DESIGN AND DEVELOPMENT OF A CONCEPTUAL AND QUANTITATIVE FRAMEWORK FOR HEALTH TECHNOLOGY DECISIONS: A MULTI-PROJECT COMPENDIUM OF RESEARCH UNDERWAY

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FOREWORD

The British Columbia Office of Health Technology Assessment (BCOHTA) was established on December 1, 1990 by a grant to the University of British Columbia from the Province to promote and encourage the use of assessment research in policy and planning activities at the government level and in policy, acquisition and utilization decisions at the clinical, operations and government levels. It is important to note that the role of the Office is to appraise the scientific evidence only, without involvement in actual policy development for the requesting agency.

Assessments are performed in response to requests from the public sector such as hospitals, physicians, professional associations, health regions, government; private sector groups such as manufacturers; and individuals from the general public. One or more of the following criteria are used to determine the priority of an assessment and the level of analysis: 1) number of users and potential change in quality of life; 2) acquisition and operating costs to the health care system; 3) potential to influence provider and consumer behaviour as a result of a review; and 4) availability of accurate information and appropriate research skills.

Electronic bibliographic databases and fugitive literature (that is not indexed or distributed publicly) are searched using predefined inclusion and exclusion criteria based on the specific search strategy. The critical appraisal of the retrieved evidence includes the formulation of logical and defensible conclusions about the technology under study.

This report, however, differs in two ways: it does not include a critical appraisal of the literature, and it does not pertain to a specific health technology. The focus of this study is to develop a rational approach for health technology decisions, mapping a route for the practical application of usually complex, sometimes voluminous, and often confounding research evidence from various fields and disciplinary perspectives.

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SECTION A

Introduction and Background

The purpose of this report is to incorporate several papers written on the same topic, a tool for decision-making in health care; the chronological presentation of this material delineates the evolution of thought and analysis inherent to each project. The earliest work, published elsewhere, is discussed briefly in this section.

The genesis of this work dates back to 1989 when a pilot project, funded by the NHRDP (grant #6610-1772-55) was undertaken to explore developing a taxonomy for health care technology (Kazanjian and Friesen, 1990). The development of a taxonomy to classify emerging and existing technologies was deemed an important first step in the compilation of useful information for policy decisions. While it would be prohibitive to undertake health technology assessment work every time a resource allocation or other policy decision had to be made, it is desirable to make such decisions based on informed judgments about the clinical, economic, and social impacts of the technology under consideration. A taxonomy would serve two purposes:

a) it would provide a priorization of technologies that could serve as a guide for further evaluative research;

b) this, in itself, would provide sufficient detail to indicate the regulatory approach most appropriate to each technology.

In summary, our pilot study described the changing patterns of diffusion of two selected categories: imaging devices and common laboratory tests. In the course of this research, we also reviewed the rapidly-growing clinical literature pertaining to the two selected categories of health care technology as well as the literature on taxonomy development. Two important points warranted noting. First, the literature on health care technology covers only a small number of technologies, is most frequently based on the less-rigorous methods, and provides very little information about the consequences of such technology. Second, this information, incomplete as it may be in breadth, is of a technical nature that is not easily retrievable and concerns a single technology at a time.

The policy maker confronted with an allocation decision has very little use for such highly-technical information specific to the attributes of one or another technology. A decision tool that quantifies, in a clear and replicable way, the relative merits of the technologies under consideration would be of great assistance. In conclusion, a decision framework that reflects current social values, and rationalizes choices between technologies in terms of equity (needs-based) as well as utility (cost-effectiveness) is arguably more useful than a priority classification scheme that is divorced from considerations of health consequences of the technology.

Further analysis of technological diffusion was undertaken in 1991, using population-based utilization data on CT scans and MRI in the province. This study is published elsewhere (Kazanjian and Friesen, 1991) and an abstract is given below.

In order to explore the diffusion of the selected technologies in one Canadian province (British Columbia), two administrative data sets were analyzed. The data included over 40 million payment records for each fiscal year on medical services provided to British Columbia residents (2,968,769 in 1988) and information on physical facilities, services and personnel from 138 hospitals in the province. Three specific time periods were examined in each data set, starting with 1979-80 and ending with the most current data available at the time. The detailed retrospective analysis of laboratory and imaging technologies provides historical data in three areas of interest: (a) patterns of diffusion and volume of utilization; (b) institutional profile; and (c) provider profile. The framework for the analysis focused, where possible, on the examination of determinants of diffusion that may be amenable to policy influence.

A more extensive and systematic review of the literature was undertaken in 1992, as part of a report to the Royal Commission on New Reproductive Technologies. Section B contains this report with a detailed appendix containing the results of the literature search from ten North American and European databases.

Further analysis of the literature pertinent to the development of a rational framework was prepared for poster presentation at the International Society for Technology Assessment in Health Care conference in 1993, and is contained in Section D.

More recently, efforts are being directed toward the development of a quantitative model. Much work remains to be done, however. An outline of how to validate the conceptual model (framework) through the quantification of each of the dimensions is contained in Section C. The proposed approach would yield an empirical model to estimate the weighted index of the technology (WIT) under consideration. The (type of) model will direct decision makers towards a more global view of the issues related to health technology and its assessment, and will highlight the weak links in that assessment process.

Finally, Section E contains the most recent effort on this subject; this work was undertaken for the United Nations Commission on Science and Technology for Development (UNCSTD). In addition to a thorough discussion of the framework, this paper elaborates on how the framework may be applied (in a hypothetical situation) to examine the diffusion of ultrasonography in a developing country and possible ensuing consequences of such technological diffusion.

The chronicle of research studies stops here. However, more work is underway; we have paused only to replenish our resources.

SECTION B

Framework for Technology Decisions: Literature Review

Report Submitted to The Royal Commission on
New Reproductive Technologies, May 1992

Also published in: Royal Commission on New Reproductive Technologies,
Volume 11, Chapter 2, Canada Communications Group, 1993

1. INTRODUCTION

Decisions regarding technology are made daily by practitioners, administrators and policy makers. Ideally, decisions regarding health technology should be based on evidence from comprehensive assessment, that is, information on the safety, effectiveness, costs and ethical/legal/social implications of the particular technology under consideration. Reality proves otherwise; the large majority of technological innovations in health care are in use long before any systematic assessment has taken place. Sometimes at the second or third generation level, technologies are found to be ineffective, or even unsafe, after belated assessment. The Canadian Standards Association safety tests medical devices, and the Canadian Food and Drug Administration polices the safety testing of pharmaceutical products (acting as the regulator). However effectiveness studies made available to health care providers are usually undertaken by the research staff of the manufacturer or the pharmaceutical company, seriously compromising the credibility of the evidence.

The role governments play in the development and diffusion of technology is clearly an influential one, especially in health care. It spans a wide range of levels of involvement: from supporting the development of technologies through funding of research in basic sciences, to regulating the marketing of certain technologies and licensing of facilities for the provision of certain technological services, to paying for such services through public funds (medical insurance). Yet, these policy decisions are most often made in the absence of accurate information on the specific as well as general implications of such technological development or diffusion.

2. BACKGROUND

Decisions about who will get how much of what in health care are made mostly in an ad hoc, often partisan, fashion with different motives operating for the different levels of decision makers. While some mechanisms exist for influencing technological adoption and/or diffusion, such as regulation under special programs for the purchase of expensive technologies (Deber, Thompson, & Leatt, 1988), or fee-for-service schedules that signal what services can be provided and how much the payment will be (Evans, 1982), policy mechanisms at present are neither coordinated nor applied consistently to ensure predefined and publicly articulated health goals. Moreover, it is unlikely that prospective assessment of the consequences of these technology decisions has ever been part of the decision-making process.

The determination of whether decisions pertaining to new reproductive technologies are more rationalized than decisions for other health technologies is an important research question, but one beyond the scope of this study. The popular assumption, however, is that the consequences - especially ethical - of new reproductive technologies are potentially more serious than those of the 'average' health technology decision. Therefore, a general understanding of how allocative decisions regarding resources for technology are made would be extremely helpful in understanding specific decisions regarding reproductive technologies.

