects on health care throughout the world.[6] Military expenditure now exceeds 108 million dollars hourly at a time when 40 000 children die daily from preventable causes. Furthermore, human brain power is being diverted from serious social problems. Most doctors would probably agree with the propriety of their medical societies to educate both the public and political leaders on the medical consequences of a nuclear war. But should doctors become activists and lobby for policies that will reduce the likelihood of nuclear war, as part of their medical calling?

Historically, the medical profession has not shied away from involvement in social and political struggles that have impinged on health.[7] Physicians have worked through the political process to improve nutrition of impoverished families, to provide special facilities for the aged, to remove asbestos from insulation and lead paint from school rooms, to prohibit smoking in public places, &c. Certainly, nuclear war is no less a threat than such hazards Commitment to maintaining life and health burdens the physician with a moral duty to work for the prevention of the final epidemic Social engagement and political involvement are consonant with the most hallowed traditions of medicine. Over a century ago, Rudolf Virchow, a principal architect of scientific medicine, maintained that "Medicine was a social science, and politics nothing but medicine on a grand scale".[8] He taught that to improve the health of the public, the physician must not shy away from social action.[9] The principles that Virchow espoused have even greater cogency today. Addressing this problem, a *Lancet* editorial speculated "If the German medical community in the 1930s had taken this view and had discerned a medical duty that extended beyond the consulting-room, might it have stopped the process that began with dislodgement of Jewish physicians, continued with the gassing of psychiatric patients, and ended with industrialised genocide?"[10]

SPECIAL ROLE OF MEDICINE

Physicians bring excellent credentials to the task of working for the abolition of nuclear weapons.[11] They have unique knowledge and expertise in areas such as the medical consequences of nuclear war, medical care in the post-attack period, the malfunctioning of technology and aberration of personality that may trigger a nuclear exchange, the diversion of resources from social and health services, and the psychological and behavioural effects in children Physicians cannot be suspected of interest other than that deriving from a deep commitment to the service of man The medical profession, unlike many others, is international, and doctors share ancient traditions, knowledge, methods, terminology, and objectives The long association of medical practitioners worldwide enables doctors to engage in effective citizen diplomacy. Furthermore, physicians are trained to find practical solutions to seemingly insoluble problems. Their educational role in society is widely recognised Thus, they constitute a potentially forceful, non-political pressure group for the rational control and the elimination of the genocidal nuclear weapons

SUCCESS OF THE PHYSICIANS ANTINUCLEAR MOVEMENT

The IPPNW has accomplished much, both in the USA and worldwide [12] Millions of people have been persuaded for the first time to confront the reality of nuclear war. Physicians' activities have exposed to public view the litany of horrors resulting from blast, fire, and radiation Many people have been convinced that there can be no useful medical response to nuclear war. Politically, no longer is there talk about the possibility of limited nuclear war, about nuclear demonstration shots to prove national resolve, or about winning or prevailing in a nuclear conflict. The subject of civil defence has become a butt for social satire. In many countries concern about the nuclear arms race has gained respectability as a legitimate issue among political parties Of no small consequence is the fact that the IPPNW was founded by American and Soviet physicians Indeed a signal accomplishment of the IPPNW has been the broad based, easy dialogue between doctors of the two contending powers [13] IPPNW has demonstrated that people can work together in spite of their political and cultural differences

The IPPNW has also engaged in advocacy Clearly, the function of medicine is to offer sound prescriptions for effective treatment and prevention Our prescription focused on a comprehensive cessation of all nuclear explosions [14] As a first step a moratorium on testing is readily verifiable and does not require trust between the superpowers A ban on testing would reduce the continuing qualitative improvement and the introduction of ever more advanced first-strike weapons and, if enacted, would begin to unwind the doomsday process.

The greatest achievement of IPPNW has been its contribution to a changed political climate worldwide which encouraged the USSR to cease all underground nuclear explosions for 18 months. Indeed at a meeting with the leadership of IPPNW on June 2, 1987, General Secretary Mikhael Gorbachev emphasised that "we [the Soviet Government] take into account the activities of your movement in shaping our foreign policy " The signing by Gorbachev and President Ronald Reagan of the INF treaty, which may soon reduce nuclear armaments by 4% and remove a class of missiles from Europe, is a vital step

LOOKING AHEAD

The exclusive task for IPPNW has been and will continue to be the abolition of nuclear weapons East and West, citizens and institutions must now strive to unclog the obstructions that exist at governmental level Proposals are being considered for an IPPNW sponsored medical "peace corps" of doctors from East and West to participate in projects serving the needs of the developing world, initiated by the World Health Organisation, Unicef, and other international agencies Another project is the creation of a satellite telecommunications network for dissemination of medical information to health professionals worldwide "Space for health" was conceived as an East-West collaboration to mitigate North-South disparities in health education and information access In early 1986 two leading Soviet academicians E Velikhov and R Sagdeyev indicated that the USSR was ready to provide a satellite and downlinks to earth stations without any charge to IPPNW At the time of the IPPNW Seventh World Congress in 1987, an agreement was signed between the USSR Academy of Science and IPPNW to implement this project The struggle of physicians against the nuclear threat may be one of the significant contributions of our profession to the survival of humankind

REFERENCES

1 Lown B. The physicians greatest challenge—the prevention of nuclear war. Proceedings of the First Congress of the International Physicians for the Prevention of Nuclear War. Airlie, Virginia, March 20–25, 1981.
2 Sidel VW Geiger J, Lown B. The physician's role in the post-attack period *New Engl J Med* 1962; **266:** 12–20.
3 Turco RP, Toon OB, Ackerman TP, et al. Nuclear winter: global consequences of multiple nuclear explosions. *Science* 1983; **222:** 1283.
4 Rylsky M. The nuclear power industry in the Ukraine. *Soviet Life* 1986; February: 8
5 Lown B. Physicians confront the nuclear peril *Circulation* 1985; **72:** 1135
6 Sidel VW. Destruction before detonation: the impact of the arms race on health and health care *Lancet* 1985; ii: 1287–89.
7 Cassel C, Jameton A Medical responsibility and thermonuclear war *Ann Int Med* 1982; **97:** 426.
8 Eisenberg L. Rudolf Ludwig Karl Virchow, where are you now that we need you? *Am J Med* 1984; **77:** 524
9 Silver GA. Virchow, the heroic model in medicine: health policy by accolade *Am J Public Health* 1987; **77:** 82.
10 Editorial The politics of genocide *Lancet* 1987; i: 1305–06.
11 Lown B, Muller J, Chivian E, Abrams H The nuclear arms race and the physician *New Engl J Med* 1981; **304:** 726.
12 Boyer P. Physicians confront the apocalypse. The American medical profession and the threat of nuclear war. *JAMA* 1985; **254:** 633.
13 Lown B, Chazov E. Cooperation not confrontation: the imperative of a nuclear age: the message from Budapest *JAMA* 1985; **254:** 655.
14 Lown B, Pastore JO A medical prescription for survival *Lancet* 1985; ii: 1285–87

PHYSICIANS, TRIAGE, AND NUCLEAR WAR

JENNIFER LEANING

Harvard Community Health Plan, Brookline, MA 02146, USA

IN disaster and mass casualty settings other than nuclear war, several key elements determine what medical response is appropriate: the medical needs, the resources available, and the triage protocols for allocation of resources to those in need. Triage is the process of sorting casualties according to severity of illness (need) and priority for treatment (allocation). Medical judgment is used to assign the injured to categories of severity that dictate the proportion of medical resources available to treat individual patients [1,2]

In modern industrial society, where resources exceed need, the hard facts of triage do not usually show. Treatment priorities are assigned merely to ensure efficiency and thus the optimum survival of nearly every casualty. If resources are scarce, however, difficult choices arise. Some people in need may have to be left to die so that more may live. The general public in Western society may find the consequences of triage in their own environment hard to accept. Medical responses to two recent disasters are described here. One response the public found acceptable; the other evoked much dismay and controversy

Amtrak Collision

When two Amtrak trains collided in 1987 on the New York to Baltimore run the emergency medical services, local civil authorities, and hospital trauma teams cooperated to rescue victims and provide emergency and definitive treatment. Within a few hours all the injured received the best of medical care.[3] In this setting (186 casualties occurring at midday in an accessible site served by many secondary and tertiary level hospitals), combined resources were more than adequate to meet the need created by the accident. Anything less efficient and competent than this response would have met with public and professional criticism

Mexico City Earthquake

The medical response to the Mexico City earthquake in September, 1985, is an example of a disaster that overwhelmed resources. Thousands of people were trapped and injured in layers of concrete extending over scores of city blocks.[4-6] The earthquake destroyed communications between the capital and the outside world. Hundreds of physicians and nurses and several of the major hospitals were among the casualties. The conflict of expectation versus possibility was not only between the public and the professionals but also within the medical emergency services.[7] Yet given the resources available to meet the number and kind of casualties that had occurred, the most skilled and humane application of triage meant that people who in other circumstances might have been treatable had inevitably to be left to die

MEDICAL RESPONSE TO NUCLEAR WAR

In nuclear war an appropriate triage protocol would mean that millions of severely injured people would be left to die, since resources would be completely inadequate. Physicians debate whether it is socially and ethically acceptable even to discuss such protocols. One point of view is that the professional duty of physicians is to assist in making plans for whatever might occur, however morally repugnant it might be.[8,9] Others assert that future reality is what you allow it to be and refuse on moral grounds to comply with making plans that are based on the acceptance of mass destruction.[10,11] Rather, these physicians consider it their responsibility to marshall all efforts at prevention.

A key aspect to the debate is whether physicians would function in their expected professional roles in nuclear war. Can the situation be approached as an extreme example of a disaster where need far outstrips resources and triage guidelines must become very austere? Or does the carnage of nuclear war constitute such an affront to the medical system that triage, as a conscious professional act, becomes inconceivable? At some threshold of stress all people, including physicians, can be expected to cease to cope.[12]

The NATO triage protocols for military use during nuclear war assume that thresholds for psychological decompensation would not be reached. Military training is oriented to helping people in the hierarchy cope with enormous stress and conform to ingrained roles. The triage protocols outline an orderly, structured approach to the management of casualties and describe procedures for determining how and when to move casualties in different treatment categories from one echelon of care to another. These NATO protocols also assume the presence of medical personnel capable of making these decisions.[13]

Outside the military, physicians who view an appropriate medical response to nuclear war as being possible believe that individuals trained in first aid will treat themselves and others.[14,15] A very different point of view, however, is that nuclear war would make victims of all survivors, erasing boundaries between providers and patients. The NATO protocols would be useless. Faced with this ultimate assault on their professional capacities, physicians might, at best, cling to some sense of role and, as did Dr Sasaki at Hiroshima, move numbly among patients, "wiping, daubing, winding, wiping, daubing, winding".[16] At this point, triage would cease to exist. Or the trauma of the disaster might remove all sense of role and force everyone, whatever his or her previous profession or work, into primitive kinds of behaviour.[17-20]

To address the response to nuclear war as if it were an issue of triage is to divert the debate from the true issues. The real debate for physicians revolves around these questions: is it the responsibility of physicians to plan for all contingencies, irrespective of the policies these plans imply? What if physicians consider these policies immoral? If, despite all efforts, the worst were to happen, what could physicians do? These questions are not new, only the terms are. As the debate has raged before, around other issues, it will persist now, because it springs from fundamental differences among physicians in their beliefs about themselves, their roles, and their moral obligation to the world

REFERENCES

1 Rund DA, Rausch TS. Triage. St Louis, Missouri: C V. Mosby, 1981.
2 Winslow GR. Triage and Justice. Berkeley: California: University of California Press 1982: 1–23.
3 American College of Emergency Physicians. Dallas: ACEP News 1987; April 4 *New York Times*, January 14 1987.
4 *Cambio* 1985; 16: (Sept 30): 107–12.
5 *Hispano Americano*, October 1, 1985, pp 3–14, passim
6. St Germain R. Disaster in Mexico City. the futility of moving mountains of debris *J Emerg Med Ser* 1985; 10: 60–62
7 Soberon G, Frenk J, Sepulveda J. The health care reform in Mexico before and after the 1985 earthquakes. *Am J Publ Health* 1986; 76: 673–80
8. Looney G. Doctor to doctor. *J Civil Def* 1982; 15: 22–23.
9 Williams SD, Schwartz AC. Nuclear war and emergency health care. *Ann Emerg Med* 1984; 13: 116–17

10. Myers BA. To plan for a hoax is a disservice to the people. *J Publ Health Policy* 1982; **3:** 119–21.
11. Shapiro SH. A cruel sham. *J Publ Health Policy* 1982; **3:** 122–129.
12. Hocking F. Psychiatric aspects of extreme environmental stress. *Dis Nerv Syst* 1970; **31:** 544–45.
13. Department of the Army. NATO handbook on the medical aspects of NBC defensive operations. Washington, DC: AMedP-6, draft 1986–87: 7–1—7–19.
14. Klinghoffer M. Suicide or medical preparedness? *Transact Soc* 1983; **20:** 18–21.
15. Orient J. The final epidemic. *JAMA* 1983; **249:** 728.
16. Hersey J. Hiroshima. New York: Bantam Books. 1977: 34.
17. Chazov EI, Vartanian ME. Effects on human behavior. In: Peterson J, ed. The aftermath: the human and ecological consequences of nuclear war. New York: Ambio, Pantheon Books, 1983: 155–63.
18. Committee for the compilation of materials. Hiroshima and Nagasaki. New York: Basic Books, 1981: 484–500.
19. Lifton RJ, Olson E. The human meaning of total disaster: the Buffalo Creek experience. *Psychiatry* 1976; **39:** 1–18.
20. Lifton RJ, Markusen E, Austin D. The second death: psychological survival after nuclear war. Leaning J, Keyes L, eds. The counterfeit ark: crisis relocation for nuclear war. Cambridge, Massachusetts: Ballinger, 1984: 285–300.

