

Low Level Radiation Bioeffects: The Need for an Educational Program for the Public

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In the arena of public health, there is no issue more subject to emotional rhetoric and less subject to factual reasoning than the potential health impact of exposure to ionizing radiation. This issue receives so much coverage by the public media that scarcely a day passes without some new revelation about the exposure of the public to radiation from one source or another. Usually, the exposure and its causes are portrayed in such an alarmist fashion that one can understand why the public in this country is shifting increasingly into an anti-radiation, antinuclear position. This shift is openly encouraged by political action and consumer protection groups who frequently use partial information, and sometimes outright misinformation, in pursuing their goal of impeding nuclear development activities around the country. On occasion, these groups are aided by dedicated but unenlightened scientists and public servants who express their anxieties about radiation exposure in quasi-scientific terms without formulating a data base sufficient to justify or quell their anxieties. The composite effect of all these activities includes the virtual halting of nuclear power development in this country and the instilling into many patients of an unwillingness or reluctance to undergo medical examinations and treatments that require exposure to radiation.

Some of you may recall the heightened public concern in this country in the early 1960's over the need for fallout shelters to protect families against nuclear attacks. Hours were spent debating the ethics of defending the shelter against invasion by neighbors with less foresight who had not built a shelter. At that time, the major concern was the undocumented but presumed genetic disaster that would befall our society if a significant fraction of the population were exposed to low levels of radiation. Advertising brochures from companies marketing fallout shelters portrayed Japanese children with large keloids, which were attributed

to exposure of the children's parents to radiation before conception. Over the decade of the 1960's, public concern over the genetic effects of radiation remained unabated even though scientific evidence continued to accumulate that genetic risks of radiation exposure were considerably lower than suspected originally. This evidence was summarized in a 1972 report of the National Academy of Sciences (1) in which the genetic consequences of radiation exposure were identified as less substantial than the carcinogenic effects. With this "BEIR II" report of the National Academy of Sciences, the "era of cancer risk" replaced the "era of genetic risk" in the study of possible radiation bioeffects.

With a refocusing of public concern over the past decade upon the possible carcinogenic effects of radiation, a myriad of pronouncements has occurred concerning the number of cancer cases induced in one population or another as a result of exposure to radiation. Among these pronouncements are reports of studies by Mancuso, Stewart, and Kneale on cancer mortality in occupationally exposed workers at the nuclear installation in Hanford, Washington (2, 3); evaluation by Bross and his associates of the incidence of leukemia and its relationship to radiation exposure from data collected in the 1960-62 tri-state leukemia study (4-7); studies by Sternglass of infant mortality and cancer incidence from fallout from Chinese open-atmosphere nuclear weapons tests, and from releases of radioactivity downwind from various nuclear power installations, including the Three Mile Island Plant (8); investigations by Najarian and Colton on cancer deaths in workers at the Portsmouth nuclear shipyards (9); and studies by Johnson of the Jefferson County Department of Health in Colorado on cancer mortality in residential populations surrounding the Rocky Flats Nuclear Plant just west of Denver (10-

11). Even more speculative comments concerning the relationship between radiation exposure and cancer incidence and mortality appear periodically in news media accounts of testimonies by a variety of antinuclear, antiradiation scientists. Each reader will recall studies and commentary other than those mentioned here, which serve to heighten the apprehension of the public about the use of radiation in medical and industrial applications and about the development of nuclear power in this country.

All of these pronouncements have created a level of anxiety and suspicion in the public that exceeds even that reached in the 1960's when the genetic scare associated with radiation exposure was at its peak. This level has risen with each new pronouncement and each news item reported in the public media until today it borders on mass paranoia with respect to radiation-related matters. At the same time, it has become increasingly clear that the carcinogenic implications of radiation exposure were overestimated by a factor of 1.5-3 in the 1972 report of the National Academy of Sciences. Downward revisions in these estimates currently are being released by the National Academy of Sciences (12). A graphical display of the differences in risk estimates for cancer induction between the 1972 and 1980 National Academy of Sciences studies is shown in Fig. 1.