While it would be prohibitive to undertake extensive technology assessment work every time a resource allocation or other policy decision had to be made, it would be desirable to make these decisions based on informed judgements about the clinical, fiscal, and social impact of the specific health technology before it is widely adopted and extensively used. Thus, in a pilot study on technology adoption and diffusion (Kazanjian and Friesen, 1990) we examined the feasibility of developing a taxonomy to classify emerging and existing technologies. The purpose of taxonomy is: identification of the object, recognition of its specific limits, grouping it into natural groups, and constructing classifications which as near as possible show the course of evolution within a group (Cain, 1959). We reviewed a vast and rapidly increasing literature in the area of technology assessment, and in a more limited fashion the clinical literature pertaining two broad categories, laboratory tests and imaging devices, as well as the literature on taxonomy development. Part of the conclusion from that study was that neither the inherent characteristics of health care technologies nor their assumed properties lend themselves to taxonomic classification. The decision maker confronted with an allocation or other technology decision has very little use for the highly technical information specific to the attributes of one or other technology; clearly, a decision tool that quantifies the *relative* merits of technologies under consideration was needed.

3. FRAMEWORK FOR TECHNOLOGY DECISIONS

Confronted with a choice to make from among several technologies, the policy maker has a number of possible alternatives (Churchill, 1987):

a) to refuse to consider the particular merits of each technology, and simply divide the resources equally, that is, each gets equal shares of most likely inadequate resources;

b) to consider resource requirements of each technology and give each an equal percentage of its request; that is, relative resource requirements are allocated to all;

c) to chose the technology that will assist the neediest or the most ill; that is, the technology that would seek to rescue those nearest to death;

d) to chose the technology that promises long-range efficiency and effectiveness; that is, a technology with a prevention emphasis which does not entail expensive or ineffective rescue efforts;

e) to chose the technology that will effectively help the largest number of persons; that is, the technology that seeks "the greatest good for the greatest number";

f) to chose the technology of greatest value to those whose condition is caused or exacerbated by previous social or economic injustices; that is, on the principle of restorative justice;

g) to chose the technology of service to those who have previously been treated or to whom one owes fidelity due to past obligations; that is, to honour long-standing obligations;

h) use the lottery approach and draw the "winner" from a hat.

Given the high stakes involved (in the sense that the entire population in a jurisdiction is affected) in government policy decisions, selecting the alternative that includes notions of equity and utility and is grounded in principles of social justice is the most appropriate. A decision framework that reflects these attributes and rationalizes choices between technologies in terms of equity and utility is arguably more useful than a priority classification scheme that is divorced from considerations of health consequences of the technology.

The rationale for the development of our health technology decision framework was centred around basic principles of justice in health care: equitable access to all effective health care which society can afford. This implies that the decision maker employs norms of utility as well as equity in making a decision. Neither of these lend themselves to easy formulation of policy. Some adjudication and interpretation is needed to translate principles into action: How much technology and for whom?

The practitioner is most motivated by clinical efficacy, the administrator by fiscal and other resource implications that impact quality of care, and the government agency by budgetary restrictions (economic efficiency). While each of them is engaged in what would be considered proper or "ethical" behaviour, all of these behaviours are based on principles of ethical individualism which are deeply rooted in our North American culture (Churchill, 1987). These principles are operant in all Canadian health care decision making.

Yet, the individual and society cannot be treated separately, or given different moral priorities, because they are complementary realities. Individuals develop a socially defined sense of selfhood and, as social creatures, no one person has a prior entitlement to health (services) based on social differences. However, given society's finite resources, an equitable health system is concerned with the provision of effective care which it can reasonably afford. This humanist perspective for the provision of health services evolves from basic principles of social justice pertaining to the collective welfare of society.

Using the humanist perspective as theoretical underpinning, and the empirical evidence from the pilot study indicating the futility of any attempt to consistently link either inherent attributes of the technology to its diffusion, or health care technology diffusion to the prevalence of disease, a preliminary decision framework was developed using five key dimensions (Table 1). The first four, population at risk, population impact, costs, and ethical/legal/social/political implications, are societal responses to the particular technologies of concern; the fifth component, technology assessment activity, is a descriptive element included to provide a "quality of medical knowledge" perspective, incorporating information on the quality of the assessment evidence and its degree of convergence.

The purpose of this conceptual model is to provide an empirical, evidence-based foundation to technology decisions, thus de-mystifying a heretofore undefined and generally misunderstood phenomenon.

Population at risk takes into account the magnitude of the health concern related to the technologies, indicated by prevalence, severity of illness, and other such epidemiological measures in that jurisdiction.

For example, AIDS affects a relatively small proportion of the population (prevalence), but its effect is fatal (severity); in comparison, arthritis affects a much larger proportion of people but the debilitating effects are generally mild to moderate to severe.

Population impact takes into account the known expected health consequences of the technological intervention indicated by comprehensive general health status measures. While a person suffering from heart disease will experience various levels of functional disability, an HIV positive person may have years of symptom-free and disability-free existence. Thus, a measure of quality of life over the life-expectancy of the respective cohorts affected by each of the technologies provides another policy component. This second dimension of the framework, combined with the first, expresses considerations of utility - the greatest good for the greatest number - the selection being made not between individuals but among categories of health concerns.

TABLE 1

MATRIX FOR DECISIONS ON HEALTH TECHNOLOGY

DIMENSION	METHOD	TOOL	SOURCE
1. POPULATION AT RISK (problem/disease/health issues)	(i) Epidemiologic Orientation (ii) Descriptive Epidemiology (iii) Indices of Community Health	(i) Natural History/Severity of illness scale (ii) Incidence/Prevalence rates, Mortality rates (iii) Life Expectancy, Social Deviance, Summary Index	(i) Clinical Epidemiology Literature (ii) Local Databases (from Vital Statistics, HMRI, MSP, Census Surveys, etc.)
2. POPULATION IMPACT (problem/disease/health issues)	Health Status Measures	(i) Functional Assessment Inventory (ii) Sickness Impact Profile (iii) Nottingham Health Profile (iv) Quality of Well-Being Scale	(i) Crewe & Athelson (1981) (ii) Bergner et al (1981) (iii) Martini & Hunt (1981) (iv) Kaplan & Anderson (1988 revision)
3. COST	Economic analysis of net cost to the health care system	(i) Aggregate Cost (ii) Cost of Alternatives (iii) Cost-Utility Analysis	Standard Measures MSP/HS1/HS2/HMRI
4. ETHICAL/LEGAL/SOCIAL/ POLITICAL IMPLICATIONS	Description synthesis of issues from literature Local situation	Score for current or potential importance of issue (on Likert-type scale)	International Journals/Experts Local Experts Media Coverage Lobby Groups
5. TECHNOLOGY ASSESSMENT ACTIVITY	Framework of Major Emphasis of Technology Assessment Activities	(i) Score for comprehensiveness of assessment activity (ii) Score for congruity of findings	Institute of Medicine (1985)

The cost component of the decision framework considers what society can reasonably afford. Aggregate costs of each of the technologies, costs of alternatives to the technologies and more specific measures of costs per well-year of life. How society arrives at decisions about what it can afford is a very important but opaque question. How a government agency arrives at that same decision appears to be less opaque. Finite financial resources set the parameters; principles of distributive justice serve to eliminate any social ordering.

No rational health technology policy decision can be taken without at least cursory consideration of the social, political, ethical, and legal ramifications of that decision. While it may be possible to clearly delineate legal implications, the other three are not as clearly identifiable. Conversely, once identified, the weight carried by political considerations may be enormous. Rational decisions then would be made by weighing the political consequences of making a choice versus not making that choice. Social implications are generally more difficult to define than the political and less likely to incite prompt government action, yet they tend to yield longer term consequences and can be considerably more serious than any of the others. Perhaps the least well understood, and therefore the most neglected, sub-component is the ethical consequences of decisions on health technology. While the field of bioethics is recently becoming more high profile, ethical considerations are not routinely incorporated in official guidelines or protocols of use of health technologies.