NUCLEAR THREAT AND HEALTH IN THE PACIFIC OCEAN

IAN MADDOCKS

215 Brougham Place, North Adelaide 5006, Australia

THE lessons from the Pacific about the health effects of nuclear testing and weapons development are not those of the long-term effects of low-level radiation; rather they tell of how human health is compromised by subtle and unnoticed ecological effects and how social disruption and cultural decay follow in the wake of nuclear strategies

The Pacific Ocean offers attractive prospects for nuclear powers. Here are compliant island communities occupying sites very suitable for the testing of nuclear warheads and missiles. Early assessments of the effects of this activity on the health of Pacific islanders concentrated on direct physical damage—such as the effects of fallout from the US tests at Bikini atoll on Marshallese islanders and Japanese fishermen, or the indirect pollution of populations dependent upon the food chains from reefs and lagoons contaminated by radioactive substances

A full scientific assessment of these effects is hampered by the lack of reliable information and the possibility that not all data have been released. The epidemiology of radiation effects is notoriously difficult. Rarely is the exposure dose of radiation accurately known. A high level of security attends all nuclear tests. Claims by British servicemen who were exposed to fall-out on Christmas Island and in whom unusual cancers developed many years later are still being contested in the courts. From Polynesia very few useful data are available about the consequences for its peoples and its islands of the 41 atmospheric and 60 underground tests done by the French on and around the island of Mururoa. In 1983 a scientific mission visited French Polynesia but did not discover any increase in cancers or other diseases attributable to radioactivity.[1] These findings were received with scepticism because of the very incomplete information to which the mission had access; the small size of the population at risk, and the absence of post-mortem records. From indirect observations of temperature measurements from the lagoon and the surrounding ocean, New Zealand scientists have calculated that significant radioactive contamination of the Pacific would occur over the next 10–100 years, in contrast to the 1000–10 000 years estimated by French scientists.[2] In the Eniwetok atolls, 33 years after a 15 mega-ton blast on Bikini atoll the evacuated inhabitants are still prevented from returning to their homes.[3] 30 years after the British conducted eight major and many minor test explosions in the desert regions of South Australia, it was recognised that large amounts of highly radioactive plutonium had been deposited over a wide area—plutonium has a half life of 24 400 years. In 1985, a Royal Commission recommended that the British Government should clean up those sites—a task estimated to cost at least US$500 million.[4] The British Government has not responded to this recommendation

Assessment of the physical effects of radiation is not enough. We are called, as physicians, to look also at the many ecological, social, and emotional consequences. At the Radiation Effects Laboratory at Hiroshima the comprehensive and attested data for Hibakusha (A-bomb survivors) do not include the social effects. Azami,[5] however, records that many survivors reported disadvantage or discrimination in employment, marriage, and education.

Ciguatera poisoning is caused by a toxin produced in the flesh of fish which feed on plankton. In northern Australia, ciguatera poisoning was first noticed after an alumina refinery was built at the port of Gove in 1972 and has now become endemic off the coast of North Queensland. The frequency of ciguatera has been particularly high in the areas of the Marshall Islands and in French Polynesia that have been most affected by nuclear tests.[6] Because of fear of the effects of ciguatera poisoning the islanders have abandoned their traditional food sources. Many other pressures stemming from military strategies have contributed to the destruction of the traditional culture of these people and have continued their dependent and depressed colonial status.

The people of Kwajalein in the Marshall Islands have suffered as much as those of Eniwetok, not from fallout but by being displaced from their home island and crowded onto nearby Ebeye so that the USA could continue to drop its test-fired missiles into the lagoon. Ebeye has become a Pacific urban slum; it is overpopulated, its shanties are teeming with malnourished children, and its adults are distracted by alcohol and television and reliant upon processed imported foods. The Marshallese people accepted this state of affairs because of their dependence upon US aid even for bare essentials. A people who once lived successfully in their coral atolls, they now are virtual beggars in world economic terms. By a "Compact of Free Association"[3] they agreed to allow the continuing occupation and use of Kwajalein in return for a generous rent

The policies of France in opposing independent status for its Pacific territories point to a link between nuclear strategy and necessary dependency. But even independence does not preserve small nations from military exploitation and pressure. On Aug 6, 1985, the thirteen independent nations of the South Pacific Forum announced a nuclear free zone covering their region, which bans the stationing, use, and testing of nuclear weapons within the zone. The failure of Britain, the USA, and France to ratify that treaty was predictable since the great powers, in their intrusions over four centuries, have rarely taken notice of the aspirations or local needs of Pacific islanders.

In Europe the demarcation of national boundaries and of conflicts seems clear, but in the northern Pacific region deep and divisive regional conflicts remain unresolved, territorial claims are still being contested, and the superpowers posture and challenge in provocative and dangerous ways. Military exercises for their own forces and those of their allies grow bigger and broader in scope each year.[7] There is currently great hope of dismantling nuclear weapons in Europe, but in the north Pacific there are no negotiations that might in any like way build confidence, reduce tension, or work towards balanced reductions in nuclear forces. The nuclear warheads stored on Pacific islands and the nuclear submarines that cruise unnoticed deep in Pacific waters carry the same risk to world survival as do their more visible counterparts in Europe, Asia, and North America

At its seventh congress, International Physicians for the Prevention of Nuclear War (IPPNW) firmly stated its policy as abolitionist.[8] The new manner of thinking, which the nuclear age demands, calls not only for the complete elimination of nuclear weapons, but also for a recognition that the Earth is as fragile as a coral atoll, and that all people

are interconnected and have equal rights to self-determination.

REFERENCES

1 New Zealand Ministry of Foreign Affairs. Report of a New Zealand, Australia and Papua New Guinea scientific mission to Mururoa Atoll. Wellington: New Zealand Ministry of Foreign Affairs. 1984.

2 Hochstein MP, O'Sullivan MJ. Geothermal systems created by underground nuclear testing. Paper presented to the Asian Pacific Regional Symposium of International Physicians for Prevention of Nuclear War, Auckland, February 10th. 1987.

3 Hayes P, Zarsky L. Bello W. American lake. Nuclear peril in the Pacific. Melbourne: Penguin Books. 1986.

4 Robotham R. Maralinga. Paper presented to the Asian Pacific Regional Symposium of International Physicians for Prevention of Nuclear War, Auckland. February 10th 1987.

5 Azami S. Current problem of physican handicap and damage in lives of Hibakusha. Paper presented to Seventh Congress of International Physicians for Prevention of Nuclear War, Moscow. May 31st, 1987

6 Ruff T. Fish poisoning in the Pacific. Paper presented to Asian Pacific Regional Symposium of International Physicians for Prevention of Nuclear War. Auckland February 10th, 1987

7 Mack A. Global and regional superpower policies. Paper presented to Asian Pacific Regional Symposium of International Physicians for Prevention of Nuclear War Auckland. February 10th, 1987

8 International Physicians for Prevention of Nuclear War. What we believe. Statement from the Seventh Congress. A New Manner of Thinking. Moscow. June 1st. 1987

THE ENEMY SYSTEM

JOHN E MACK

Center for Psychological Studies in the Nuclear Age, Harvard Medical School, Cambridge, Massachusetts 02139, USA

[T]here is] a substantial, politically influential, and aggressive body of American opinion for which the specter of a great and fearful external enemy, to be exorcised only by vast military preparations and much belligerent posturing, has become a political and psychological necessity."—GEORGE F KENNAN former US Ambassador to the USSR [1]

"Our enemy is a coarse, crooked megalomaniac who aims to kill us"—TOMMY WHITE retired US Air Force Chief of Staff [2]

THE threat of nuclear annihilation has stimulated us to try to understand what it is about mankind that has led to such self-destroying behaviour. Central to this inquiry is an exploration of the adversarial relationships between ethnic or national groups. It is out of such enmities that war, including nuclear war should it occur, has always arisen. Enmity between groups of people stems from the interaction of psychological, economic, and cultural elements. These include fear and hostility (which are often closely related), competition over perceived scarce resources,[3] the need for individuals to identify with a large group or cause,[4] a tendency to disclaim and assign elsewhere responsibility for unwelcome impulses and intentions, and a peculiar susceptibility to emotional manipulation by leaders who play upon our more savage inclinations in the name of national security or the national interest. A full understanding of the "enemy system"[3] requires insights from many specialities, including psychology, anthropology, history, political science, and the humanities.

In their statement on violence[5] twenty social and behavioural scientists, who met in Seville, Spain, to examine the roots of war, declared that there was no scientific basis for regarding man as an innately aggressive animal, inevitably committed to war. The Seville statement implies that we have real choices. It also points to a hopeful paradox of the nuclear age: threat of nuclear war may have provoked our capacity for fear-driven polarisation but at the same time it has inspired unprecedented efforts towards cooperation and settlement of differences without violence.

THE REAL AND THE CREATED ENEMY

Attempts to explore the psychological roots of enmity are frequently met with responses on the following lines: "I can accept psychological explanations of things, but my enemy is real. The Russians [or Germans, Arabs, Israelis, Americans] are armed, threaten us, and intend us harm. Furthermore, there are real differences between us and our national interests, such as competition over oil, land, or other scarce resources, and genuine conflicts of values between our two nations. It is essential that we be strong and maintain a balance or superiority of military and political power, lest the other side take advantage of our weakness."

This argument does not address the distinction between the enemy threat and one's own contribution to that threat—by distortions of perception, provocative words, and actions. In short, the enemy *is* real, but we have not learned to understand how we have created that enemy, or how the threatening image we hold of the enemy relates to its actual intentions. "We never see our enemy's motives and we never labor to assess his will, with anything approaching objectivity" [6]

Individuals may have little to do with the choice of national enemies. Most Americans, for example, know only what has been reported in the mass media about the Soviet Union. We are largely unaware of the forces that operate within our institutions, affecting the thinking of our leaders and ourselves, and which determine how the Soviet Union will be represented to us. Ill-will and a desire for revenge are transmitted from one generation to another, and we are not taught to think critically about how our assigned enemies are selected for us.

In the relations between potential adversarial nations there will have been, inevitably, real grievances that are grounds for enmity. But the attitude of one people towards another is usually determined by leaders who manipulate the minds of citizens for domestic political reasons which are generally unknown to the public. As Israeli sociologist Alouph Haveran has said, in times of conflict between nations historical accuracy is the first victim.[8]

THE IMAGE OF THE ENEMY AND HOW WE SUSTAIN IT

Vietnam veteran William Broyles wrote: "War begins in the mind, with the idea of the enemy."[9] But to sustain that idea in war and peacetime a nation's leaders must maintain public support for the massive expenditures that are required. Studies of enmity have revealed susceptibilities, though not necessarily recognised as such by the governing élites that provide raw material upon which the leaders may draw to sustain the image of an enemy.[7,10]

Freud[11] in his examination of mass psychology identified the proclivity of individuals to surrender personal responsibility to the leaders of large groups. This surrender takes place in both totalitarian and democratic societies, and without coercion. Leaders can therefore designate outside enemies and take actions against them with little opposition. Much further research is needed to understand the psychological mechanisms that impel individuals to kill or allow killing in their name, often with little questioning of the morality or consequences of such actions.

Philosopher and psychologist Sam Keen asks why it is that in virtually every war "The enemy is seen as less than human? He's faceless. He's an animal."[12] Keen tries to answer his question: "The image of the enemy is not only the soldier's most powerful weapon; it is society's most powerful weapon. It enables people en masse to participate in acts of violence they would never consider doing as individuals."[12] National leaders become skilled in presenting the adversary in dehumanised images. The mass media, taking their cues from the leadership, contribute powerfully to the process.

The image of the enemy as less than human may be hard to dislodge. For example, a teacher in the Boston area reported that during a high school class on the Soviet Union a student protested: "You're trying to get us to see them as people". Stephen Cohen and other Soviet experts have noted how difficult it is to change the American perception of the Soviet Union, despite the vast amount of new information contradicting old stereotypes.[13] Bernard Shaw in his preface to *Heartbreak House*, written at the end of World War I, observed ironically: 'Truth telling is not compatible with the defence of the realm."

Nations are usually created out of the violent defeat of the former inhabitants of a piece of land or of outside enemies, and national leaders become adept at keeping their people's attention focused on the threat of an outside enemy.[14] Leaders also provide what psychiatrist Vamik Volkan called "suitable targets of externalization"[10]—ie, outside enemies upon whom both leaders and citizens can relieve their burdens of private defeat, personal hurt, and humiliation.[15]

All-embracing ideas, such as political ideologies and fixed religious beliefs act as psychological or cultural amplifiers. Such ideologies can embrace whole economic systems, such as socialism or capitalism, or draw on beliefs that imply that a collectivity owes its existence to some higher power in the universe. It was not Stalin as an individual whom Nadezhda Mandelstam blamed for the political murder of her poet husband Osip and millions of other

citizens but the "craving for an all-embracing idea which would explain everything in the world and bring about universal harmony at one go".[16]

Every nation, no matter how bloody and cruel its beginnings, sees its origins in a glorious era of heroes who vanquished less worthy foes One's own race, people, country, or political system is felt to be superior to the adversary's, blessed by a less worthy god The nuclear age has spawned a new kind of myth This is best exemplified by the United States' strategic defence initiative This celestial fantasy offers protection from attack by nuclear warheads, faith here being invested not in a god but in an anti-nuclear technology of lasers, satellites, mirrors, and so on in the heavens

INDIVIDUAL GROUP LINKAGES AND LESSONS IN CHILDHOOD

To find out the source of hatred or antagonism we need to understand the complex relationship between the psychology of the individual, and the national group.[17] We can start by examining how enmity develops in childhood. In the first year of life a child begins to have a sense of self,[18] which includes the ability to distinguish between familiar people with whom he or she feels comfortable and those who are strangers or are felt to be alien The small child's ability to distinguish between friends and strangers[19] is accompanied by thought patterns that tend to divide people and things into good and bad, safe and unsafe. It is out of such primitive thinking that the structures of enmity later grow In the second year the child learns that ill-will directed towards those upon whom he is dependent is dangerous to his own wellbeing He develops, therefore, mechanisms such as displacement and externalisation which allow him to disown such negative impulses. Grandparents and parents may pass on to their children stories of the designated enemy groups' evil actions so that chosen displacements persist from one generation to another.