There is little question but that ionizing radiation can be hazardous and has the potential for inducing cancer and, possibly, genetic abnormalities in individuals who are exposed either as a result of their occupation or medical condition, or simply because as a member of the public they happened to be in the wrong place at the wrong time. Like any useful but potentially dangerous agent, nuclear materials and ionizing radiation must be used carefully and judiciously so that the maximum benefit can be extracted from their applications with the least possible risk to society. In deciding between wise and foolish applications of radiation, a public enlightened with correct information can be a great asset. On the other hand, a public instilled with fear and anxiety can be a great handicap. In today's society, unfortunately, sources of enlightenment on radiation matters are far too few in number and accessibility, and sources of information and misinformation that instill fear and anxiety in the public have a very high profile.

Across the country, among the major sources of correct information about radiation are physicians, medical scientists, and allied health specialists practicing in communities where they are respected as community leaders, knowledgeable about technical issues in general and about medi-

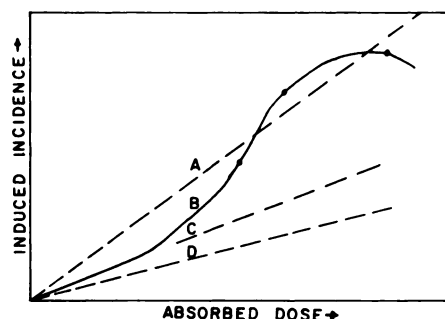


FIG. 1. Models for increased incidence of biological effect as a function of absorbed dose. Solid curve B represents linear-quadratic model with cell killing and is model recommended as most appropriate for estimating radiobiological risks in 1980 study by National Academy of Sciences (12). Curve A represents linear model for radiation induced effects and is model used for estimating risks in the 1972 report of the National Academy of Sciences (1). Curve C represents experimental data obtained at high doses but low dose rates. At very low dose rates, low dose rate curve may become indistinguishable from extension of linear portion of linear-quadratic curve (curve D). (Modified from Bond, V.: Radiation cancer risk; What is "safe" exposure? Proc. of a Conf. on Known Effects of Low Level Radiation Exposure, Pittsburgh, 1979, NIH Publication No. 80-2087, 1980, pp 123-137.)

cal and public health issues in particular. These persons are trained to think objectively and to make decisions unemotionally on the basis of factual knowledge. In almost all cases, these abilities to think objectively and respond unemotionally are recognized and respected by the general public. With knowledge about the relative benefits and risks of radiation exposure, physicians, medical scientists, and allied health specialists could be an effective influence in helping the public examine the radiation exposure and nuclear power issues from a more objective, less emotional perspective than that which exists today.

To exercise this influence, physicians, medical scientists, and allied health personnel need a continuing education program that provides information about radiation bioeffects as accurate and complete as present scientific knowledge permits. This program needs to be implemented through local and regional medical societies and should include presentations at hospital staff conferences, medical society meetings, and symposia sponsored by educational institutions throughout the country. At the present time, the major impediment to such a project is the deficiency of resource persons at the community level with the knowledge and initiative necessary to implement an educational program on the potential bioeffects of low-level exposure to radiation. It is this deficiency and its resolution that I wish to address in the remainder of this article. In particular, I wish to consider how those of us involved in

nuclear medicine can contribute to alleviation of this deficiency.