The final component, technology assessment activity, is different from the other four in that it indicates the level of scientific knowledge about the technology which acts as backdrop to the decision. Whereas most of the research in technology diffusion assumes that the mere existence of technology assessment will influence diffusion, generally it fails to separate the three levels of stakeholders in technology assessment who affect diffusion in different ways (Fodor, 1988; McGivney, 1988; Peddecord, 1988). Physicians, facility administrators and government officials all look to technology assessment for different reasons and, therefore, assessment has a different function for each of the groups (the role of the public is omitted from this discussion for the sake of brevity). New information from technology assessment may affect physicians' clinical behaviour, could help the administrator in acquisition decisions, and should assist the government agency in reimbursement or regulatory policy making.

The temporal order of evaluation-decision is also very different for each of the stakeholders. For the policy maker, ideally, the assessment should precede policy formulation but it rarely, if ever, does. For the administrator, the information is sought only when it affects that particular institution. For the physician, the information is useful when it affects medical practice (appropriate care to patients). Thus, it is reasonable to argue that clinical evaluation of medical/surgical procedures should precede their widespread use. This order also holds true for regulatory bodies such as the Canadian Standards Association and Canadian Food and Drug Administration, whose mandate is to establish safety and efficacy before releasing devices and drugs. But it is quite unreasonable to suggest that all government financing and insurance coverage policies should be based on locally undertaken primary assessment of each technology

when that information may already exist in other jurisdictions (Davis, 1986). There are ten identified sources of influence in the adoption or abandonment of health technology (Institute of Medicine, 1985), of which environmental constraints and incentives are the major ones susceptible to policy influence. It may therefore be more efficient for the policy maker to develop such incentive/disincentive policies first, based on a synthetic evaluation of available knowledge, and subsequently call for more serious primary assessment efforts, if required. It is unrealistic to believe that technology diffusion would stop while extensive evaluation is being undertaken.

In summary, this last dimension of the decision framework is used to qualify the four preceding components and alerts the policy maker to the relative assessment status of each technology.

4. OBJECTIVE AND SCOPE OF STUDY

The objective of this study is to provide a critical appraisal of the literature on each of the five dimensions developed in the preliminary health technology decision model, which would, ultimately, provide a framework to analyze decision making pertaining to the allocation of resources for health technologies. The critical appraisal of the literature examines the quality and volume of the evidence pertaining to the conceptual model and establishes the feasibility of its empirical application. In addition, the literature review delineates the evidence on how decision making processes evolve, and what type of information is sought by the individual making clinical, administrative, or public policy decisions.

While beyond the scope of the present study, the extension of this work would lead to the development of quantitative measures - new or already existing - which can be combined to develop a simple mathematical model to estimate "Global Score" for health technologies under consideration, whenever a decision necessitating a choice between technologies has to be made. The purpose of the mathematical model, once it is developed, is to facilitate the ways in which priorities can be established around health technologies through the application of this Global Score. Such a measure would indicate the broader socio-medical value of one technology relative to others which, although unrelated, may be competing for the same limited resources.

5. METHODOLOGY

The literature review proceeded in four phases. The first phase involved identifying relevant sources of information on literature related to decision making in health care. To do this, a group of librarians from a variety of disciplines were selected and interviewed to determine which databases would yield both comprehensive and relevant results. Fifteen databases representing social science, bio-medical, scientific, feminist[1] and business literature were recommended. Twelve of these are North American databases and include the following: ABI\INFORM, US Political Science Documents (UPSD), Management Contents, Economic Literature Index, Public Affairs Information Service (PAIS), Sociological Abstracts, MEDLINE, Health Planning and Administration (HEALTH Database), Biobusiness, NTS Bibliographic Database, MathSci, and Health Periodicals Database. The other three databases are European and include: FRANCIS, PASCAL and Bioethics. A concise description of each database follows:

5.1 North American Databases

5.1.1 ABI/Inform

Contains more than 480,000 citations, with abstracts, to the periodical literature in the areas of business and management. Covers over 800 international periodicals in these subject areas: accounting and auditing; economics; electronic data processing systems and information science; engineering management; finance and financial management; **health care**; law and taxation; **management science;** marketing; advertising and sales management; personnel, employee benefits, and labour relations; banking; insurance; **public administration and government**.

A hierarchical classification system allows users to create broad topical subsets before applying specific search terms. Five areas are covered by the classification codes: business environment (e.g., economic conditions, social policy), management function (e.g., public relations, planning, information management), industries and markets, article treatment (e.g., company specific, product specific), and organization does (e.g., small business, non-profit institution).

5.1.2 US Political Science Documents (UPSD)

UPSD provides detailed abstracts and indexing from approximately 150 of the major American journals publishing scholarly articles in the broad area of political science. Coverage includes such specific areas as foreign policy, international relations, behavioral sciences, **public administration,** economics, law and contemporary problems, world politics, and **all areas of political science, including theory and methodology. This database is of particular interest to the academic community, providing a central source from which to access significant research results in the political, social, and policy sciences.**

[1] A search on 'CUADRA' On-Line Database indicated that Sociological Abstracts would best capture the feminist literature.

5.1.3 Management Contents

The Management Contents database provides current information on a variety of business and management-related topics to aid individuals in business, consulting firms, educational institutions, government agencies or bureaus, and libraries in decision making and forecasting. Articles from over 140 US and international journals, as well as conference proceedings, transactions, business course materials, newsletters, and research reports, are fully indexed and abstracted to provide up-to-date information in the areas of finance and economics (including accounting, banking, and managerial economics); industry (including commodities and goods, production, industrial relations); and **management and administration (including public administration, planning, decision science,** human resource development, management philosophy, operations research, and marketing).

5.1.4 Economic Literature Index

Economic Literature Index is an index of journal articles and book reviews from 300 economics journals and from approximately 200 monographs per year. Covers general economic theory, history, and systems; economic growth, development, planning and fluctuations; quantitative economic methods and data; international economics; domestic monetary and financial theory and institutions; administration, business finance, marketing and accounting; industrial organization, technological change and industry studies; agriculture and natural resources; manpower, labour, and population; welfare programs; consumer economics; and urban and regional economics. Since June 1984, abstracts from selected journals have been added to approximately 25% of the records in the file. The descriptive abstracts are approximately 100 words in length and are written by the author or editor of the journal article; all are in English. The database corresponds to the index section of the quarterly Journal of Economic Literature and to the annual Index of Economic Articles.

5.1.5 Public Affairs Information Service (PAIS)

PAIS is a bibliographic index to the **public policy literature** of business, economics, finance, law, international relations, **government, social sciences and political issues and the making and evaluating of public policy**. It provides references in English to material published worldwide in any of six languages: English, French, German, Italian, Portuguese, and Spanish. Approximately 60% of the items indexed were originally published in English. It covers printed material in all formats: periodical articles; books, state, local, federal, and non-US government documents; committee hearings, pamphlets; and the reports of public and private organizations. **PAIS provides comprehensive coverage of all issues of public policy relating to** social, economic or political problems, including taxation, multinational corporations, banking, labour, insurance, crime, **health,** international relations, international trade, and specific industries. It is an enhanced compilation of two print publications: PAIS Bulletin and PAIS Foreign Language Index.

5.1.6 Sociological Abstracts

Sociological Abstracts covers the world's literature in sociology and related disciplines in the social and behavioral sciences. Over 1600 journals and other serial publications are scanned each year to provide coverage of original research, reviews, discussions, monographic publications, panel discussions, case studies, conference papers, and dissertations.

5.1.7 MEDLINE

MEDLINE produced by the US National Library of Medicine provides access to the worldwide biomedical literature, including research, clinical practice, administration, policy issues, and health care services. MEDLINE corresponds to three print indexes: Index Medicus, Index to Dental Literature, and International Nursing Index. MEDLINE covers virtually every subject in the broad field of biomedicine, indexing articles from over 3000 international journals published in the United States and 70 other countries. Citations to chapters or articles from selected monographs are also included from May 1976 through 1981.