From the drawings and comments of children in Germany, the United States, Central America, and Samoa, Hesse showed that by age five a child understands the idea of an enemy, which he or she will depict as whatever in the culture seems most immediately fearful or threatening—a monster, wild animal, or bad man [20] By age eight a child understands that "the idea of the enemy" has to do with an unfriendly relationship But this idea does not usually become cast in political terms until age ten to twelve It is noteworthy that Hesse's research children, including the older ones, tend not to see their own country as bad or responsible for bad actions

The small child's sense of helplessness is accompanied by a feeling of vulnerability and awareness of dependence on others The formation of relationships or alliances with other individuals and groups, beginning with family members and extending to the neighbourhood, classroom, school playground, and teenage youth group, is an important strategy for gaining a sense of power. Such alliances are the prototype for later political relationships

All of these primitive, or child-like, mechanisms provide fertile soil for political leaders in real life interethnic or international conflicts. Nationalistic slogans and media manipulation focus the child's mind (or the child-mind of the adult) on the peoples or system he is supposed to hate or fear (Jews, Arabs, capitalists, or communists) In the United States patriotic recruitment is accompanied by commercial profiteering—for example, robotic war toys designed to kill communists [21]

The extraordinary dimensions of the nuclear threat have also spawned examples of apocalyptic thinking, in which the world is divided into forces of good and evil, and the belief that, in the event of a nuclear holocaust, the good would be saved and the evil would perish In such thinking the primitive, polarising tendencies of the child's mind are all too evident

CREATING A SAFER WORLD

Hesse's finding that even older children do not perceive their own country's responsibility for states of enmity is in accord with those of psychologists and social scientists—that there is no self-awareness or self-responsibility at the political level which corresponds to the awareness of personal responsibility with which we are familiar in a clinical setting.[22] In political life, the assignment of blame, disclaiming of responsibility, and the denial of one's own nation's contribution to tensions and enmity are the norm.[23]

The first task, therefore, is to apply the insights of the behavioural sciences to create a new expectation of political self-responsibility. Nuclear weapons have connected all the peoples of the earth Not only the nuclear superpowers but also all peoples are now interdependent and mutually vulnerable Nations may have conflicting values but they cannot afford to have enemies Education in elementary and secondary schools that reflects this new reality should be our highest priority. Instead of constant blaming of the other side, we need to give new attention to the adversary's culture and history, to his real intentions as well as his hopes, dreams, and values. To understand is not to forgive, but awareness and knowledge could lead to a more realistic appreciation of who has contributed what to the problems and tensions that exist in the world. Young people should be taught in their homes and schools how to identify and resist ideological propaganda.

In the nuclear age we need to redefine hackneyed ideas such as national security or the national interest. Just as we can no longer afford enemies, there is no longer such a notion as national security. The security of each depends on the other, and the communication of this reality must become a major focus of our educational system Similarly, the national interest can no longer be defined unilaterally but exists in a context of mutual interests and dependencies Physicians who understand the physical realities of nuclear technology, and are gaining a greater awareness of these psycho-political dynamics, can play a vital part in educating their patients and the general public about the basic requirements of planetary safety in the nuclear age

Political self-responsibility can begin at an early age. Nancy Condee asked Tolya, a nine-year-old Russian boy, "What kinds of solutions should be sought to reduce tensions between our two countries?" The boy replied: "I would tell Reagan that the thing he's building in space is going to cause war. I'd tell him 'Build it slowly! Take your time! Don't rush!' If he could spend a million years building it, we would have a million years of peace And only afterwards, as soon as it was already built, then we would have war"

REFERENCES

1 Kennan GF. The Gorbachev prospect Review of Perestroika: new thinking for our country and the world by Mikhail Gorbachev. New York: Harper and Row 1987 In: *The New York Review* 1988; **34:** 3 and 6–7

2 White T Quoted in Kaplan F The wizards of armageddon New York: Simon and Schuster, 1983.

3 Zur O. The psychohistory of warfare: the co-evolution of culture psyche and enemy *J Peace Res* 1987; **24:** 125–34

4 Kelman H. On the sources of attachment to the nation. Presented at panel on patriotism: Meeting of the International Society of Political Psychology. San Francisco, 1987, July 4–7.

5 Seville Statement, Interciencia, 1987; **12:** 53–54.

6 Bunting III. Looking for truths from an old enemy. Review of brothers in arms. a journey from war to peace by William Broyles Jr. New York: Knopf. 1986. *The Boston Sunday Globe* 1986; May 25: B11–B12.

7 Mack JE. Foreword in: Cyprus-war and adaptation: a psychoanalytic history of two ethnic groups in conflict. Volkan Vamik E. Charlottesville: University Press of Virginia. 1979. ix–xxi.

8 Harevan A. Notes and transcript of a conference on psychological impediments to international negotiations. Watergate Hotel. Washington. DC. January 20–26. 1980.

9 Broyles W Jr. Why me?—why them? *The New York Times* 1986, May 26: 19.

10 Volkan VD. The need to have enemies and allies: a developmental approach. *Political Psychol* 1985; **6:** 219–47.

11 Freud S. Group psychology and the analysis of the ego. Complete psychological works. Vol 18. London: Hogarth, 1955: 67–143.

12 Keen S. Faces of the enemy. Public Broadcasting Service. 1987, May 27.

13 Cohen SF. America's Russia. *Princeton Alumni Weekly.* 1986; September 30: 11–13

14 Mack JE. National security reconsidered: new perspectives generated by the prospect of a nuclear winter. In: Grinspoon L. ed. The long darkness: psychological and moral perspectives on nuclear winter. New Haven: Yale University Press. 1986: 103–40.

15 Shulman MD. Man bites dogma. New York: Columbia, 1981: 17–20.

16 Mandelstam N. Hope against hope: a memoir. New York: Atheneum. 1983.

17 Mack JE. Nationalism and the self. *The Psychohistory Review* 1983; **11:** 47–69.

18 Stern DN. The interpersonal world of the infant: a view from psychoanalysis and developmental psychology. New York: Basic Books. 1985

19 Pinderhughes CA. Differential bonding from infancy to international conflict. *Psychoanalyt Inquiry* 1986; **6:** 155–73.

20 Hesse P. Stereotypes mask feelings of fear. *Media and Values.* 1987; **39** (May): 5–6.

21 Carlsson-Paige N, Levin D. The war play dilemma; balancing needs and values in the early childhood classroom. New York: Teachers College Press. Columbia University. 1987.

22 Mack JE. The challenge of political self-responsibility in the nuclear age. *J Humanistic Psychol* (in press).

23 Hoffman S. On the political psychology of peace and war: a critique and an agenda. *Political Psychol* 1986; **7:** 1–21

THE ARMS RACE AS A THREAT TO HEALTH

VICTOR W. SIDEL

Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, NY 10467, USA

FOR a quarter of a century, since the publication of our initial articles,[1] members of Physicians for Social Responsibility (PSR) and International Physicians for the Prevention of Nuclear War (IPPNW) and their affiliates have been studying the consequences of the use of nuclear weapons. The lesson we have learned and have widely taught is that doctors must work actively for the prevention of nuclear war. Although prevention remains our main goal, over the past five years many members of PSR and of the other national organisations have been concerned with the consequences of the arms race to health and well-being, even if the arms themselves are never directly used to kill and maim. These consequences have become known as "destruction before detonation".[2]

National security is often invoked as the reason for increased military spending. However, as Kennedy's recent analysis of five hundred years of power relationships demonstrates, true national security is not gained by mere military might.[3] In the nuclear age the world's arsenals already contain some three tons of TNT for every person on earth. Such arsenals do not increase national security; they simply put the world at greater risk. By devoting excessive resources to the military (in 1960–85 $15 trillion, to-day over $900 billion yearly worldwide[4]) at the expense of a vibrant economy, sound education systems, poverty relief, health care, and meeting other pressing human needs, the nations of the world have neglected, and indeed undermined, their true security.[5] In 1987 the PSR board of directors recognised the importance of this issue: "As physicians, we will emphasise the importance to national security of a healthy people and a strong, productive economy."[6]

IMPACT OF ARMS SPENDING ON INDUSTRIALISED NATIONS

Several of the world's industrialised nations spend large amounts of their resources on arms. The expenditures lead to general economic difficulties as well as specific diminution of governmental funding for services to promote health and human welfare.[7] In the United States, for example, annual military spending has risen from $143·9 billion to $289·6 billion in the past eight years—the total spending over this period is about 2 trillion dollars or about $21 000 for each US family. Of these expenditures, an estimated 20–25% is spent on nuclear arms and their delivery systems.[8] Federal budget deficits have soared along with military spending. The present US administration's contribution of $1·6 trillion to the US national debt, which now stands at $2 trillion, has been greater than that of the Truman, Eisenhower, Kennedy, Johnson, Nixon, Ford, and Carter administrations combined.[8]

An even greater impact is felt in the Soviet Union. Although the USA and the USSR spent roughly similar amounts of resources on arms from 1960 to 1981, because of its lower gross national product (GNP) the USSR's percentage of GNP (11·5% in 1984) spent on arms is considerably greater than that of the USA (6·2%).[4] Such massive expenditures must have major economic and health and human services effects in the USSR.

Productivity

Adequate public support for health care and other human services depends partly on an expanding economy. Massive arms investment diverts capital away from the growth of productive capacity in the civilian economy. Countries such as Japan, Denmark, Italy, and Sweden, for example, have spent a far lower percentage of their GNP on arms than have the UK, the USA, and the USSR; the low arms budget countries have generally greatly surpassed the high arms budget countries in the rate of growth of their manufacturing productivity. When the size of the economic pie is not increasing, it is hard to persuade decision makers in countries like the USA and the UK to increase the amount spent on publicly funded services for the undeserved. Such allocations are often perceived as decreasing the current standard of living of taxpayers rather than as an acceptable diminution in the rate of improvement of their standard of living in order to help others.[7]

Unemployment

Expenditures for modern armaments create far fewer jobs than expenditures for health and human services: in 1982, 1 billion dollars spent in the USA on guided missiles, for example, was estimated to generate some 19 000 jobs and the same amount spent on military ordnance about 27 000 jobs, but that amount spent on health services produces 50 000 jobs and on education 51 000 jobs. Overall, the increases in military spending in the USA from 1981 to 1985 cost its people over 1100 000 jobs compared with what would have been generated if the money had been used for civilian economic activities.[9] Furthermore, many minority people and other low skilled workers are rarely qualified for employment in military industries, and unemployment rates for blacks and other racial minorities are about double that of whites. Unemployment generally affects the poor more than the affluent, with respect to both direct health effects and ability to pay for health services. In addition, since many health insurance programmes in the USA are tied to unemployment, unemployment often terminates health insurance coverage.[7]

Reduced Services and Research for Health and Other Human Needs

The US economy provides one of the world's highest standards of living. Yet, in recent years, the gulf between the rich and poor has widened: 29 million people were below the poverty line in 1980 but by 1985 that number had grown to 33 million.[10] About 35 million Americans do not have health insurance; hospitals across the country turn away patients who are unable to pay for health care.

In the USA governmental research funding for health and human services pales in comparison to that for military research. Whereas funding for military research and development increased by 28% over the past three years, that for health and human services was reduced by 5% over the same period. In the fiscal year 1987 military programmes consumed 71% of the total federal research and development budget. Military research also diverts highly trained people from working to improve health and the quality of life. World expenditure on weapons research exceeds the combined spending on the development of new energy technology, improvement of human health, and agriculture productivity, and control of pollutants.[5]

IMPACT OF ARMS SPENDING ON DEVELOPING NATIONS

The almost 1 trillion dollars that nations of the world now spend on arms annually is equivalent to $2 5 billion each day and to the incomes of 2 6 billion people in the 44 poorest nations, over half the world's population. This one-year expenditure on arms is also equivalent to the entire debt that the poor nations of the world owe the rich nations. Furthermore, this extraordinary waste of the world's resources is increasing rapidly. In 1960, world military expenditures totalled about 4 7% of world economic output—now they amount to over 6%.

In developing countries, close to 1 billion people are estimated to be below the poverty line, 780 million are undernourished, 850 million are illiterate, 1 5 billion have no access to medical facilities, an equally large number are unemployed, and 1 billion people are inadequately housed.[11] Such problems and the mortality and morbidity associated with them are exacerbated by the diversion of disproportionate resources to the military.[12 13]

The gulf between developed and developing countries continues to widen. From 1960 to 1983, the gain in per capita income was 12 times larger on average in developed than in developing countries: the per capita increase for the richest fifth of the world's population was $4800 and was $70 for the poorest fifth. In the third world three governments in five spend more against military foes than against all the enemies of good health. Since 1960, military expenditures (corrected for inflation) have increased seven times, while the aggregate GNP has risen less than four times and per capita GNP only two times. The rapidly rising military expenditures by the developed countries have far exceeded the slight rise in their foreign economic aid since 1960. The developed countries spend on average 5 4% of their GNP for military purposes and 0 3% in aid to poorer countries.

Compounding this tragedy is the fact that even small conversions of the funds being spent on arms into spending on health could produce enormous benefits:[2] the cost of one hour's world spending on arms is equivalent to the entire cost of the successful twenty-year effort to eradicate smallpox; the cost of three hours of world arms spending would pay for all of the World Health Organisation's annual budget; the cost of a half-day of world arms spending annually would pay for the full immunisation of all children against the common infectious diseases; the cost of four days of world military spending would pay for a five year programme to control malaria, probably the world's greatest cause of death due to illness; the cost of three weeks of world arms spending would pay for primary health care for every child in poor countries, including safe water supplies and full immunisations.

