

The respondents to OTA's survey indicated that significant benefits from AIDS/HIV research have flowed to a wide variety of fields ranging from the basic sciences to clinical applications and public health. More than one-quarter of respondents, for example, reported that AIDS/HIV research has contributed greatly to advances in all of the basic sciences and half of the medical disciplines included on the survey. These findings are especially noteworthy given that, as one respondent commented, substantial lead time is needed for advances to influence other fields.

Although OTA employed a survey of biomedical and social scientists to learn of contributions of AIDS/HIV research to other fields, methods other than surveys may be used to evaluate the usefulness of research. For example, bibliometric methods can examine the extent to which certain publications are used by others, and economic evaluations can assess the returns to investment in research.

Bibliometric methods have been successfully used to measure how the publications of a particular researcher or a research institute are utilized.¹ The research discipline of bibliometrics evaluates scientific publications as a measure of research output and relies on the existence of large databases containing key information on the published literature. One bibliographic method that could be used to investigate the contributions of AIDS/HIV research to other fields involves identifying a set of articles representing federally funded research in the National Library of Medicine's literature database MEDLINE (or AIDSLINE) and examining to what extent the non-AIDS/HIV literature cite these articles by using the Institute for Scientific

¹Bibliometric methods have also been used to study researcher productivity, the evolution of scientific fields, the diffusion of scientific ideas, program evaluation, and the identification of innovative areas of scientific research (4,5,8,10,11).

Information's database of articles and their references (the Science and Social Science Citation Indexes (SCI and SSCI)).^{2,3}

Economic analyses have been used to measure the "spinoffs" and "spillovers" of research conducted by some Federal agencies. For example, the overall benefits to society from four technologies stimulated by work at the National Aeronautics and Space Administration (NASA) --gas turbine engines, integrated circuits, cryogenics, and an advanced computer program dealing with structural analysis--were estimated to be about \$7 billion over a 10-year period (12).⁴ Another approach used to evaluate NASA spinoffs is to study how industry uses the licenses and patent waivers granted by NASA. Some benefits of federally funded research are difficult to measure. The creation of a multibillion dollar satellite communications industry and a tenfold reduction in the cost of satellite communications, for example, can be traced to NASA's space research and development program (12).

Because substantial Federal funding for HIV research is relatively recent, dating only from the latter part of the 1980s, it would be premature to evaluate the economic implications of its applications in other fields. Even in the best of circumstances, one would expect several years to elapse from the start of research on HIV to applications to HIV disease and an even longer lag for advances from HIV research to be incorporated into other fields and produce tangible economic benefits.

²Another approach would involve identifying a set of highly-cited AIDS/HIV research articles within SCI and seeing to what extent these articles are cited by non-AIDS/HIV articles within both SCI and SSCI.

³The principal difficulty in conducting these analyses is distinguishing the AIDS/HIV literature from the non-AIDS/HIV literature. Any bibliometric analysis would require retrieving articles or their abstracts and reviewing them for content.

⁴The analysis was conducted in 1975 for the period 1975 to 1984. Economic benefits were measured in constant 1975 dollars (12).

18- How Has Federal Research on HIV Disease Contributed to Other Fields?

Two studies exemplify approaches to address underlying issues related to funding for HIV research, namely the appropriateness of the distribution of resources between HIV and other research areas and the distribution of HIV research funding among different categories.

Using funding levels for fiscal year 1986, Hatziafreu and her colleagues compared Federal spending for biomedical research that was targeted to HIV disease with spending for other leading causes of death in the United States (2). Based on expected deaths and potential years of life lost for 1991, they calculated research expenditures per unit of disease burden for several conditions. They concluded that AIDS was receiving about the same priority as cancer and that there was no indication that funding for AIDS was excessive relative to cancer and heart disease. Compared with 1986, however, funding for HIV research has increased about fourfold. Comparable figures are not available for current Federal funding of research on cancer and heart disease.

To examine the allocation of funds for HIV research among alternative uses, Siegel and her colleagues surveyed members of the Institute of Medicine's Committee on AIDS, a multidisciplinary group that had studied Federal HIV policy (9). Compared with the distribution contained in the expected budget for fiscal year 1987, the dominant sentiment of these experts favored increased funding for research on behavioral and social science.

The findings of OTA's survey also address the issue of allocating resources among different research areas. Although over three-quarters of the respondents felt that Federal spending for AIDS/HIV research was about right or too low, nearly half felt that too much of available research funds has been diverted to AIDS/HIV research from other fields. These responses indicate not only support for current or augmented Federal AIDS/HIV research funding levels but also concern that other research areas are not adequately funded.

Not surprisingly, responses to questions about the level of Federal spending for AIDS/HIV research depend on whether scientists are engaged in

AIDS/HIV research and whether they depend on Federal resources. Scientists in receipt of Federal funds for AIDS/HIV research are most likely to hold the opinion that Federal AIDS/HIV funding is too low, and more than two-thirds of scientists receiving external funding for other-than AIDS/HIV research felt that too much research funding has been diverted to AIDS/HIV from other areas.

Nearly one-half of OTA survey respondents received no external funding in 1989. The opinions expressed by these respondents are of particular interest because they are less likely to have vested interests in funding policies. Over one-half of these respondents felt that AIDS/HIV funding is about right, and nearly one-third felt that funding was too low. Only eight percent felt that AIDS/HIV funding was too high. On the question of diversion of research funds, more than one-half of scientists without external funding did not agree, but nearly one-third agreed that too much research funding has been diverted to AIDS from other areas. Over one-half of scientists who receive Federal support for AIDS/HIV research disagreed that research funds have been diverted to AIDS from other areas, but as many as 38 percent agreed that diversion has occurred.

In addition, in separate comments, survey respondents raised the issue of allocating resources to HIV and other targeted fields versus to basic research. One respondent, for example, pointed out that contributions from basic research conducted prior to the HIV epidemic had furthered advances in subsequent HIV research and, while questioning the contributions of HIV research to basic biology, felt that, "...our understanding of basic biology has made possible all AIDS research."

In conclusion, results from OTA's survey indicate that, in the opinion of the scientific community, HIV research has made many important contributions to advances in the biomedical and behavioral sciences. Furthermore, the dominant sentiment of survey respondents support current or augmented levels of HIV research. Opinion was divided on the question of whether too much research funding has been diverted to AIDS/HIV research from other fields. The results raise for continued consideration the appropriate allocation of research funds among HIV, other targeted areas, and basic science.