5.1.8 Health Planning and Administration (Health Database)

Health Planning and Administration, produced by the US National Library of Medicine, contains about 500,000 citations to the worldwide literature on health care delivery. Covers health care planning and facilities, health insurance, and the aspects of financial management, personnel administration, manpower planning, and licensure and accreditation that apply to the delivery of health care. References in Health Planning and Administration are drawn in part from MEDLINE and from the American Hospital Association's Hospital Literature Index. Documents from the National health Planning Information Center are included, as well as additional journals of special importance to the health care field

5.1.9 Biobusiness

Contains about 164,000 citations, with abstracts, to the worldwide periodical literature on business applications of biological and biomedical research. Covers agriculture and forestry, food technology, genetic engineering, pharmaceutical products, and other industries affected by biotechnological developments. Also covers patents in such areas as immunological testing, food processes, and fishing. For each patent record, includes inventor's name and address, patent title and number, patent classes, date granted, and assignee. Sources include journals, books, newsletters, monographs, and conference proceedings.

5.1.10 NTS Bibliographic Database

Contains about 1.4 million citations, most with abstracts, to unrestricted technical reports from U.S. and non-U.S. government-sponsored research, development, and engineering analyses. The unpublished U.S. reports are prepared by federal, state, and local agencies and their contractors or grantees. Major areas covered include the biological, social, and physical sciences, mathematics, engineering, and business

information. Includes announcements of computer-readable software and data files, U.S. government-owned inventions available for licensing, selected reprints, federally sponsored translations, and some non-English-language reports. Corresponds to the biweekly publication Government *Reports Announcement & Index* (GRA&I) and in part to the weekly *Abstract Newsletters*.

5.1.11 MathSci

MathSci contains evaluative reviews and abstracts of the international research literature in mathematics, computer science, statistics, econometrics, and applications in areas such as physics, engineering, biology, and information systems. MathSci has seven subfiles on-line: *Mathematical Reviews* (MR) and *Current Mathematical Publications* (CMP), published by the American Mathematical Society; *ACM Guide to Computing Literature* (GCL) and *Computing Reviews* (CR), published by the Association for Computing Machinery; *Technical Reports in Computer Science* (STR), compiled by Stanford University; *Current Index to Statistics* (CIS), published by the American Statistical Association and Institute of Mathematical Statistics; and *Index to Statistics and Probability* (Tukey), by Tukey and Ross. The combined coverage of the seven subfiles is very comprehensive. Approximately 600 journals are reviewed cover-to-cover and 2,500 journals are covered selectively. In addition, over 10,000 monographs, conference proceedings, theses, and technical reports are reviewed annually.

5.1.12 Health Periodicals Database

Health Periodicals Database provides indexing and full text of journals covering a broad range of health subjects and issues. Subjects covered include pre-natal care, dieting, drug abuse, AIDS, biotechnology, cardiovascular disease, environment, public health, safety, paramedical professions, sports medicine, substance abuse, toxicology, and much more. Articles are collected from core health, fitness, and nutrition publications. The database provides a valuable resource for corporate, medical, and legal librarians, human resources professionals, and product analysts.

5.1.13 CUADRA

The CUADRA database contains descriptions of about 5,000 databases worldwide, including over 4,500 on-line databases and over 950 "portable" (i.e., databases available on CD-ROM, diskette, and magnetic tape.

Each entry provides the database name, type classification (Audio, Bibliographic, Full Text, Full Text/Images, Images, Numeric, Referral, Software, Textual-Numeric, Video), database producer or information provider, on-line services or vendors through which the database can be accessed or purchases, content description, subject, language, geographic coverage, time span, frequency of updating, and, as applicable, conditions of access or price. For portable databases, CUAD also covers format (e.g., High Sierra or ISO 9660 for CD-ROMs, number and size for diskettes), hardware and software requirements, and corresponding on-line and printed information sources. CUAD includes addresses and contact

numbers for database producers/information providers and on-line services/vendors. It corresponds to the printed Directory of On-line Databases and Directory of Portable Databases.

5.2 European Databases

5.2.1 FRANCIS

A leading bibliographical database of the human, social and economic sciences. Coverage includes both the human sciences and the social sciences. The database language is French with English, German and Spanish descriptors.

5.2.2 Bioethics

International database on biomedical ethics, including coverage of **health policy,** neonatology, doctor-patient relationships, **reproductive contraception, abortion, reproductive technology, genetic engineering,** experiments on humans, artificial and implanted tissue and problems related to death and violence. Database is in English and French.

5.2.3 PASCAL

Contains about 8 million citations, with abstracts, to the worldwide literature in science, technology and medicine. Covers applied science, biomedicine, chemistry, computer science, earth sciences, engineering, fundamental and applied biology, marine science, mathematics, medicine, physics, psychology, and space science. Sources include books, theses, reports, conference proceedings, and more than 4500 periodicals.

During the second phase of the review lists of key words were created, using the controlled vocabulary of the respective databases. Next, search strategies for each database were developed. Following from this, extensive searches were executed using Boollean logic[2]. It should be pointed out that the terms decision making, health policy and public policy are the subject of many literatures; to ensure the applicability of the literature to our particular needs we limited our searching to articles where decision making, health policy and public policy were the focus of the article. The details of the search strategies, and the results of searches for ten databases can be found in the Appendix (see Appendix to Section B).

The final stage of the literature review involved selection of relevant articles and critical appraisal of the literature. The appraisal considered a variety of factors including theoretical grounding, empirical evidence, methodological rigour, clarity of findings, and convergence of findings with other work.

[2] Online database searching employs Boolean logic, a method of logic developed by the mathematician and logician George Boole. Boolean operators combine sets or terms in various relationships. The major logical operators are: 'and', 'or' and 'not'. 'And' is used to combine concepts. It will retrieve records containing both terms or sets in a combination. 'Or' is used to search on all or any concepts. It will retrieve records containing all or any terms in the statement. 'Not' is used to exclude information.

6. RESULTS

In total, the literature review yielded approximately 1300 abstracts related to decision making in health care (this is the result after overlap in articles has been eliminated). Tables 2 - 4 outline the results from three of the database searches respectively. In Table 2 the results from the search of ABI\INFORM indicate that although there are a total of 28,214 articles with a focus on decision making, only 1502 (5%) of the articles are related to decision making in health care. In Table 3 the results from the search of MEDLINE show there are 3658 articles related to decision making or policy and the results from the HEALTH Database search in Table 4, show there are a total of 5434 articles related to decision making or policy.

TABLE 2

ABI/Inform Database Search

DATABASE	SEARCH WORD(S)	# ARTICLES
ABI/Inform (1986 - Nov 1991)	Decision/Policy	28214
	Decision/Policy related to Health Care	1502
	Decision/Policy related to Health Care 'and' Population Health/ Population Impact	149
	Decision/Policy related to Health Care 'and' Economics	61
	Decision/Policy related to Health Care 'and' Technology Assessment	48
	Decision/Policy related to Health Care 'and' Law	200
	Decision/Policy related to Health Care 'and' Politics	29
	Decision/Policy related to Health Care 'and' Ethics	28

TABLE 3

MEDLINE Database Search

DATABASE	SEARCH WORD(S)	# ARTICLES
MEDLINE (1987 - Jan 1992)	Decision/Policy	3658
	Decision/Policy related to Delivery of Health Care	33
	Decision/Policy related to Costs/Cost Benefit Analysis	107
	Decision/Policy related to Health	16
	Decision/Policy related to Health Care Rationing	43
	Decision/Policy related to Health Facilities	19
	Decision/Policy related to Health Planning (search limited to 1990-92)	17
	Decision/Policy related to Health Priorities (search limited to 1990-92)	11
	Decision/Policy related to Health Resources (search limited to 1990-92)	19
	Decision/Policy related to Health Services (search limited to 1990-92)	26
	Decision/Policy related to Health Services Research	35
	Decision/Policy related to Health Status Indicators (search limited to 1990-92)	14
	Decision/Policy related to Health Surveys	16
	Decision/Policy related to Technology Assessment	50
	Decision/Policy related to Population Surveillance	4
	Decision/Policy related to medical ethics	149