WHAT IS TO BE DONE?

The health workers of every nation must urge their nation to immediately initiate action to reallocate funds from arms to human services. Costa Rica, for example, has consistently spent very little on arms over the past three decades. It has in consequence had these resources to spend on improvement in its health and social conditions, and the results have been striking. The People's Republic of China began systematically in the mid-1970s to reduce its military expenditures; they fell from 15% of the GNP to 7 5% in 1985. China has announced a plan to cut its armed services by 24% and it is spending $360 million over two years to retrain these 1 million service people for return to civilian life. By 1984 Argentina had reduced its military expenditure to half that of 1980. In the USA, as a result of the work of PSR and other groups, half the population now feels that too much is being spent on the military.[14] The US administration has proposed a much smaller increase in military expenditures in 1989, one that would be lower than the projected inflation.[15] And in the USSR, General Secretary Mikael Gorbachev has emphasised the Soviet Union's eagerness to reduce expenditure on both nuclear and non-nuclear arms.[16]

Over 25 years ago, President Dwight D. Eisenhower stated the choices: "Every gun that is made, every warship launched, every rocket fired signifies, in the final sense, a theft from those who hunger and are not fed, those who are cold and are not clothed. This world in arms is not spending money alone. It is spending the sweat of its laborers, the genius of its scientists, the hopes of its children".[17] And the international conference on the relationship between disarmament and development recently restated these choices: "The world can either continue to pursue the arms race with characteristic vigour or move consciously and with deliberate speed towards a more stable and balanced social and economic development within a more sustainable international economic and political order; it cannot do both".[11]

REFERENCES

1 Special Study Section. Physicians for Social Responsibility. The medical consequences of thermonuclear war. *N Engl J Med* 1962; **266:** 1126–55.
2 Sidel VW. Destruction before detonation: the impact of the arms race on health and health care. *Lancet* 1985; ii: 1287–89.
3 Kennedy P. The rise and fall of the great powers. New York: Random House, 1987
4 Sivard RL. World Military and Social Expenditures 1987/88. Washington: World Priorities, 1987.
5 Brown LR. Redefining national security: state of the world 1986. New York: Norton 1986.
6 National security chosen as focus for 1988. *PSR Reports* 1988; **9:** 1.
7 Sidel V. Socioeconomic effects of the arms race. *Prev Med* 1987; **16:** 342–53.
8 Two trillion dollars in seven years. *Defense Monitor* 1987; **16:** (no 7).
9 Anderson M, Frisch M. Oden M. The empty pork barrel: the employment cost of the military build-up 1981–1985. Lansing Michigan: Employment Research Associates, 1986
10 Sidel R. Women and children last: the plight of the poor women in affluent America. New York: Viking, 1987
11 Report of the International Conference on the Relationship between Disarmament and Development (A/CONF 130/39). New York: United Nations, 1987
12 Woolhandler S, Himmelstein D. Militarism and mortality. *Lancet* 1985; ii: 1375.
13 Stott R. Even before the bomb drops. London: Medical Campaign Against Nuclear Weapons, 1988.
14 Americans talk security. Boston: Martilia and Kiley, 1987.
15 Cushman JH. 299-Billion military budget drops weapons and people. *New York Times*, February 19, 1988
16 Gorbachev M. Perestroika: new thinking for our country and the world. New York: Harper and Row. 1987
17 Eisenhower DD. The chance for peace. Speech on April 16 1933

NUCLEAR WEAPONS TEST BAN 1988

MICHAEL MCCALLY CHRISTINE K. CASSEL

5624 S Dorchester 3, Chicago, Illinois 60637,USA

IN the 1950s American citizens went to Nevada with camp chairs and sunglasses to watch nuclear weapons tests In 1986 alone three carefully researched books were published about American nuclear weapons testing.[1-3] The medical consequences of testing is a central theme in these accounts. Did we damage the health of sailors who washed down radioactive ships, soldiers in trenches a few hundred yards from ground zero, Utah ranchers down-wind of the test site, Bikini islanders exposed to fallout, or weapons production workers themselves, particularly the plutonium handlers? Little is known about nuclear weapons testing or the US test site After the limited test ban treaty (LTBT) was signed in 1963, testing went underground, literally and figuratively. But citizens are now asking: Why do we need to test nuclear weapons? What would be the consequences of stopping? Can we verify that the other side has in fact also stopped?

To address these questions, the First International Scientific Symposium on a Nuclear Test Ban was held in 1988 in Las Vegas, Nevada. The meeting was sponsored by International Physicians for the Prevention of Nuclear War, its US affiliate, Physicians for Social Responsibility, and the Natural Resources Defense Council (NRDC), the Union of Concern Scientists, the Sierra Club, and the Council on Economic Priorities. More than 400 scientists, physicians, politicians, peace activists, citizens, and journalists from Canada, USA, Sweden, Britain, Spain, Germany, and Norway attended. The NRDC report on US nuclear tests, 1945–87, revealed 117 unannounced US nuclear weapons tests, twice the number previously suspected.[4] The study, which was based on careful re-examination of old earthquake seismographs, demonstrated the ability of technology and analysis to verify a test ban with a high degree of reliability

PRESENT POLICIES

The US Government gives five reasons for its testing programme: (1) the need to develop technology for new generations of weapons; (2) the need to check the reliability of existing weapons; (3) the need to investigate weapons effects (such as the damage by electromagnetic pulse to communications and control systems); (4) the need to develop safety devices to prevent inadvertent explosions and concern about weapons proliferation.[5] The 5th argument is a new justification mentioned only in 1986 that a comprehensive test ban (CTB) would raise questions about the reliability of our stockpiles and therefore encourage US allies to acquire and test their own weapons—which is in stark contrast to the widely held view that a CTB would help restrict the number of weapons

The policy of the present US Administration is that a CTB is a long-term objective, achievable perhaps some time in the 21st century, but that testing must continue as long as the US and its allies depend on nuclear weapons for their security The administration has said it is willing to discuss interim measures such as limits on the numbers of tests or lower thresholds But public opinion polls show that over 70% of Americans support a halt to testing.[6] In 1987 Congress voted twice in support of a test ban.

Internationally, there is also strong support for a test ban In Britain 82% of the population favours a halt. The Prime Minister Mrs Margaret Thatcher sees advantages to a test ban. The Five Continent Peace Initiative leaders (heads of state of Sweden, Greece, Mexico, Argentina, and Tanzania), the non-nuclear signatories of the Nuclear Non-proliferation Treaty, and the United Nations General Assembly are calling for a test ban

BACKGROUND TO THE TEST BAN

A CTB has been pursued since the mid-1950s when fallout from atmospheric testing aroused worldwide protest The first era ended with the signing of the LTBT by President J. F. Kennedy and General Secretary N. Krushchev in 1962

In his comments at the symposium, Dr Glenn Seaborg, former head of the Atomic Energy Commission, emphasised the important role of leadership and political will. The LTBT was achieved, Seaborg argued, because Kennedy was deeply committed to reducing the threat of nuclear war and "devoted a major part of his energies to the test ban issue". Seaborg is convinced that if Kennedy and Krushchev had survived significant further steps in arms control and a CTB would have been achieved.[7] The question that Kennedy raised is unanswered to this day: Are the risks in a CTB less than the risks of reaching no agreement?

NUCLEAR TESTING AND NATIONAL SECURITY

Dr Ray Kidder, a senior physicist of the Lawrence Livermore National Laboratory, presented a politically charged study directly refuting claims made by Roger Batzel, director of Livermore, and former US Defence Secretary Casper Weinberger that nuclear testing is necessary to ensure the reliability of weapons in the stockpile Batzel's testimony to the Senate Armed Services Committee in February, 1987, has, however, been used to make the argument for nuclear testing. Kidder concludes that "a high degree of reliability in the existing stockpile is justified and that it is sufficiently robust to permit confidence in the reliability of remanufactured war heads in the absence of nuclear explosive proof-tests".[8]

Following a CTB of nuclear weapons would scientists and engineers drift away from the laboratories or become stale for lack of professional challenge? Kidder pointed out that laboratories are pleasant and secure places to work and that weapons designers could move with ease into complementary activities such as fusion or conventional ordinance Dr Theodore Taylor, a theoretical physicist and retired Las Alamos weapons designer, was not so sanguine about weapons designers doing other work The audience was ill-at-case as Taylor described himself as "a former uncontrolled addict to nuclear weaponry I have come to believe that this addiction, like alcohol or drug addiction is a disease . It is incurable . . The only way to control it effectively is total abstinence." Taylor's concerns in the late 1960s about the lack of control of weapons grade plutonium and the potential for terrorist diversion of quantities sufficient to make a bomb have been well related by McPhee.[9]

The central issue in the CTB debate is whether the security of the United States requires that we continue the development of new types of nuclear weapons Clearly the new weapons technology, particularly star wars technology, is the barrier to a test ban According to Taylor we have already opened the "Pandora's Box" of third generation weapons, and their development is endless. X-rays, gamma-rays, light, heat, and neutrons can be fashioned into various potential weapons.[10]

VERIFICATION

The ability to verify compliance has been the main barrier to negotiation.[11] Explosions in the atmosphere, in space, or underwater are readily detected, but the monitoring of underground tests is controversial Nonetheless there is a strong consensus among technical specialists that a test ban can be verified by a combination of detection methods A CTB would in fact be easier to verify than a threshold limit

since only that a test had occurred, and not its yield, would have to be established Dr Charles Archambeau a geophysicist from the University of Colorado, told us that earthquakes usually occur at over 15 km below the earth's surface whereas underground nuclear tests are at less than 1–2 km, a difference that makes it possible to distinguish all but 1–2 events per year. Dr Vitali Goldanskii, director of chemical physics of the Soviet Academy of Sciences, shared Archambeau's view—a 20-ton chemical explosive test jointly conducted by the Soviet Academy and the NRDC in September, 1987, had been easy to distinguish from an earthquake that occurred 40 seconds before the explosion. Furthermore, new observer satellites could be used to monitor test activity, as Jeremy Leggett, a British earth scientist and verification expert, emphasised US verification technology and monitoring techniques have not fully used existing technology.

Since the Reagan administration has refused to negotiate a CTB, Congress is considering a 1-kiloton nuclear testing threshold. Although a phased approach to a CTB, through lowered thresholds, could give us experience with verification of compliance, threshold limits could preclude the achievement of a CTB [12] Taylor, however, pointed out that the use of small contained nuclear explosions (inertial confinement fusion), studied for many years for power production, has weapons potential and would not be constrained by a threshold ban Disputes about verification and compliance might lead to breakdown of negotiations towards a complete ban on testing, in which verification is more straightforward

ENVIRONMENTAL AND HEALTH EFFECTS OF TESTING

About 15% of underground nuclear weapons explosions at the Nevada test site vent radiation to the atmosphere. After review of the little available information Dr Thomas Hamilton, an internist specialising in occupational medicine at the University of Washington, concluded that it is not clear what, if any, health effects these ventings produce. Recent congressional hearings suggest that the present radiological monitoring is inadequate to properly estimate the size and distribution of off-site releases and that it ought to be augmented

No systematic studies have been done of the potential health effects of underground testing Hamilton suggested that his study of the prevalence of thyroid nodules among the Marshall islanders resulting from the 1950s atmospheric testing there might be a model for the type of research needed.[13] He pointed out the striking indirect health consequences of testing in the South Pacific: the forced migration of islanders, crowding, and the loss of traditional life styles and food sources have produced very large increases in infant mortality and malnutrition, alcoholism, suicide, hepatitis, tuberculosis, and sexually transmitted disease at Kwajalein, a ballistic missile test station in the Marshall Islands

ECONOMIC ISSUES

Economics inextricably link our problems in the environment to expenditures for nuclear weapons development, as pointed out by Dr Anne Ehrlich, of the Sierra Club, and Dr Alice Tepper-Marlin, of the Council on Economic Priorities of New York The US Department of Energy has primary responsibility for the design, testing, and production of weapons, and 60% of the agencies' $13 billion budget goes to these activities In 1988 about $2 billion will go for testing and research. The Council on Economic Priorities estimates that up to $4 billion could be saved if research, testing, and production of nuclear weapons were halted

REFERENCES

1 Ball H. Justice downwind. America s atomic testing program in the 1950s New York. Oxford University Press. 1986
2 Miller RL Under the cloud: the decades of nuclear testing New York The Free Press, McMillan: 1986
3 Titus AC Bombs in the backyard: atomic testing and American politics Reno University of Nevada Press, 1986.
4 Norris RS, Cochran TB, Arkin WM Known U S. nuclear tests July 1945 to December 1987 Natural Resources Defense Council 1350 New York Ave NW #300 Washington DC 20005, January, 1988.
5 United States Department of Energy. Why do we need nuclear testing? Nevada Operations Office. Las Vegas NV 89193; October, 1987; and United States Department of State. US policy regarding limitations on nuclear testing Special Report no. 150 August 1986.
6 Public Agenda Foundation Voter options on nuclear arms policy Six E 39th St. New York, NY 10016, 1984.
7 Seaborg GT, Loeb BS Kennedy Krushchev and the test ban Berkeley: University of California, 1983.
8 Kidder R Maintaining the US stockpile of nuclear weapons during a test ban UCLR–97877 Preprint Lawrence Livermore Laboratory December. 1987.
9 McPhee J. The curve of binding energy: a journey into the awesome and alarming world of Theodore B. Taylor. New York: Farrar, Strauss, and Giroux 1973
10 Taylor TB. Third-generation nuclear weapons *Sci Am* 1987; **256:** 30–39.
11 Krass S. Verification: how much is enough Lexington: Lexington Books. D C Heath and Co, 1985.
12 Goldblatt J Cox D Nuclear weapons tests: prohibition or limitation? New York. Oxford University Press. 1988.
13 Hamilton TE van Belle G, LoGerfo JP. Thyroid neoplasia in Marshall Islanders exposed to nuclear fallout *JAMA* 1987; **258:** 629–36