On the national level, efforts of both The Society of Nuclear Medicine and the American College of Nuclear Physicians are beginning to coalesce toward the development of educational programs to explain the contributions of nuclear medicine to patient welfare and to identify the truths and fallacies concerning the hazards of radiation exposure. One of these programs is a public relations effort being developed by the College with financial support from the Department of Energy. This effort probably will include television and radio spot broadcasts concerning the medical breakthroughs and contributions made by nuclear medicine. At the most recent annual meeting of The Society of Nuclear Medicine, continuing education programs were held on the topics of "Nuclear Power Reactors and Their Potential for a Radiological Emergency" and on the "Biological Effects of Low Level Radiation." At the upcoming midwinter meeting of The Society in February in New Orleans, a half-day program will be presented on the topic of "Nuclear Accidents: The Physicians' Role in Off-Site Contamination." Also, The Society is sponsoring a program on "Nuclear Power and Accidents: A Challenge for Physicians" at this year's winter meeting of the American Medical Association. At the moment, the Executive Committee of The Society is developing a grant application to the Nuclear Regulatory Commission in response to a July 25th announcement in the Federal Register of the availability of funds to support meetings and publications for the transfer of knowledge to assess the safety of nuclear power. If funded, this grant would support a workshop for about 50 individuals on topics associated with the biological consequences of low-level exposure to radiation. Each attendee would leave the workshop with 35 mm slide packages and text outlines on these topics for use in his or her local community. Individuals would be selected for participation in the workshop in part as a reflection of their commitment to serve as resource persons in their medical communities on the topics covered in the workshop. This proposed program is designed to provide accurate information to physicians and other individuals in the health care field on the topics of radiation bioeffects and exposure risks, with the objective that in turn these individuals would serve as a conduit for communication of accurate information to the public.

As promising as these efforts are, they are not adequate in themselves to fulfill the responsibility each of us has to help the public discriminate between the true and the mythical hazards of radiation sources and nuclear power. In every medical community, I believe that nuclear medicine physicians, scientists, and technologists have the distinct obligation to speak out aggressively and clearly on issues such as the bioeffects

and risks of radiation exposure in medicine, and the benefits and hazards of nuclear power as compared with the advantages and risks of alternate sources of energy. My own recognition of this obligation has most recently surfaced in the form of an educational program for Colorado physicians, which we are developing in the Department of Radiology at the University of Colorado Health Sciences Center. This program includes letters to Colorado physicians and an editorial in the state medical journal announcing that members of the department are willing to go anywhere in the state at no cost to the requesting organization to speak on the concerns associated with low-level exposure to radiation from medical and environmental sources. Supportive responses for this effort have been received from organizations such as the Colorado Medical Society, the Colorado Division of the American Cancer Society, the Colorado Radiological Society, and the outreach educational program of the University. In fact, financial support for travel reimbursement has been offered by the local office of the American Cancer Society and the University's outreach educational program through its Area Health Education Centers. I see no reason why similar programs cannot be developed in educational institutions throughout the country, provided that persons, such as readers of this editorial, will take the initiative to develop them.

The time has passed when knowledgeable community leaders, such as physicians, medical scientists, and allied health specialists, can sit idly by while issues that affect the health and well-being of the public of this country are decided emotionally in a political arena. Our continued reluctance to become involved and our unwillingness to share with others what we know to be true about the consequences of radiation exposure from medical and environmental sources is, in my opinion, unconscionable at this point in time when the course of the country is headed toward helplessness with respect to future sources of energy. Becoming involved in these issues is a time-consuming, challenging task with little reward other than knowing that we are speaking from our conscience with as accurate a data base as is presently available, and that we are fulfilling an obligation that we have as leaders of a medical community and as responsible members of the public. I hope these rewards are sufficient in themselves.

ACKNOWLEDGEMENT

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SOCIETY OF NUCLEAR MEDICINE COMPUTER COUNCIL ANNUAL MEETING INSTRUMENTATION COUNCIL MEETING

February 6-7, 1981

Marriott Hotel

New Orleans, Louisiana

The Computer Council and Instrumentation Council of the Society of Nuclear Medicine will meet February 6 and 7, 1981 at the Marriott Hotel in New Orleans, Louisiana.

A topical symposium is being sponsored by the SNM Computer Council consisting of invited presentations, contributed papers, educational sessions, and active attendee participation. Submitted papers are encouraged on Functional Mapping of Organ Systems. Submitted papers will also be considered in other aspects of the use of instruments and computers in nuclear medicine.

The Councils welcome the submission of abstracts from members and nonmembers of the Society of Nuclear Medicine. The title, author, and institutional affiliations should be included at the top of the first page. The name of the author presenting the paper must be underlined. Abstracts should contain a statement of purpose, the methods used, results, and conclusion.

Original abstracts and supporting data should be sent in duplicate to:

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Abstracts must be received no later than October 1, 1980.