TABLE 4

Health Database Search*

DATABASE	SEARCH WORD(S)	# ARTICLES
Health Database (1975 - Jan 1992)	Decision/Policy	5434
	Decision/Policy related to Delivery of Health Care	33
	Decision/Policy related to Costs/Cost Benefit Analysis	69
	Decision/Policy related to Health	14
	Decision/Policy related to Health Care Rationing	11
	Decision/Policy related to Health Facilities	11
	Decision/Policy related to Health Planning (search limited to 1990-92)	28
	Decision/Policy related to Health Priorities (search limited to 1990-92)	16
	Decision/Policy related to Health Resources (search limited to 1990-92)	25
	Decision/Policy related to Health Services (search limited to 1990-92)	4
	Decision/Policy related to Health Services Research	27
	Decision/Policy related to Health Status Indicators (search limited to 1990-92)	4
	Decision/Policy related to Health Surveys	4
	Decision/Policy related to Technology Assessment	49
	Decision/Policy related to Population Surveillance	8
	Decision/Policy related to medical ethics	25

* Overlap between Health Database and MEDLINE has been eliminated in this search

6.1 Descriptive Analysis

All of the abstracts were reviewed; however, only a small proportion (13%) were actually relevant to the particular focus of this study. The final review examined, in depth, 173 (13%) of the total number of abstracts (1,300) captured by the original search. Entire articles were retrieved for the majority (160) of the analysis; however, in 13 of the cases we only had access to abstracts.

The appraisal took place in several stages. First, we looked at the quality of evidence; articles were categorized as being either theoretical/analytical, empirical, or editorial/personal viewpoint. Table 5 describes the results of these processes. About 51 percent of the articles were theoretical/analytical in nature and 44 percent were editorial or personal viewpoints. Only 5 percent of the articles were empirically based. With respect to focus it should be pointed out that the majority of the literature addressed more than one dimension. The results are as follows: 55 of the articles (32%) discussed the role of economics; 88 of the articles (51%) discussed the role of ethics/equity; 42 of the articles (24%) discussed the role of political and legal factors; 57 of the articles (33%) discussed the role of social factors; 41 (24%) of the articles discussed the role of epidemiological factors (population at risk, population impact); and, 54 (31%) of the articles discussed the role of technology assessment activities.

TABLE 5
ANALYSIS OF ARTICLES REVIEWED

AUTHOR(S)	ECONOMIC	ETHICAL/ EQUITY	LEGAL/ POLITICAL	SOCIAL	EPIDEMIO-LOGICAL	TECHNOLOGY ASSESSMENT
Aaron, Henry and William B. Schwartz (1990)	P					
Adams, Orvill (1988)			P			
Allen, Anne (1991)		P		P		
Ayry, M. (1991)					T	
Balk, Roger A. (1990)		T		T		
Banta, H. David and Per Buch Andreasen (1990)						T
Banta, H. David et al. (1987)						T
Battista, Renaldo (1989)						T
Begin, Patricia (1989)		T	T	T		
Behrens, Cornelia and Klaus-Dirk Henke (1987)	P					
Benjamin, M. (1990)		T				
Berman, Gary D., T. E. Kottke and D. J. Ballard (1990)						P
Berwick, Donald M. (1988)	P					
Binney, Elizabeth A. and Carroll L. Estes (1988)		T		T		
Björk, Stefan and Per Rosén (1991)		P				
Blank, Robert H. (1988)						T
Blank, Robert H. (1984)						T
Bloche, M. Gregg and Francine Coumos (1990)	T	T	T	T	T	
Blumstein, James F. (1976)			T			
Bowie, Robert D. (1991)	P					
Bozeman, Barry and Frederick A. Rossini (1979)						T
Brehm, Henry P. and Ross M. Mullner (1989)						T
Brody, Baruch et al. (1991)	E					
Brody, Baruch A. (1988)		P		P	P	
Brown, Lawrence D. (1991)	T	T		T	T	T
Bucci, Vincent A. (1991)						P
Callahan, Daniel (1991)		P		P		
Callahan, Daniel (1988)	P	P		P	P	P

.../continued

Legend:
T = Theoretical/Analytical
P = Personal Viewpoint/Editorial
E = Empirical

TABLE 5 (continued)
ANALYSIS OF ARTICLES REVIEWED

AUTHOR(S)	ECONOMIC	ETHICAL/ EQUITY	LEGAL/ POLITICAL	SOCIAL	EPIDEMIO-LOGICAL	TECHNOLOGY ASSESSMENT
Calltorp, Johan (1988)						E
Capron, Alexander Morgan (1989)		P	P	P		
Chana, Harjinder S. and Karl J. Lundstrom (1990)		P		P		
Chapman, Fern Schumer (1985)	P	P				
Connelly, Michael D. (1991)		P	P	P		
Council on Ethical and Judicial Affairs (1991)		E		E		
Crane, Vicki S. (1988)					T	
Crichton, A. (1989)		T				
Danis, Marion and Larry R. Churchill (1991)		T		T		
de Wachter, Maurice A.M. (1988)		T				
Deber, Raisa B. and Vivek Goel (1990)		T		T		
Deber, Raisa B., G. G. Thompson and P. Leatt (1988)			T			T
Detsky, Allan S. and I. Gary Naglie (1990)	T	T	T			
Drane, J.F. (1988)	T	T	T	T	T	
Drummond, Michael F. (1990, a)	T					
Drummond, M. (1989, b)		T			T	
Drummond, Michael F. (1987)	T				T	
Drummond, Micahel F. (1987)					P	
Duff, Raymond S. and A.G.M. Campbell (1980)		P		P		
Duggan, J.M. (1989)	P	P	P		P	
Eddy, David M. (1990, a)						P
Eddy, David M. (1990, b)	P					
Eddy, David M. (1990, c)	P		P	P		
Ellencweig, Avi Y. (1988)						T
Emery, Danielle Dolenc (1989)	T	T				
Emson, Harry E. (1991)	P	P	P			P
Etzioni, Amitai (1991)		P		P		
Etzioni, Amitai (1975)	P	P			P	

.../continued

Legend:
T = Theoretical/Analytical
P = Personal Viewpoint/Editorial
E = Empirical

TABLE 5 (continued)
ANALYSIS OF ARTICLES REVIEWED

AUTHOR(S)	ECONOMIC	ETHICAL/ EQUITY	LEGAL/ POLITICAL	SOCIAL	EPIDEMIO-LOGICAL	TECHNOLOGY ASSESSMENT
Evans, Robert G. (1990)			T	T		
Evans, Roger (1983)		T				
Feeny, David and Greg Stroddart (1988)						T
Feldstein, Paul J. (1990)	T	T	T	T		
Fox Daniel M. and Howard M. Leichter (1991)		T		T		T
France, George (1988)						T
Friedman, Emily (1989)		P				
Friedman, Emily (1987)		P		P		
Fuchs (1990)						P
Gafni, Amiram (1991)	T					
Garber, Alan M. and Judith L. Wagner (1991)	T				T	T
Gemmette, Elizabeth Villiers (1991)		T	T	T		
Ginzberg, Eli (1982)						P
Goldberg, Allen I. (1988)		E	E	E	E	
Golding, A.B.M. (1984)						P
Grannemann, Thomas W. (1991)		T	T			T
Gula, R.M. (1990)		T	T	T		
Haan, Ger (1991)	T	T		T		
Hadorn, David C. (1991, a)	T	T	T	T	T	
Hadorn, David C. (1991, b)				T	T	
Hakulinen, Timo and Matti Hakama (1991)					T	
Halstead, Scott B., P. Tugwell and K. Bennett (1991)						T
Ikegami, Naoki (1988)						T
Jacobson, Peter D. and C. John Rosenquist (1988)						T
Jennett, Bryan (1988, a)	T	T				
Jennett, Bryan (1988, b)						T
Kaplan, Robert M. and John P. Anderson (1988)					T	
Kelly, Lucie S. (1990)	P	P	P			
Kelsey, Beverly (1975)	P	P	P	P	P	