INADVERTENT NUCLEAR WAR

HERBERT L. ABRAMS

Stanford University Center for International Security and Arms Control, and Department of Radiology, Stanford University School of Medicine, Stanford, California 94305, USA

AS nuclear stockpiles have grown year by year, all countries, whether or not they have these weapons, have become increasingly anxious about the risk of unintentional nuclear war. No rational leader would intentionally initiate a major exchange; it is more likely that nuclear war will come about through misunderstanding, miscalculation, misinterpretation, or accident [1,2] One can identify certain crisis situations that make an inadvertent nuclear war more likely (figure).[3] Examples are: threats to regional interests, as in the Persian Gulf or Central America; escalation of a conventional war; and the political misinterpretations and misjudgments of political leaders, as in the 1914–18 war. Such crises would be compounded by nuclear terrorism; by innovations in weapons technology, such as increased accuracy, decreased delivery time, and antisatellite weapons; by inadequate security for weapons materials (unaccounted for enriched uranium in the United States amounts to 4500 kg since 1950, enough for 250 Hiroshima size bombs[4]); and by current non-nuclear states (at least 33 seem technically capable of making nuclear weapons within ten years) acquiring the weapons without the safeguards that many of the existing nuclear powers have introduced [2]

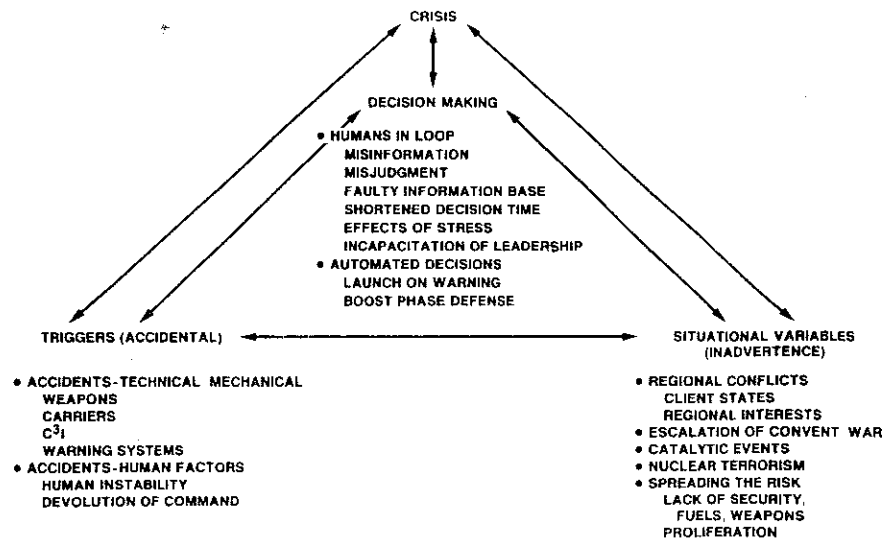
True accidents can be classed as mechanical/technical or human, and among the human factors should be included instability among those who handle weapons and the disability of leaders.

Between 1945 and 1976, on average at least one nuclear weapons accident occurred every $2\frac{1}{2}$ months,[5] including the accidental launch of a missile over Cuba and the aberrant flight of another over the Straits of Taiwan. Weapons transport systems are vulnerable too. Soviet and American submarines have been sunk in accidents, and at least ten nuclear bombs have never been recovered.

Nor can command and control systems be relied upon.[6] In a 1975 test of the US worldwide military command and control system, the computer network failed to transmit messages in 62% of hundreds of tests.[7] Every year sees thousands of faulty warnings.[8] Most are readily sorted out, but others have been far more serious. A false alarm perceived as an attack by a country that has introduced a launch-on-warning response remains the most obvious potential prelude to accidental nuclear war—and the shorter the delivery time of weapons becomes the more likely launch-on-warning policies will be.

If the weapons systems and back-up are vulnerable, so are the people. Over 50 000 men and women in the US were taken off nuclear weapons duties forces during a recent ten-year period because of drug abuse (33%), alcohol abuse (9%), psychiatric illness, criminal behaviour, and other factors.[9,10] It might be thought that safeguards would prevent unstable personalities from controlling nuclear weapons launches but surface ships with nuclear weapons on board have no mechanical safeguards such as permissive action links. It is physically possible for a commander and crew to use nuclear weapons without authorisation. Furthermore, during a crisis, when measures to guard against inadvertent launches tend to undermine launch readiness, commanders might loosen those safeguards, and so open the way for unstable personnel to exert control over nuclear weapons.

Disability in the leaders/decision makers has not been adequately emphasised. Such studies as have been done have dealt with the responses to stress of "normal" or "stable" individuals. However, mentally unstable policy makers have remained in high office and there have been senior government officials who have been unable to cope with prolonged stress.[3,11] In older men and women physical illness may diminish their capacity to function effectively.[12] Drugs that affect behaviour and decision-making profoundly are widely used by those in the military and government alike.[9,10,13] Among major national figures with important physical or psychological problems at one time or another were Churchill, Roosevelt, Eden, Hitler, Stalin, Brezhnev, Andropov, and Chernenko—all men with political power at the beginning of or during the nuclear era. There have been sixteen US presidents and seven Soviet secretaries general in the 20th century: twelve had heart



Accidental or inadvertent nuclear war

conditions while in office, seven had major surgery, and seven died of natural causes while in office.[3] After his heart attack Eisenhower acknowledged that in the first week he could not have handled "the concentration, the weighing of the pros and cons, and the final determination" of a crisis.[14] No consideration of the risk of inadvertent nuclear war can avoid discussing the incapacity in national leaders during crisis.

No single factor will trigger a third (nuclear) world war, but crises, accidents, and human frailty can act synergistically (figure). If events of low likelihood are projected over a sufficient time improbability may begin to approach certainty

REFERENCES

1 Abrams HL. Prescription for survival: the doctor s dilemma. *Invest Radiol* 1985; **20:** 653–57

2 Abrams HL. The problem of accidental or inadvertent nuclear war. *Prev Med* 1987; **16:** 319–33

3 Abrams HL. Inescapable risk: human disability and accidental nuclear war. *Curr Res Peace Confl* (in press).

4 Nuclear Control Institute. Issue brief: the use of atom bomb material in civilian research reactors. Washington, DC: Nuclear Control Institute, 1984.

5 Leitenberg M. Accidents of nuclear weapons systems. In: Stockholm International Peace Research Institute, ed. SIPRI yearbook of world armaments and disarmament 1977. Cambridge, Mass: MIT Press, 1977: 53.

6 Ball D. Can nuclear war be controlled? (Adelphi paper no 169). London: Institute for Strategic Studies, 1981: 38.

7 Bobbitt PC. Communication failures: discussion. In: Roderick H, ed. Avoiding inadvertent war: crisis management. Austin, Texas: Lyndon B Johnson School of Public Affairs, University of Texas, 1983: 51.

8 US Congress, Senate, Committee on Armed Services. Recent false alerts from the nation's missile attack warning system. Report prepared by Senators Barry Goldwater and Gary Hart. Washington DC: US Government Printing Office 1980: 4–5

9 Abrams HL. Who s minding the missiles? *The Sciences* 1986; **26:** 22–28.

10 Abrams HL. Sources of human instability in the handling of nuclear weapons. In: The medical implications of nuclear war. Washington, DC: Institute of Medicine National Academy of Sciences, National Academy Press 1986: 490–528.

11 Roger AA. Disability in high office. *Med Opinion Rev.* 1966; **1:** 16–19

12 Post JM. On aging leaders: possible effects of the aging process on the conduct of leadership. *J Geriatr Psychol* 1973; **6;** 109–16.

13 Lubit R, Russett B. The effects of drugs on decision making. *J Conflict Resol* 1984; **28:** 85–102.

14 Eisenhower DD. The White House years: mandate for change, 1953–1956. Garden City, NY: Doubleday, 1963

YOUTH AND THE THREAT OF NUCLEAR WAR

The Psychological Task of Venturing into Unknown Territory

WILLIAM R BEARDSLEE

Department of Psychiatry, Children's Hospital, Boston, Massachusetts

As the likelihood of nuclear war increased and awareness of its overwhelming destructiveness became more widespread, attention turned to psychological factors in living with this threat. Research over the past several decades included inquiries into adults' attitudes, beliefs, and perceptions about nuclear war, based on survey techniques,[1,2] and adults' uses of denial, repression, and dehumanisation[3-5] as responses. In the past decade increasing concern has been expressed about what threat is doing to children and adolescents. This anxiety has been voiced by parents, educators, physicians, and other health professionals and by children and adolescents themselves. Research has been conducted by standard survey techniques, by interviews, and by explorations of the experience of youngsters in their open-ended essays.[6]

THE EXTENT OF YOUTH'S CONCERN

Systematic surveys based on standard sampling techniques have demonstrated repeatedly that significant numbers of youngsters have fears about nuclear war and annihilation. In the United States the largest surveys,[7,8] part of a national survey of youth attitudes, gathered annual questionnaires from students graduating in consecutive years from high-school classes from 130 public and private high schools from 48 States. From 1976 to 1982 the sample sizes ranged from 16 662 to 18 942. These data show a steady rise in the percentage who worried sometimes or often about the nuclear threat. In 1976, 7·2% of the male seniors reported that they worried about it often, while in 1982 31·2% did so. Similar rates were found for female high-school seniors. Over the same period there was a steady increase in the percentage of both boys and girls who agreed with the statement, "Nuclear or biological annihilation will probably be the fate of all mankind within my lifetime". Between 1982 and 1984 the rates have remained more or less stable and in no year did the percentage who often worried about the nuclear threat reach 50%. Youngsters from less affluent homes and in minority groups were as likely to be concerned as others.

Standard Gallup opinion surveys in the United States showed that about half the teenagers think that a nuclear war is likely during their lifetimes, and many indicate that the possibility of nuclear war had some influence on their lives. Surveys employing various sampling techniques in other countries, including the Netherlands, West Germany, Finland, Norway, Sweden, New Zealand, Russia, Britain, and Canada, strongly support the notion that a substantial number of youngsters, varying from 25% to 80% depending on the survey, indicate concern about the nuclear threat.[6] Of particular interest is a recent study[9] from Columbia, the first data on Third World children, which reflects the children's considerable anxiety about the possibility of nuclear war.

To compare fear of nuclear war with concern about other issues, Goldenring and Doctor[10] studied 900 youngsters in the 7th–12th grades of high school in southern California. The questionnaire used embedded queries about the nuclear threat among other worries of adolescents. The greatest reported worry was parental death, followed by school performance, and then nuclear war. In other countries, concern about nuclear war ranked even higher. In Finland[11] standard sampling techniques disclosed that fear of war was the commonest concern of Finnish youth age 12–18; 81% listed war as one of the three main fears. In Canada,[12] a similar research approach to youngsters in grades 9–13 showed that 41% of students mentioned work and employment as their greatest concern; 29% gave war and peace as their second greatest worry; and 51% of the total group named war and peace as one of their three major worries, the highest ranking of any category. 10% of the sample thought about nuclear war daily; and 30% reported some thoughts on the subject at least twice a week. Among Swedish youth, in a recent survey,[6] war was the foremost worry.

IMPACT OF THE NUCLEAR THREAT ON ADOLESCENTS' ADJUSTMENT

Qualitative examination of verbatim responses to questionnaires and interview studies support the idea that for many youngsters the nuclear threat generates serious and intense concerns which they believe have an effect on themselves and on their thinking about the future. At least in the United States, most find out about the nuclear issues through the media; and most of them are alone with their fears and do not talk with parents or others about their anxieties.

No evidence has so far emerged which indicates that serious diagnosable psychopathology can be caused by fears of nuclear war. A modest connection does seem to exist, however, between indices of overall psychological functioning and the nuclear threat. A relationship between indicators of good psychological functioning and degree of awareness and worry about the nuclear issue has emerged from independent studies in three separate countries—the United States,[13] Finland,[14] and Canada.[15] In all three, youngsters who indicated higher levels of awareness and concern about the nuclear threat also had scores indicating better overall adjustment than their counterparts who were not as aware of or concerned about the nuclear threat. These studies indicate, of course, cross-sectional correlations in attitudes and not cause and effect. The large United States survey[8] identified two separate groups within those young people who expressed concern about nuclear war: those who worry about it (who increased in number over the period of the survey); and those who express despair about the threat. Youngsters who worry did not differ from others in the survey on any indices of functioning, but they had a greater interest in government and social issues. The group who expressed despair did not increase in size during the survey; and their despair about nuclear war was associated with pessimism and despair about the future in general. Despairing youngsters were more likely to feel worthless, alienated, and dissatisfied in general and had somewhat lower scores on some indices of mental health.

DEVELOPMENTAL PROGRESSION

At least a few very young children, aged 4–8 years, do express concerns about nuclear war. Since research in this area is slight, no definitive conclusions can be drawn about

the course of a developmental progression in awareness of the nuclear issue. Clearly, however, as youngsters grow older, they do become more concerned.

Some studies indicated that youngsters feel alone with their fears: the issues are not widely discussed with others. For many, the media provide the main sources of information. Some authors have suggested that there are family taboos against discussing this issue. In the one study in the United States which examined family attitudes in two generations, 317 college students and their parents were assessed. Students and parents did not share attitudes to the nuclear threat, nor were they particularly good at predicting each other's attitudes, supporting the view that these issues are not discussed.[16]

Finally, such evidence as exists on the role of discussion and education demonstrates that it is helpful. Teachers engaged in the development and implementation of curricula designed to deal with the threat of nuclear war report positive responses from students.[17] A large percentage of their sample in Norway[18] expressed pessimism, powerlessness, and repression about the future. Those who were optimistic about the future felt so, in part, because they or their parents joined in political actions directed at nuclear or other similar issues. In the Finnish study, youngsters who discussed nuclear matters either at home or with friends were more confident in their own ability to effect the prevention of war than others, regardless of anxiety level or frequency of thinking about war.[14] This was also true for discussions initiated by teachers.

Thus, the research supports strongly the contention that a substantial number, but by no means a majority, of youth voice major concern about the threat of nuclear war and that the concern is serious and intense. While much of the research today is of good scientific quality, much more research is needed. Fuller discussion of the methodological issues in these and similar studies and the need for more research and have been presented elsewhere.[19]

THE PSYCHOLOGICAL TASK: A VENTURE INTO UNKNOWN TERRITORY

Youngsters are being asked to shoulder a heavy psychological task in dealing with the immense destructiveness of nuclear weapons and the increasing threat of nuclear war. This burden is reflected in the experiences of those who have worked on the nuclear issue, including research workers, parents, teachers, and physicians, and in the reactions of youngsters themselves, as recorded in interviews, open-ended essay questions, and public discussions.

If they contemplate the threat of nuclear war young people must venture into unknown and uncertain territory into which many of the adults around them will not travel. It requires an act of the imagination that is difficult, if not impossible, for most adults. The threat is abstract, outside people's experience, yet overwhelming in its horror and scale. Major nuclear war would destroy the countries taking part and it could kill most of the inhabitants of the world. To consider the possibility of nuclear war seriously is to contemplate the destruction of life as it exists on earth; it means the end, not only of one's own life, but of the lives of everyone. It is a horrifying idea, a vision of a holocaust unlike anything the planet has known. Moreover, it is not clear that any one citizen can do very much by himself or herself alone, so there is an attendant sense of helplessness. The belief that a nuclear war will happen obviates any need to think about the future.

The threat raises fears of being both victims and perpetrators of nuclear violence: victims, because everyone would perish and there is so little control over the weapons; perpetrators, because those citizens of countries with nuclear weapons who used them would be, however unwillingly, participants in starting or waging nuclear war.

The threat has characteristics that set it apart from other social and political issues. First, there has been an understandable, though unfortunate, tendency to keep these matters secret.[20] The weapons were developed in secret in wartime when debate was impossible; and since then the major attitude has been that the issue is best left to scientific experts. Moreover, the subject is so painful, frightening, and seemingly technically imprenetrable that many adults have chosen to deal with it by denial and avoidance.[3-5] Until recently nuclear weapons figured little in public discussions, certainly much less than many other issues. Furthermore, the subject itself, precisely because it is painful and controversial, is inherently divisive. Among experts it arouses intense conflict about such questions as nuclear winter and the consequences of disarmament. It has provoked polarisation of political viewpoints. It is hard to obtain the distance necessary to evaluate its effect objectively or to engage in reasonable discussion.

Thus, the nuclear threat has not stimulated widespread action by citizens: it is painful and difficult, an air of secrecy surrounds it, and it engenders a sense of powerlessness and hopelessness. Survey after survey in the United States,[1,2] for example, has shown that most adults are concerned about nuclear war and have been for decades; many favour some sort of a mutual or unilateral freeze on nuclear weapons; and *yet* the great majority of adults take no action whatsoever. If someone were told that he or she had a significant risk of cancer and the risk was increasing, we would be profoundly disturbed if he or she took no action. This situation is analogous to the nuclear threat, and yet people do little. This attitude is not helpful either in public discussion and decision making or in preventing nuclear war.

THE NEED FOR EDUCATION

The major implications of the studies of children and adolescents are the need for much more careful, systematic, and sensitive education for youth about nuclear issues, encouragement of their participation in discussions, and awareness of the complexity and pain involved in knowing about the nuclear issues. The data indicate that youngsters who are more aware of the nuclear issues, even if worried or concerned, are not functioning less well psychologically than those who are unaware and, in fact, may be functioning better.

Education about the nuclear issue should be systematic, not partial or incomplete.[21,22] It should take place in a context which allows continued back-and-forth questioning. It may be provided by schools, by media presentations with follow-up discussions, and by parents, physicians, and other educators. Those providing it must have knowledge, sensitivity to the inner processes of working through the painful feelings engendered, and a willingness to try to come to grips with what youngsters are voicing. They must have learned to deal to some extent with the issue themselves. Just as teachers found that they could not teach students about the Holocaust without some preparation and support for themselves, so special curricula and support for teachers

have proved necessary in teaching about the nuclear issue.[17] The central aim of education must be to make individuals aware that they are not powerless and that their actions are important and do and will make a difference.

REFERENCES

1 Fiske S T, Fischhoff B, Milburn MA, eds. Images of nuclear war. *J Social Issues* 1983; **39**.

2 Fiske S T. Adult beliefs, feelings, and actions regarding nuclear war: evidence from surveys and experiments. In: Solomon F, Marston RQ, eds. The medical implications of nuclear war. Washington, DC: Institute of Medicine, National Academy of Sciences, National Academy Press, 1986.

3 Psychosocial aspects of nuclear developments. Task Force Report no 20. Washington, DC: American Psychiatric Association, 1982.

4 Group for the advancement of psychiatry: psychiatric aspects of nuclear war. Report 57. New York: Mental Health Materials Center, 1964.

5 Frank J. Sanity and survival: psychological aspects of war and peace. New York: Vantage Books, 1967.

6 Beardslee WR. Children s and adolescents' perceptions of the threat of nuclear war: implications of recent studies. In: Solomon F, Marston RQ, eds. The medical implications of nuclear war. Washington, DC: Institute of Medicine, National Academy of Sciences, National Academy Press, 1986.

7 Bachman J. American high school seniors view the military, 1976–1982. *Armed Forces and Society* 1983; **16:** 86–94.

8 Diamond G, Bachman J. High-school seniors and the nuclear threat, 1975–84: Political and mental health implications of concern and despair. In: Schwebel M, ed. Mental health implications of life in the nuclear age. *J Ment Hlth* 1986; **15:** 210–41.

9 Ardila R. The psychological impact of the nuclear threat on the third world: the case of Colombia. In: Schwebel M, ed. Mental health implications of life in the nuclear age. *Int J Ment Hlth* 1986; **15:** 162–71.

10 Goldenring JMI, Doctor R. California adolescents' concerns about the threat of nuclear war. In: Solantaus T, Chivian E, Vartanyan M, Chivian S, eds. Impact of the threat of nuclear war on children and adolescents. Boston: International Physicians for the Prevention of Nuclear War, 1985.

11 Soltantaus T, Rimpela M, Taipale V. The threat of war in the minds of 12–18-year-olds in Finland. *Lancet* 1984; i: 784–85.

12 Sommers FG, Goldberg S, Levinson D, et al. Children's mental health and the threat of nuclear war: a Canadian pilot study. In: Solantaus T, Chivian E, Vartanyan M, Chivian S, eds. Impact of the threat of nuclear war on children and adolescents. Boston: International Physicians for the Prevention of Nuclear War, 1985: 61–93.

13 Goldenring JM, Doctor R. Teen-age worry about nuclear war: North American and European questionnaire studies. In: Schwebel M, ed. Mental health implications of life in the nuclear age. *Int J Ment Hlth* 1986; **15:** 72–92.

14 Solantaus T, Rimpela M. Mental health and the threat of nuclear war: a suitable case for treatment? In: Schwebel M, ed. Mental health implications of life in the nuclear age. *Int J Ment Hlth* 1986; **15:** 261–73.

15 Goldberg S, LaCombe S, Levinson D, et al. Thinking about the threat of nuclear war: Relevance to mental health. *Am J Orthopsychiat* 1985; **55:** 503.

16 Hamilton SB, Knox TA, Keilin WG. The nuclear family: correspondence in cognitive and affective reactions to the threat of nuclear war among older adolescents and their parents. *J Youth Adolescence* 1986; **13:** 133–45.

17 Snow RS, Goodman L. A decision making approach to nuclear education. *Harvard Ed Rev* 1984; **54:** 321–28.

18 Raundalen M, Finnoy OJ. Children s and teen-agers' views of the future. In: Schwebel M, ed. Mental health implications of life in the nuclear age. *Int J Ment Hlth* 1986; **15:** 114–25.

19 Beardslee WR. Perceptions of the threat of nuclear war: research and professional implications. In: Schwebel M, ed. Mental health implications of life in the nuclear age. *Int J Ment Hlth* 1986; **15:** 242–52.

20 Carson DI. Nuclear weapons and secrecy. In: Psychsocial aspects of nuclear developments. Task Force Report no 20. Washington, DC: American Psychiatric Association, 1982.

21 Schwebel M. Effects of the nuclear war threat on children and teenagers: implications for professionals. *Am J Orthopsychiat* 1982; **52:** 608–18.

22 Beardslee WR, Mack JE. Adolescents and the threat of nuclear war: the evolution of the perspective. *Yale J Biol Med* 1983; **56:** 79–91.

COULD WE SAFELY NEGOTIATE A TREATY BANNING ALL NUCLEAR TESTS?

JEREMY LEGGETT

Department of Geology, Imperial College of Science and Technology, London SW7 2BP

A COMPLETE ban on nuclear testing would bring to an end the qualitative nuclear arms race. If signed—and abided by—a Comprehensive Test Ban Treaty (CTBT) would mean that the nuclear weapons on the drawing-boards in weapons laboratories today could not be brought to fruition. Such weapons include highly accurate warheads, earth-penetrators, and other devices which can be used in a nuclear preemptive strike. But could those who sign the treaty be sure that other signatories were not cheating? To use arms-control parlance, could a CTBT be verified?

The Partial Test Ban Treaty, the 25th anniversary of which fell on Aug 10, 1988, banned nuclear tests in the atmosphere, underwater, and in space. Since it was signed, however, testing underground has continued apace. In September, 1987, the US and Soviet Governments opened negotiations on nuclear weapons testing. The mandate for negotiations commits the two superpowers to proceed "stage by stage" to "the ultimate objective of a complete cessation of nuclear testing." But the word "ultimate" commits no-one to a timescale, and the US Government policy, spelt out on many occasions in the past few years, is that some level of nuclear testing will always be necessary as long as the US relies on nuclear weapons for deterrence. The present Administration is unique among US Governments of the nuclear age in not supporting the principle of a CTBT.

The Soviet Union favours attempts to negotiate a CTBT; and its 18-month self-imposed moratorium on nuclear testing from August, 1985, to February, 1987, was aimed at encouraging the US and the UK to reopen CTB talks (last held in 1977–80). But the moratorium went unreciprocated, and the Soviet Union has now accepted the "step-by-step" approach favoured by the US [1]

In August, as the first step, Soviet scientists went to Nevada to measure a US nuclear test. American scientists are soon to travel to Kazakhstan to measure a Soviet nuclear test. These joint verification experiments (JVE's) are designed to improve measurement of the size of nuclear explosions of between 50 and 150 kilotons. They are not relevant to a comprehensive test ban, but they are designed to test an on-site instrument, known as CORRTEX, which, the US Government insists, is necessary for the effective verification of a treaty signed in 1974 but never ratified. This, the Threshold Test Ban Treaty, limits the size of tests to 150 kilotons (about 10 times the size of the Hiroshima bomb).

MONITORING OF TESTS—OR THEIR ABSENCE

Many experts believe that the size of nuclear tests can be monitored just as accurately from afar as CORRTEX is able to do at the site of the explosion. Explosions set up seismic waves in the planet's outer shell, which can be recorded by sensitive instruments (seismometers). The Office of Technology Assessment (OTA), an independent scientific body set up with bipartisan support to advise the US Congress, has recently completed a lengthy study of nuclear test-ban verification [2] Reviewing evidence, classified and unclassified, from governmental and non-governmental experts, it concludes that seismometers outside the Soviet Union could detect any explosion in hard rock in the Soviet Union down to a level of 1 kiloton. The Soviet Union has agreed, if there is a test ban, to install seismometers inside its territory. Furthermore, the OTA report concludes that if several types of seismic wave are measured, monitoring explosions at a distance of thousands of kilometres is just as accurate as using CORRTEX at the Soviet test site.

For these reasons, the President of the US Arms Control Association has described the JVEs as "a needlessly complex and circuitous assault on a largely manufactured problem."[3]

But how low a level of clandestine testing could seismology be relied on to uncover? This is a critical question when the options of a comprehensive test ban or a threshold test ban are weighed. Parties to a treaty have to bear in mind, firstly, that explosions must be distinguished from other seismic events such as earthquakes and, secondly, that an attempt might be made to evade the test ban by detonating a bomb in a huge cavern, a technique known as decoupling, so as to dampen the seismic waves.

The conclusions of the OTA on possible evasion by the Soviet Union are instructive. The Soviet Union could attempt to evade a test ban only with a small bomb—up to 10 kilotons at most. And that would require the use of a cavern some 90 metres in diameter at a depth of around 1 km, a feat which could be attempted only in salt deposits. This enterprise would be a daunting prospect—trying to hide, in geologically favourable areas, the preparation and use of the cavern from surveillance by photographic and signals-intelligence satellites.

The report assesses what might be monitorable satisfactorily by the US if the Soviet Union tried to run the evasion gauntlet, concluding that "most experts agree that a high quality network of internal (seismic) stations combined with stringent treaty constraints, could monitor a threshold of around 5 kilotons." This, the report emphasises, is a *consensus* view: in other words, a view shared by scientists inside and outside the US Government. Furthermore, the report makes clear, the seismological constraints do not allow for possible improvements to the monitoring abilities of seismic stations using high frequencies, about which there is as yet no clear consensus in the expert community. An exploding bomb pushes seismic energy into the ground at a range of frequencies. At the higher frequencies the dampening effect of detonating a bomb in a cavern is reduced.