Legend:
T = Theoretical/Analytical
P = Personal Viewpoint/Editorial
E = Empirical

.../continued

TABLE 5 (continued)
ANALYSIS OF ARTICLES REVIEWED

AUTHOR(S)	ECONOMIC	ETHICAL/ EQUITY	LEGAL/ POLITICAL	SOCIAL	EPIDEMIO-LOGICAL	TECHNOLOGY ASSESSMENT
Kilner, John F. (1988)		T		T	T	
King, John R. (1990)		P				
Klein, Rudolf (1989)						P
Klein, Rudolf (1990)						T
Koska, Mary T. (1991)						P
Krahn, Murray D. and Allan S. Detsky (1992)	P				P	
Lamm, Richard D. (1990)						P
Lamm, Richard D. (1989)						P
Lamm, Richard D. (1987)		P		P		
Lan, Chung-Fu (1987)						T
Larson, Eric B. (1987)						T
Laupacis, Andreas (1992)	T	T	T			
Levey, Samuel (1990)						P
Levkoff, Sue and Terrie Wetle (1989)		E		E	E	
Lomas, Jonathan (1990)						T
Loomes, Graham and Lynda McKenzie (1989)					T	
Maher, Walter B. (1991)	T	T				
Marmor, Theordore R. (1990)		P				
McCormack, Thelma (1988)		T	T	T		
McGivney, William T. and Andrea L. Schneider (1988)						T
Morey, Dennis A.J. (1988)		P				
Murphy, Donald J. and David B. Matchar (1990)	T	T		T	T	
Myers, Beverlee A. (1977)		P				
Natiello, Thomas A. (1988)	P					P
Neuhauser, Duncan and Kirstine Napier (1989)						P
O'Malley, Nora C. (1991)		E		E		
Omenn, Gilbert S. (1990)	T				T	
Oster, Gerry (1988)	T					
Paris, John J. and Kevin O'Connell (1991)	P	P	P	P	P	
Parker, Barnett R. (1990)						T
Peña-Mohr, Jorge (1987)						T

Legend:

.../continued

T = Theoretical/Analytical
P = Personal Viewpoint/Editorial
E = Empirical

TABLE 5 (continued)
ANALYSIS OF ARTICLES REVIEWED

AUTHOR(S)	ECONOMIC	ETHICAL/ EQUITY	LEGAL/ POLITICAL	SOCIAL	EPIDEMIO-LOGICAL	TECHNOLOGY ASSESSMENT
Read, Kevin (1990)	P	P		P		
Reagan, Michael (1989)		P				
Reiser, Stanley J. (1992)			T	T		
Relman, Arnold S. (1990)						P
Rettig, Richard A. (1989)		T				T
Reynolds, R. Larry (1989)	T	T	T	T	T	
Rice, Dorothy P. (1989)	T				T	
Rodin, Judith and Aila Collins, ed. (1991)		T	T	T	T	
Ross, John Jr. (1991)	P	P	P	P		
Rossiter, Louis F. (1990)	P					
Rothschild, Ila S. (1990)			P			
Russell, Louise B. and Jane E. Sisk (1988)						T
Rutten, Frans and H. David Banta (1988)						T
Sabatino, Frank (1991)		P			P	
Salter, B. (1991)	P	P	P	P	P	
Schweitzer, Stuart O. (1990)						P
Shannon, Thomas A. (1987)		P		P		
Sidel, Victor W. (1987)		P				
Siegler, Mark (1985)	P	P		P		
Sisk, Jane E. (1987)						P
Smith, Lee (1989)	P	P		P		
Starr, Paul (1975)				P		
Steinwachs, Donald M. (1989)					T	
Svanström, Leif (1988)		P				
Tanneberger, Stephan (1988)						T
Thompson, Mark and Aubrey Milunksy (1979)	T	T	T			
Tokarski, Cathy (1990)			P			
Torrance, George W. (1987)	T					
Tugwell, Peter, et al. (1986)						T
Tymstra, Tjeerd (1989)				T		

Legend:

.../continued

T = Theoretical/Analytical
P = Personal Viewpoint/Editorial
E = Empirical

TABLE 5 (continued)
ANALYSIS OF ARTICLES REVIEWED

AUTHOR(S)	ECONOMIC	ETHICAL/ EQUITY	LEGAL/ POLITICAL	SOCIAL	EPIDEMIO-LOGICAL	TECHNOLOGY ASSESSMENT
Vilnius, Douglas and Suzanne Dandoy (1990)	T	T	T		T	
Wagstaff, Adam (1991)		T			T	
Weinstein, Milton (1990)	T					
Weinstein, Milton C. (1989)	T				T	
Weinstein, Milton C. and William B. Stason (1977)	P	P	P			
Wennberg, John E. (1990)						P
Wetle, Terrie, Julie Cwikel, and Sue E. Levkoff (1988)			E	E	E	
White, Gladys B. (1989)		P				P
Wikler, Daniel (1991)		T				
Williams, Alan (1988)		T	T	T		
Williams, Alan (1987)	P	P	P	P	P	
Wissema, Johan G. (1981)						P
Wray, Nelda et al. (1988)		E		E		
Wright, Richard A. (1991)		T				
Zajac, Barry M. (1989)			P			
Zeckhauser, Richard and Donald Shepard (1976)	T	T	T			
Ziporyn, Terra (1983)						P

Legend:
T = Theoretical/Analytical
P = Personal Viewpoint/Editorial
E = Empirical

6.2 Convergence of Findings

That rational analysis and systematic planning ought to be the norms governing health technology decisions appears to be a consensus statement. There is appreciable convergence of research findings regarding policy decisions pertaining to health technologies, regardless of source, disciplinary perspective, or methodology. Some differences emerge, however, when the criteria and/or factors that constitute the focus of rational planning are being considered. The proposed decision framework, described in Section 3 of this report, was used to provide focus to the critical appraisal of the literature reviewed. The identification of the model's key dimensions, addressed by each of the selected articles, provides a measure of convergence of thought that was heretofore unmeasured.

As indicated in Table 5, very few articles addressed only a single dimension; generally these pertained to the economic issues of health technology or the role of technology assessment in decision making. The large majority of the reviewed articles examined ethical concerns regarding health care technology, most frequently discussed as questions of equity. Related closely to this were issues of the social impact of health technologies and, therefore, social costs. In particular, questions regarding experimental, expensive, and/or newly introduced technologies are raised, especially in terms of the need to understand how they affect social relations, current and future, for the patient and family/friends as well as the health care providers. The emotional costs of new choices, its paradoxical effects on individuals and stake-holder groups and the often false sense of freedom arising from it, are postulated to be at least as important as the financial costs. The literature also indicates that the burden of illness is ultimately shared by the society at-large; while one individual may be the recipient of a public good - in the form of a technological intervention paid for through universal health insurance - other individuals have to forego other public goods in health care or other public services.

There is also appreciable convergence in the literature on the political aspects of resource allocation. The evidence indicates that beyond establishing the safety, efficacy and effectiveness of technologies, scientific knowledge does not provide the answer to "how much technology and for whom?" These types of decisions should be made by officials elected to represent the public interest, accountable to a legislative body. While it is generally obvious that public policy-makers are responsible for the public interest, it is often assumed that health professionals, as providers, are responsible only to the individuals under their care. There is growing literature, however, to indicate that providers do bear some public responsibility as stewards of the common wealth.