Scientists from the US Natural Resources Defense Council (NRDC) have been operating three seismic stations around the Soviet test site in Kazakhstan since 1985. These stations, monitoring at high frequencies, have recorded at distances of 200–650 km chemical explosions of 0·01 kilotons on the Soviet test site. The OTA report comments that "the recent NRDC recordings at very high frequencies . . . are very impressive in this regard." Seismologists who believe that such encouraging early results from seismic stations within the Soviet Union will prove to be typical maintain that, given enough monitoring stations by the Soviet Union, a 1-kiloton limit could be monitored effectively [4,5]

But that is not the same as monitoring the complete absence of nuclear testing. Would it not, then, be better to negotiate a low-yield test ban, with a threshold of 1–5 kilotons? Such a ban would prevent the development of most but not all, future nuclear weapons.

THE EVASION GAUNTLET

The critical question is whether geological and operational aspects of the evasion gauntlet could be exploited, as well as the seismological, so as to fashion a verification scheme which generates confidence in compliance with a complete ban.

A regime intent on cheating would have to confront two main aspects of the gauntlet, other than the seismological one.[6]

First, the evader could not be sure of being able to hide from satellite surveillance the preparation of a new cavern (which, by any method, would take several months at least), the modification of an existing cavern, the positions of which are known, or the extensive engineering preparations for the test itself. Challenge on-site inspections, whereby the verifier could visit at short notice an installation under suspicion, could be negotiated as a confidence-building measure to narrow the gauntlet further. Such short-notice challenge inspections were negotiated as part of the INF Treaty. A register of mining activities would help this process. Again, there are precedents in the extensive database of the INF Treaty's Memorandum of Understanding.

Second, the aftermath of the test would present uncertainties for the evader. For example, the cavern might leak tell-tale radiation, or collapse. Tamper-proof radiation monitors could be stationed at sites where large caverns could be built, as a further confidence-building measure.

As with the verification measures negotiated in the INF treaty, other moves are available. Specialised equipment for nuclear testing could be dismantled; and inspectors could be stationed on-site at key facilities. Collaborative experiments could be conducted to calibrate seismic monitoring stations and to investigate the technical feasibility of decoupling (the one decoupling experiment in the West involved a nuclear device of only 380 tons). An inspectorate could be set up to monitor large conventional explosions, to ensure that they are not mistaken for nuclear tests. Prior notification of such explosions could be required, with the option of on-site inspection of the quarries, dam sites, and excavations where they were to take place.

CONFIDENCE IN VERIFICATION MEASURES

All such cooperative measures intrude less into militarily sensitive areas than do some of the confidence-building measures under discussion for the strategic arms reduction treaty, agreed for the INF Treaty, or under consideration for a treaty cutting conventional forces. For example, the INF treaty involves on-site inspections of two factories where components for nuclear weapons are still being assembled; the strategic arms treaty includes agreement-in-principle to lift the hatches of ballistic-missile submarines so that warheads may be counted; and an agreement on conventional forces would be likely to stipulate inspections of areas where tanks are stored.

The "global double zero" aspect of the INF treaty (abandonment of all shorter-range and all longer-range intermediate nuclear forces) made that treaty much easier to verify than a partial ban on INF missiles—for two reasons. First, the entire existing infrastructure will be demolished, and seen to be so by inspectors on-site; and clandestine development of a new force would mean a wholly new infrastructure. Second, evidence of the existence of any missile—manufacture, storage, flight testing, deployment—would expose a clandestine programme. That is a formidable disincentive, since a great many missiles would have to be secretly deployed before any military advantage could accrue to the cheater. In the same way, a total ban on nuclear testing can be made easier to verify in principle than a partial ban, no matter how low the threshold.

Whether or not this would be the case in practice would depend upon how cooperative the superpowers were prepared to be when negotiating confidence-building measures. With the discussions at present effectively designed to rubber-stamp nuclear tests of 50–150 kilotons, negotiators are, sadly, not likely to have to face this challenge in the immediate future.

REFERENCES

1 Joint US–USSR Summit statement. Washington, DC, December, 1987.
2 US Congress Office of Technology Assessment. Seismic verification of nuclear testing treaties. Washington DC, 1988.
3 Keeny SM. Notes from underground. *Arms Control Today* 1988; **18:** 2.
4 Evernden JF, Archaubeau CB, Cranswick E. An evaluation of seismic decoupling and underground nuclear test monitoring using high-frequency seismic data. *Rev Geophys* 1986; **24:** 143–215.
5 Sykes LR. Present capabilities for the detection and identification of seismic events. In: Goldblat J, Cox D, eds. Nuclear weapon tests: prohibition or limitation. 1988. London: Oxford University Press. 145–48.
6 Leggett JK. Techniques to evade detection of nuclear tests. In: Goldblat J, Cox D, eds. Nuclear weapon tests: prohibition or limitation. 1988. London: Oxford University Press. 209–36.

A VIEW FROM A NATION LESS LIKELY TO BE A TARGET FOR NUCLEAR WEAPONS

OSVALDO VELASQUEZ

School of Medicine, Universidad Nacional, Box 4531, Panama 5RP

IN a nuclear war countries in the northern hemisphere would be more exposed to direct nuclear attack than those in the tropics or the southern hemisphere. If the tropical countries were spared, they could be a haven for human survival because of their dense tropical forests, rich in flora and fauna, their vast water resources, and their stable warm climate. If the tropical zone became a nuclear target, however, ecological and atmospheric changes would ensure that it offered little shelter for survivors.

On the American continent, the tropical zone includes the southern part of Mexico, Central America, the Caribbean, and the northern part of South America. Most countries in this part of the world are regarded as non-targeted nations. How would the ecosystem change in any of these countries if they were in fact to become targets and to what extent would such changes affect the northern and the southern hemispheres?

Geiger and Leaning[1] have discussed the secondary effect on the southern hemisphere of a nuclear exchange in the north. What would be the effects in the north if the targeted nations were in the tropical zone or the southern hemisphere? What changes can be predicted in the ecosystem of the tropics and the southern hemisphere if, in addition to the secondary changes from direct nuclear impacts in the north, they themselves received direct impacts?

For example, take one tropical country, the Republic of Panama, which lies on an isthmus that joins two vast continents. Here a canal was built, 50 miles long, from the Pacific to the Atlantic, of great strategic and commercial significance to the world, particularly to the United States. During the year ending September, 1987, the canal registered 13 444 single transits in either direction, carrying cargo from all parts of the world. A third of this cargo consisted of petroleum, chemicals (including radioactive material), and minerals.[2] In other words, the Panama canal is a very important waterway for the transport of raw materials for vital industries and the manufacture of weapons.

A nuclear bomb, such as the one dropped on Hiroshima (about 15 kilotons), could destroy the canal and generate severe changes in the ecosystem. It may be assumed that the nuclear attack would be directed against the canal, since the rest of the country is of no strategic significance. The heat and blast of the explosion could destroy the canal installations to the point of creating a free connection between the two oceans. Depending on the severity of the bombing, hundreds of thousands of people living along the canal in the cities of Panama and Colon, could die instantly from the heat, blast, and radiation. In a matter of minutes or hours many more would die in the flooding of this zone.

Heat and radiation would seriously damage the tropical forest, vital for the regeneration of oxygen and water. Few regions in the world support such a density of terrestrial life in so small an area as the isthmus of Panama, in which are found 865 classified birds species, 145 of which are migrant visitors escaping winter in northern latitudes.[3] Even man's present deforestation may drastically affect both migratory and resident birds.[4]

It is hard to predict the immediate and later effects of radiation on the insect population, which in the tropics varies in size between the dry and wet seasons, but an increase is to be expected in the proportion of insects resistant to radiation. The dead flora and fauna and the lack of pesticides in the new environment could encourage rapid proliferation. Radiation might induce mutations that would make some insects more detrimental to man and other animals. Insects exposed to radiation could serve as food to migratory birds, which might conceivably, through some immunodeficiency, become more susceptible to diseases transmissible to man.

If a nuclear attack on the Panama canal produced a confluence of the two oceans, there would be a free interaction of species that have been separated for between 3 and 5 million years. Fish populations could be harmed by this passage of water since clear ecological differences exist between the two oceans.[5]

After a nuclear attack on a tropical zone, environmental desolation could be extreme. Radioactive fallout and the contamination of plants, animals, and water, would reach noxious levels. The ozone concentration in the stratosphere would be reduced after the ascent of oxides of nitrogen generated in the huge fires.[6]

The sum of these effects makes it very unlikely that the new environment would be suitable for human life.

REFERENCES

1 Geiger J, Leaning J. Nuclear winter and longer-term consequences of nuclear war. *Prev Med* 1987; **16:** 308–18.

2 Panama Canal Commission Annual Report. Fiscal year ended Sept 30, 1987.

3 Wetmore A. The Panamic Biota. The birds of the isthmus of Panama. *Bull Biol Soc Washington* 1987; no 2: 211.

4 Willis E. Ecological roles of migratory and resident birds on Colorado Island, Panama. In: Migrant birds in the neotropics: ecology, behavior, distribution and conservation; 205. Washington, DC. Smithsonian Institution Press, 1980.

5 Olson A. Origin of the existing Panamic molluscan biotas in terms of their geologic history and their separation by the isthmian land barrier. *Bull Biol Soc Washington* 1987; no 2: 117.

6 Greene O, Longman A. Nuclear winter: uncertainties, scientific consensus, and the SCOPE-ENUWAR report. *Medicine and War* 1987; **3:** 161–70.

NUCLEAR WINTER

THOMAS PIEMONTE

Glover Memorial Hospital, Needham, Massachusetts, USA

DESPITE several years of study and debate, the atmospheric and climatic effects of an unlimited nuclear war remain a matter of controversy. Particularly debatable is the theory of a nuclear winter postulated by some scientists who believe that, after a nuclear war, exploded debris in the atmosphere would cause a dramatic drop in the earth's surface temperature, with devastating biological consequences. This issue has been hotly debated in both scientific and political literature.

THE TTAPS STUDY

Shortly after Crutzen and Birks[1] first advanced the theory, a group of atmospheric scientists, in association with the astronomer Carl Saga, published, in 1983 the TTAPS study[2] (an acronym formed by the initials of its authors). This study, which gave widespread recognition and credibility to the concept of nuclear winter, is based on projections indicating that, in the event of a significant ground-burst explosion, millions of tons of dust and soot would spew into the earth's atmosphere. The dust particles would absorb much of the sun's heat and energy and the heated dust particles would rise in the earth's atmosphere. A cooling of the earth's surface would create a large temperature shift from the lower to the higher atmospheres. Ordinarily, rain would clear the atmosphere of smoke and soot, but this heated mass would rise above the rain clouds and persist for longer than usual. The TTAPS estimates indicate that the earth's surface would be in near total darkness after a large nuclear conflict. This blackout would inhibit photosynthesis and disrupt the food chain.

Using a computer model to estimate the effects of a 5000-megaton exchange, multiple scenarios were applied to estimate the amount of dust and smoke generated and how much sunlight would be absorbed. Temperature changes on the earth's surface, wind factors, and their effects on the spread of smoke and soot were also studied. The TTAPS study concluded that the earth would be plunged into near total darkness within one week after a large nuclear conflict. Subfreezing temperatures, possibly as low as −25 °C, have been forecast. Lakes and rivers would freeze, killing plant life and most farm animals. Consequently, human survivors would face starvation. Because oceans would not freeze, the coastal land masses would be protected from the dire cooling effects seen inland. Widespread devastation and death would spread rapidly, even to non-combatant nations. Tropical areas would be devastated because they are more sensitive to even minor changes in temperatures. It is generally agreed that the ozone layer would be signfiicantly depleted as a direct result of the release of oxides of nitrogen into the atmosphere by large-scale nuclear explosions. Initially, dust particles injected into the earth's atmosphere would absorb ultraviolet rays, but, after the dust cleared, UVB doses 1·6 times greater than normal would be transmitted to the earth's surface, possibly resulting in a large increase in cancer among survivors of a nuclear war.

Dr Jack H. Geiger, of the City College of New York, who has written extensively on this subject and nuclear war in general, stated[3] that in the aftermath of a 5000-megaton exchange, the survivors would face extreme cold, water shortages, lack of food and fuel, and heavy burdens of radiation, disease, and severe psychological stress—all in twilight and darkness. It is clear that the ecosystem effects alone would be enough to destroy civilisation as we know it, at least in the northern hemisphere. These long-term effects, combined with direct casualties from blast, heat, and radiation, suggest that eventually there might be no human survivors in the northern hemisphere; human beings and other animals and plants in the southern hemisphere would also suffer profound consequences.

Some investigators have been concerned about the effect of toxic chemicals released from urban areas after a nuclear attack. It is believed, however, that the release of toxic chemicals (such as synthetic materials stored in strategic industrial urban areas and gas and oil refineries) would not pose a serious environmental hazard. Even if the entire year's production of organic chemicals were released and mixed over half the northern hemisphere, the concentration of chemical compounds would still be far below the 50% lethal dose for HCN gas, say these investigators.

DOUBTS ABOUT THE "APOCALYPTIC VISIONS

The dire conclusions about nuclear winter have not been accepted by all scientists; and they have been scrutinised and criticised by government scientists in particular. Thompson and Schneider[4] stated that "apocalyptic visions of environmental effects of nuclear war have been part of our popular culture for decades. But, apart from appreciating their entertainment value, the cognoscenti of nuclear war regard the doomsday prediction as ignorant at best, or dangerous propaganda at worst." (Thompson is an atmospheric scientist at the National Center for Atmospheric Research, Boulder, Colorado, and Schneider is an atmospheric scientist, public-safety analyst, and deputy director of the advanced study program at NCAR.) Although they dismissed the "apocalyptic" conclusions of nuclear-winter theories, they admit that there is no satisfactory understanding of the environmental effects of nuclear war. Even accepting estimates that a 5000-megaton nuclear war would produce 225 million metric tons of smoke and 65 million metric tons of stratospheric dust, critics of the TTAPS study question the severity of the environmental effects of nuclear war.

The areas of uncertainty are: the amount of smoke generated and its initial altitude distribution; the degree to which smoke would spread globally and how quickly it would be removed from the atmosphere; and the detailed regional and seasonal weather patterns and how they would influence the severity of a climatic effect of a nuclear exchange. Although these factors were not clearly addressed in the TTAPS study or subsequent studies, it is generally agreed that they represent a serious risk. Appeals have therefore been made to policy makers in the USA and the USSR to address the need for continued arms reduction in the light of these grave predictions.

I gratefully acknowledge the assistance of Peter Zheutlin.

REFERENCES

1 Crutzen P, Birks J. The atmosphere after a nuclear war: twilight at noon. *Ambio* 1982; **11**: 114–25.

2 Turco RP, Toon OB, Ackerman TP, Pollack JB, Sagan C. Nuclear winter: global consequences of multiple nuclear explosions. *Science* 1983; **222**: 1283–92.

3 Geiger JH. *IPPNW Report* 1984; **2**: 8.

4 Thompson S, Schneider S. Nuclear war reappraised. *Foreign Affairs* 1986; **64**: 981–1005.

MEDICAL EDUCATION AND NUCLEAR WAR

MICHAEL MCCALLY CHRISTINE K CASSEL
LEAH NORGROVE

University of Chicago, Pritzker School of Medicine, Chicago, Illinois 60637, USA

MANY physicians accept that it is a medical task to estimate the effects of nuclear weapons and to educate others about these consequences. We contend that information about the impact of nuclear war should be part of every medical school's curriculum. To omit this information is to neglect the most significant threat to public health facing the world today. We here present a status report on the development of educational programmes about nuclear weapons and nuclear war and a justification for their inclusion in schools of medicine.

PREVENTION: A TRADITIONAL MEDICAL TASK

It is true that nuclear war is not a medical problem: it is a political and military problem with great public-health and social implications. Medical expertise is necessary for the evaluation of the health, environmental, and psychosocial consequences; and doctors can speak with authority on the public-health consequences of the arms race [1]. Reports by the United States National Academy of Sciences Institute of Medicine[2] and the British Medical Association[3] are examples of major medical contributions to the understanding of these issues.

In academic settings, if medicine and nuclear war are to be linked, teaching must be distinguished from political advocacy. One view is that to teach physicians and medical students about nuclear war is inappropriate or unphysicianly. The Editor of the *New England Journal of Medicine*, for example, once argued[4] that physicians ought not to involve themselves, as physicians, in areas outside their direct medical competence. From another perspective the issue can be seen as political partisanship. Physicians who speak and teach on nuclear war may appear to be adopting the political agenda of unilateral disarmament [5].

There is, however, no necessary partisanship in teaching nuclear issues. We are justified in telling medical students about nuclear weapons and nuclear war because a body of information exists that is relevant to physicians as public-health practitioners and as educators. This knowledge is separable from how one thinks about national security or what one does with the information. Such content can be taught, if not "value free", at least without partisan advocacy.

Clearly, no sane person wants nuclear war, although some are more sanguine than others about the risks of its happening. Disagreement exists only on how best to prevent nuclear war. Some favour arms control and the ultimate abolition of nuclear weapons. Others believe that high levels of military arsenals, including nuclear weapons, are necessary. But there is universal agreement that nuclear war must be prevented. And prevention of a health hazard is a traditional medical task.

A substantial historical precedent exists for physicians to engage in social and political action to improve the health of groups and communities. Physicians are active politically for improvements in working conditions, air quality, and road safety, for example. Concern for the health of the public has been accepted as a medical responsibility since before the time of the industrial revolution. Schools teach medical aspects of these social issues but do not proseletyse for particular courses of political action. Medical schools ought to treat nuclear war similarly.

Efforts to design curricula on the medical dimensions of nuclear war have been constrained by the controversy over political advocacy. Most medical schools in North America, however, have some sessions on various topics of social responsibility and ethics. It is precisely in these areas of controversy that medical students are seeking guidance from their faculties. They want to know what individual physicians think about complex social and value issues.

CONTINUING MEDICAL EDUCATION

Information about nuclear weapons and the issues involved for physicians were first systematically presented in the early 1960s by a United States medical organisation, Physicians for Social Responsibility. A series of articles in the *New England Journal of Medicine* in 1962 described, in still accurate detail, the consequences of a nuclear attack on the city of Boston.[6,7] They contributed to the international public debate that resulted in the Partial Test Ban Treaty of 1963; but detente with the Soviet Union diverted public concern to other issues.

Physicians for Social Responsibility renewed its activities in 1979, using the format of continuing medical education. In major cities across the country large-one-day and two-day symposia were held at which experts in medicine, physics, weapons effects, radiation, health economics, and military and political science presented lectures on the medical consequences of nuclear weapons. While these meetings were open to the public most of those attending were health professionals. These symposia continue to be held, usually co-sponsored by a local medical school or medical society.

In the United States the issues have also been presented at meetings of most major professional societies, such as the American College of Physicians, the American Psychiatric Association, the American Public Health Association, the American Academy of Pediatrics, and the Association of American Medical Colleges. The American Medical Association has passed a resolution encouraging all physicians to work to educate themselves, the general public, and Government officials about the devastating consequences of nuclear war and the inability of physicians to respond to the massive casualties. Similar actions have been taken by medical associations and specialty societies around the world.

COURSES IN MEDICAL SCHOOLS

In response to these postgraduate activities medical students began to ask for the same subjects to be included in the undergraduate curriculum. In 1981 at an American medical school pressure from students of medicine and nursing prompted the faculty to offer a ten-week for-credit elective course entitled Medicine and Nuclear War. The course was deemed successful, and the faculty published a letter and a short communication about the experience [8]. These reports prompted over 250 requests for the curriculum from physicians, deans, and educators all over the world. These inquiries suggested broad interest in medical attention to the prevention of nuclear war.

The content of teaching may vary with the particular expertise of the faculty and the interests of the students. The following list of topics has been accumulated from syllabi of courses taught in medical schools in the United States:[9]

- Nuclear weapons and how they work
- Immediate medical effects of nuclear weapons: blast and burn
- Radiation and nuclear weapons
- Long-term climatic and ecological effects of nuclear war
- Long-term medical problems of survivors
- The social and psychological consequences of nuclear war

The medical response and implications for civil defence
The social psychology of the nuclear arms race
The effects of nuclear war on non-combatant nations
The social responsibility of health care professionals

These topics are well covered in recent textbooks and anthologies.[10,11]

Perhaps even more important for students than the medical information is discussion of social responsibility and the opportunity to deal openly with value-laden issues. If we accept that nuclear war is not survivable or permissable then we can invoke the public-health responsibility to justify social and political efforts towards reducing the risk. Students can be encouraged to consider for themselves the political dimensions of their profession.

When evaluations were available[9] students judged these courses to be "good" to "optimal" learning experiences. Many expressed a positive attitude towards a course which examined in a practical way health professionals' social responsibility. These courses not only provided medical material about nuclear war but also served as a vehicle where students could develop their own concepts.

DESIGN OF A COURSE

An undergraduate course on nuclear war should enable the student to: demonstrate knowledge of nuclear weapons including the medical, social, and ecological consequences of their use; identify principles of social ethics which define a role for physicians in the age of nuclear weapons; and suggest professional activities consistent with these principles.

The design of such a course must take into account the interests of the institution in which it is to be held and the potential resources. At some institutions a new course within a single department may be possible; at others interdisciplinary programmes may be more suitable. Any deficiences in teaching resources may be offset in several ways: by inviting colleagues or guests as presenters; by framing the course as a collaborative learning exercise of faculty and students alike in which neither are expert; or by faculty attendance at summer faculty development programmes now available. Excellent curriculum guides are also available.[12,13]

Because the interpretation and use of the information taught may be challenged, academic course work on nuclear war must be objective and rigorous. Where there are "sides" all ought to be presented. Every effort should be made to provide expert teachers, factual information, and academic rigor, including examinations. In addition, it may be desirable to present (in collaboration with other interdisciplinary or departmental offerings in the university) topics which are less strictly medical, such as:

History of the nuclear age
Economics of the arms race
The threat of nuclear war
Arms control and disarmanent
Space weapons: technology and the arms race
Accidental and inadvertent nuclear war
Nuclear war: causes and solutions

INTERNATIONAL PERSPECTIVES

The World Health Organisation several years ago produced and distributed globally in six languages an authoritative document, Effects of Nuclear War on Health and Health Services. An extensive revision was released early in 1988.[14] Recently the WHO asked International Physicians for the Prevention of Nuclear War to develop a model curriculum on nuclear war for worldwide distribution to medical faculties. This document is now available.[13] The curriculum suggests as appropriate texts the revised WHO report and the National Academy of Sciences report.[2]

In a 1984 survey in the United States, distributed to 123 schools (of which 89 schools responded), 63% of the respondents answered "yes" to the question, "Does your institution offer or sponsor any activity dealing with medical aspects of nuclear war?"[9] A similar survey of the world's 1130 recognised schools of medicine was completed in 1985 and 140 schools responded, of which 54% answered yes to the same question.[15]

Of 3 schools in the United Kingdom which responded to the 1985 international survey, 2 had a teaching activity. We plan to repeat the international survey in 1990 to determine the status of such programmes, particularly their position in the curriculum and the results of evaluations. For example, by 1988 all 6 medical faculties in Sweden have included health aspects of nuclear war in their required curricula. These courses, held during the clinical years, have scored very well in student evaluations.

The surveys showed that teaching may take several forms: one or more lectures in a social or community medicine course, a continuing medical education programme, or an elective course. Some programmes used only outside experts, others only local medical-school staff. Unfortunately, few evaluations of individual teaching programmes have been completed, but one study suggests that specific knowledge of the consequences of nuclear weapons is associated with a reluctance to "countenance nuclear war".[16]

THE PHYSICIAN'S OATH

Medical oaths and codes are intended to state the fundamental values of the profession. It seems reasonable then to include in these oaths a clear commitment to the medical responsibility to educate about the consequences of nuclear war. In the United States it has been proposed that medical students and physicians recognise this responsibility by adding to the oath taken on graduation a statement such as, "Recognising the danger which nuclear weaponry represents for mankind I promise to work for peace and the prevention of nuclear war".[17] The authors of this proposal noted that in 1983 such a sentence was added to the oath taken by graduating physicians in the Soviet Union. At its annual convention in 1984 the American Medical Student Association passed a resolution urging its members to include in their graduation oath a statement about the physician's responsibility to work for the prevention of nuclear war. IPPNW through its affiliated national organisations has pressed for such changes to physicians' oaths worldwide, but we do not know how widespread this practice has become.

OUTCOMES

What can one conclude about the effort to educate medical students about the consequences and prevention of nuclear war? First, some faculties of medicine recognise that such instruction is important. It is a widely but not universally held position that estimating the health effects of nuclear war and acting to prevent these consequences are medical responsibilities. Second, there is a body of

information about medical aspects of nuclear war that can be taught without partisan political advocacy. Finally, the committment of WHO to the dissemination of its report and to the development of a model medical curriculum is evidence of international medical concern about the prevention of nuclear war. An initiative is under way to include a statement about nuclear war in the text of physicians' oaths. The development of courses on nuclear war in schools of medicine should be encouraged and supported

REFERENCES

1 Cassel CK, Jameton AL. Medical responsibility and thermonuclear war. *Ann Intern Med* 1982; **97:** 426–32.
2 Institute of Medicine, National Academy of Sciences. The medical implications of nuclear war. Washington DC: National Academy Press, 1986.
3 British Medical Association Board of Science and Education. The medical effects of nuclear war. John Wiley, 1983.
4 Relman AS. Physicians, nuclear war, and politics. *N Engl J Med* 1982; **307:** 744–45
5 Orient JM. The medical metaphor for nuclear warfare: a critique. *Perspec Biol Med* 1984; **27:** 289–98.
6 Ervin FR, Glazier JB, Aronow S, et al. The medical consequences of thermonuclear war I: Human and ecological effects in Massachusetts of an assumed thermonuclear attack on the United States. *N Engl J Med* 1962; **266:** 1127–37
7 Sidel VW, Geiger HJ, Lown B. The medical consequences of thermonuclear war II: The physicians role in the post attack period. *N Engl J Med* 1962; **266:** 1137–44.
8 Cassel C, Garland M, McCally M. Design of a course on the medical consequences of nuclear war. *J Med Educ* 1982; **57:** 866–68.
9 McCally M, Cassel CK, Coe RM, Pepper M. A survey of medical programs on nuclear war. *J Med Educ* 1984; **59:** 900–01.
10 Cassel CK, McCally M, Abraham H. Nuclear weapons and nuclear war: a source book for health professionals. New York: Praeger Scientific, 1984.
11 Craig PP, Jungerman JA. Nuclear arms race: technology and society. New York: McGraw-Hill Book Co, 1986
12 Ringler R. Nuclear war: a teaching guide. *Bull Atomic Scientists* 1984; **40** (suppl): 1–32.
13 International Physicians for the Prevention of Nuclear War. Medicine and nuclear war: a model curriculum. 126 Rogers St, Cambridge MA 02142, USA, 1988.
14 World Health Organisation. The effects of nuclear war on health and health services. Geneva: WHO, 1987.
15 McCally M, et al. An international survey of medical school programs on nuclear war. *Med Educ* 1985; **19:** 364–67
16 French P. The physician as nuclear war educator. *N Engl J Med* 1984; **310:** 1397–98.
17 Cassel CK, Jameton AL, Sidel VW, Storey PB. The physician's oath and the prevention of nuclear war. *JAMA* 1985; **254:** 652–54

**The headquarters of IPPNW are at 126 Rogers Street, Cambridge, MA 02142, USA. Its UK affiliates are the Medical Association for the Prevention of War (16b Prince Arthur Road, London NW3 6AY) and the Medical Campaign Against Nuclear Weapons (3 Stamford Street, London SE1 9NT)

Printed in Great Britain
by Robquest Ashford Kent