While the field of technology assessment is a relatively new one, fraught with the usual problems of multi-disciplinary work, the research evidence indicates that the usefulness of scientific evidence would be limited if produced in a vacuum, that is, divorced from the decision-making processes. The value of integrating the technology assessment research with public policy was recognized more than a decade ago (Bozeman,

1979); it was suggested that the research process should include the interplay of values, making it part of the bureaucratic-political environment. The importance of linking research findings to clinical, administrative, or policy decisions is clearly a point of convergence in our findings. Regardless of disciplinary perspective, researchers agree that political considerations must be an important dimension of technology assessment, and increasing the involvement of the decision makers in the research process would increase the latters' commitment to use the research evidence (Banta, 1990; Drummond, 1990). Slowly emerging, is the literature on evaluating the research evidence, whether this is economic evaluation or clinical trials (Laupacis, 1992; Larson, 1989). Furthermore, as the integration of technology assessment and decision-making becomes better coordinated, attention should be paid to eliminating the structural barriers to such integration, usually through the clarification of long-standing ambiguities regarding decision-making authority. As well, the attenuation of chronic border disputes between government and medicine, or between government and hospitals, over who decides what issues, would clarify who should be the target audience for the information generated through technology assessment (Lomas, 1990).

Finally, it is reasonable to conclude that health care systems are grounded in societal norms and propelled by culturally defined value systems which are not immutable over time. Thus, changing values in Canadian society (as well as in the rest of the Western world) have altered the traditional relationships between government, medical practitioner, and health care consumer with a consequent shift in their respective authority to manage the system. The public is now less likely to endow the medical practitioner with paternalistic attributes, and at the same time, less likely to unquestionably transfer these attributes to public officials. In addition, since views of the human condition, concepts of health and disease, approaches to medical practice, and notions of distributive justice are all culturally defined, incorporating underlying paradigms in research may shed better light on outcomes of care than simply studying the technical capacity of the health care system.

The tabular presentation of the quality of research evidence in Table 5 indicates that much more empirical work needs to be undertaken on how decisions regarding public policy, that best serve the public interest, ought to be made.

7. CONCLUDING REMARKS

The purpose of the proposed decision framework (see Table 1) is the creation of a clear, precise, manageable, and replicable process designed to generate information about the consequences of the various decision options. Models are fundamental to policy analysis; while they may not predict consequences with the same assurance as the best scientific models, policy models tell us what the possibilities are, based on various assumptions about the factors of concern. Decisions are often made intuitively, without explicit models. However, in that case, a tacit model or an unconsciously calculated decision is being developed. Faced with a phenomenon that is too complex and too expensive to study directly, a natural inclination is to

study a model, which resembles the phenomenon of framework interest in its essential features but is more manageable, less expensive, easier to study.

It is possible to test the predictions based on a model and determine the correctness and relevance of these predictions for real-world decisions. Our proposed conceptual model provided the broad parameters within which this literature review was conducted. A critical appraisal of the literature has provided an examination of the quality and volume of the evidence pertaining to health technology decisions; evidence pertaining to the attributes of health care technologies was not investigated. This literature review was undertaken primarily to establish the feasibility of the model's empirical application. Two general findings warrant brief discussion.

First, the literature we reviewed for this project clearly indicated that the dimensions of the proposed framework were the appropriate ones to include in a health technology decision model. While these factors were not always grouped similar to our particular grouping, singly or in multiples the same factors appeared in most of the literature we examined. In addition, the evidence from this literature review indicated that the decision making process, as described by the studies referenced here, is receptive to systematic inputs of information which enhance the potential for better decisions. Several of the articles reviewed proposed decision models with similar, but usually less comprehensive characteristics (see, for example, Balk 1990; Deber & Goel, 1990; Eddy, 1991c; Hadorn, 1991a; Kaplan and Anderson, 1988; Murphy, 1990).

The second general comment about our findings pertains to the technical feasibility of developing the mathematical model based on the suggested conceptual one. The degree of difficulty in developing quantitative measures for each of the model dimensions will vary appreciably from one dimension to the next, but the task is not an impossible one. Economic and epidemiological measures are easier to compile from already existing ones than developing measures for ethical and social concerns, quantification of the political milieu may prove to be a challenging exercise. However, these methodological hurdles do not appear to be insurmountable, in light of the evidence on the importance of using norms of utility as well as equity in making health technology decision.

REFERENCES

Aaron, Henry and William B. Schwartz. "Rationing Health Care." *Across the Board* 1990;27(7-8): 34-39.

Adams, Orvill. "Rational Decision-making in Health Care: Is There Hope?" *Canadian Medical Association Journal* 1988;138(April):591.

Allen, Anne. "Rationing Health Care Resources: Who Will Set Limits?" *Journal of Post Anesthesia Nursing* 1991;6(4):294-295.

American Medical Association. Council on Ethical and Judicial Affairs. "Gender Disparities in Clinical Decision Making." *Journal of the American Medical Association* 1991;266(4):559-562.

Ayry, M. "Measuring the Quality of Life: Why, How and What?" *Theoretical Medicine* 1991; 12(2):97-116.

Balk, Roger A. "Should Transplantation Be A Part of A Health Care System?" *Canadian Family Physician* 1990;36(June):1129-1132.

Banta, H. David and Per Buch Andreasen. "The Political Dimension in Health Care Technology Assessment Programs." *International Journal of Technology Assessment in Health Care* 1990; 6(1):115-123.

Banta, H. David et al. "An Inquiry Concerning Future Health Care Technology: Methods and General Results." *Health Policy* 1987;8:251-264.

Battista, Renaldo N. "Innovation and Diffusion of Health-Related Technologies." *International Journal of Technology Assessment in Health Care* 1989;5:227-248.

Begin, Patricia. "New Reproductive Technologies." Background report for the Library of Parliament, Research Branch, BP-204E (May 1989).

Behrens, Cornelia and Klaus-Dirk Henke. "Cost of Illness Studies: No Aid to Decision Making? Reply to Shiell et al. (Health Policy, 8 (1987) 317-323)." *Health Policy* 1988;10:137-141.

Benjamin, M. "Philosophical Integrity and Policy Development in Bioethics." *Journal of Medicine & Philosophy* 1990;15(4):375-389.

Berman, Gary D., Thomas E. Kottke, and David J. Ballard. "Effectiveness Research and Assessment of Clinical Outcome: A Review of Federal Government and Medical Community Involvement." *Mayo Clin Proc* 1990;65:657-663.

Berwick, Donald M. "The Society for Medical Decision Making: The Right Place at the Right Time." *Medical Decision Making* 1988;8(2):77-80.

Binney, Elizabeth A. and Carroll L.Estes. "The Retreat of the State and its Transfer of Responsibility: the Intergenerational War." *International Journal of Health Services* 1988;18(1):83-96.

Björk, Stefan and Per Rosén. "Health Care Politicians and Prioritising. Do Ethics Matter." *IHE Information* 1991;4:6-7.

Blank, Robert H. "Rationing Medicine." New York: Columbia University Press (1988).

Blank, Robert H. "Redefining Human Life. Reproductive Technologies and Social Policy." Boulder: Westview Press (1984).

Bloche, M. Gregg and Francine Cournos. "Mental Health Policy for the 1990s: Tinkering in the Interstices." *Journal of Health Politics, Policy and Law* 1990;15(2):387-411.

Blumstein, James F. "Constitutional Perspectives on Governmental Decisions Affecting Human Life and Health." *Law & Contemporary Problems* 1976;40(4):231-305.

Bowie, Robert D. "Health Economics: A Framework for Health Service Decision-making." *New Zealand Medical Journal* 1991;104 (March):99-102.

Bozeman, Barry and Frederick A. Rossini. "Technology Assessment and Political Decision-Making." *Technological Forecasting and Social Change* 15 (1979).

Brehm, Henry P. and Ross M. Mullner. "Health Care, Technology, and the Competitive Environment." New York: Praeger Press (1989).

Brody, Baruch et al. "The Impact of Economic Considerations on Clinical Decisionmaking: The Case of Thrombolytic Therapy." *Medical Care* 1991;29(9):899-910.

Brody, Baruch A. "Challenges of Organ Transplantation: Selected Social Issues." *Texas Medicine* 1988;84(12):80-82.

Brown, Lawrence D. "The National Politics of Oregon's Rationing Plan." *Health Affairs* 1991; 10(2):28-51.

Bucci, Vincent A. "Health Outcomes Research: Its Influence on Clinical Decision Making and the Development of New Imaging Technologies." *American Society of Neuroradiology* 1991; 12(May/June):397-399.

Burt, Robert A. "The Limits of Law in Regulating Health Care Decisions." *Hastings Center Report* 1977;7(6):29-32.

Cain, A. J., ed. "Function and Taxonomic Importance." London: The Systematics Association (1959).

Callahan, Daniel. "Ethics and Priority Setting in Oregon." Commentary in *Health Affairs* 1991;10(2):78-87.

Callahan, Daniel. "Allocating Health Resources."*Hastings Center Report* 1988;18(2):14-20.

Calltorp, Johan. "Consensus Development Conferences in Sweden." *International Journal of Technology Assessment in Health Care* 1988;4(1):75-88.

Capron, Alexander Morgan. "Bioethics on the Congressional Agenda." *Hastings Center Report* 1989;19(2):22-23.

Chana, Harjinder S. and Karl J. Lundstrom. "Role of Communities in Decision-Making Eye Care Programs." *Ophthalmic Surgery* 1990;21(10):741-743.

Chapman, Fern Schumer. "Deciding Who Pays to Save Lives." *Fortune* 1985;111(3):59-70.

Churchill, L. R. "Rationing Health Care in America: Perceptions and Principles of Justice." Indiana: University of Notre Dame Press (1987).

Connelly, Michael D. "Confronting the "Rights" Issue in Health Policy." *Health Progress* 1991; 72(9):12-16.

Crane, Vicki S. "Economic Aspects of Clinical Decision Making: Applications of Clinical Decision Analysis." *American Journal of Hospital Pharmacy* 1988;45 (March):548-553.

Crichton, A. "Canada's Provinces Review Their Health Services." *International Journal of Health Planning & Management* 1989;4(1):49-62.

Danis, Marion and Larry R. Churchill. "Autonomy and the Common Weal." *Hastings Center Report* 1991;21(1):25-31.

Davis, K. "Research and Policy Formulation." In *Application of Social Science to Clinical Medicine and Health Policy*, edited by L.H. Aiken and D. Mechanic. New Jersey: Rutgers University Press, (1986).

de Wachter, Maurice A.M. "Ethics and Health Policy in the Netherlands." In *Health Care Systems. Moral Conflicts in European and American Public Policy*, edited by Hans-Martin Sass and Robert U. Massey. Norwell, MA: Kluwer Academic Publishers (1988):97-116.

Deber, Raisa B. and Vivek Goel. "Using Explicit Decisions Rules to Manage Issues of Justice, Risk, and Ethics in Decision Analysis: When Is It Not Rational to Maximize Expected Utility?" *Medical Decision Making* 1990;10(3):181-194.

Deber, Raisa B., Gail G. Thompson, and Peggy Leatt. "Technology Acquisition in Canada." *International Journal of Technology Assessment in Health Care* 1988;4(2):185-206.

Detsky, Allan S. and I. Gary Naglie. "A Clinician's Guide to Cost-Effective Analysis." *Annals of Internal Medicine* 1990;113:147-154.

Drane, J.F. ""Ethical Workup" Guides Clinical Decision Making." *Health Progress* 1988;69(11):64-67.

Drummond, Michael F. "Allocating Resources." *International Journal of Technology Assessment in Health Care* 1990;6:77-92.

Drummond, Michael F. "Output Measurement for Resource Allocation Decisions in Health Care." *Oxford Review of Economic Policy* 1989;5:1.

Drummond, Michael F. "Resource Allocation Decisions in Health Care: A Role for Quality of Life Assessments." *Journal of Chronic Diseases* 1987a;40(6):605-616.

Drummond, Michael F. "Discussion: Torrance's "Utility Approach to Measuring Health-Related Quality of Life."" *Journal of Chronic Diseases* 1987b;40(6):601-603.

Duff, Raymond S. and A.G.M. Campbell. "Moral and Ethical Dilemmas: Seven Years Into the Debate About Human Ambiguity." *Annals AAPSS* 1980;447 (January):19-29.

Duggan, J.M. "Resource Allocation and Bioethics." *The Lancet* 1989;1(8641):772-773.

Eddy, David M. "Clinical Decision Making: From Theory to Practice." *Journal of the American Medical Association* 1990a;263(3):441-443.

Eddy, David M. "What Do We Do About Costs?" *Journal of the American Medical Association* 1990b;264(9):1161-1170.

Eddy, David M. "Connecting Value and Costs. Whom Do We Ask, and What Do We Ask Them?" *Journal of the American Medical Association* 1990c;264(13):1737-1739.

Eddy, David M. "The Individual vs Society. Is There a Conflict." *Journal of the American Medical Association* 1991a;265(11):1446-1450.

Eddy, David M. "What's Going On in Oregon?" *Journal of the American Medical Association* 1991b;266(3):417-420.

Eddy, David M. "What Care Is 'Essential'? What Services Are 'Basic'?" *Journal of the American Medical Association* 1991c;265(6):782-788.

Eisenberg, John M. "Clinical Economics. A Guide to the Economic Analysis of Clinical Practices." *Journal of the American Medical Association* 1989;262(20):2879-2886.

Ellencweig, Avi Y. "Development of Medical Care Technology." *International Journal of Technology Assessment in Health Care* 1988;4(2):255-267.

Emery, Danielle Dolenc and L. J. Schneiderman. "Cost Effectiveness Analysis in Health Care." *Hastings Center Report* 1989;19(4):8-13.

Emson, Harry E. "Down the Oregon Trail - The Way for Canada?" *Canadian Medical Association Journal* 1991;145(11):1441-1443.

Etzioni, Amitai. "Health Care Rationing: A Critical Evaluation." Commentary in *Health Affairs* 1991;10(2):88-95.

Etzioni, Amitai. "Public Policy Issues Raised by a Medical Breakthrough." *Policy Analysis* 1975;1(1):69-76.

Evans, Robert G. "Tension, Compression, and Shear: Directions, Stresses, and Outcomes of Health Care Cost Control." *Journal of Health Politics, Policy and Law* 1990;15(1):101-128.

Evans, R.G. "The Fiscal Management of Medical Technology: the Case of Canada." In *Resources for Health: Technology Assessment for Policy Making*. New York: Praeger Publishers, (1982).

Evans, Roger W. "Health Care Technology and the Inevitability of Resource Allocation and Rationing Decisions." *Journal of the American Medical Association* 1983;249(16):2208-2219.

Feeny, David and Greg Stoddart. "Toward Improved Health Technology Policy in Canada: A Proposal for the National Health Technology Assessment Council." *Canadian Public Policy* 1988;14(3):254-265.

Feldstein, Paul J. "An Economic Perspective on Health Politics and Policy." *Quarterly Review of Economics and Business* 1990;30(4):117-135.

Fodor, J. "Major Equipment Purchases: A Committee Approach." *Health Progress* 1988;69(10):12, 14.

Fox, Daniel M. and Howard M. Leichter. "Rationing Care in Oregon: The New Accountability." *Health Affairs* 1991;10(2):7-27.

France, George. "Emerging Policies for Controlling Medical Technology in Italy." *International Journal of Technology Assessment in Health Care* 1988;4(2):207-227.

Friedman, Emily. "Technically Correct and Morally Good: Ethics and Decision Analysis." *Medical Decision Making* 1989;9(1):65-67.

Friedman, Emily. "AIDS and Insurers: Keeping the Covenant?" *Healthcare Forum Journal* 1987(November/December):11-12, 44.

Fuchs, Victor R. and Alan M. Barber. "The New Technology Assessment." *The New England Journal of Medicine* 1990;323(10):673-677.

Gafni, Amiram. "Willingness-to-Pay as a Measure of Benefits. Relevant Questions in the Context of Public Decisionmaking About Health Care Programs." *Medical Care* 1991;29(12):1246-1252.

Garber, Alan M. and Judith L. Wagner. "Practice Guidelines and Cholesterol Policy." *Health Affairs* 19__;10(2):52-66.

Gemmette, Elizabeth Villiers. "Selective Pregnancy Reduction: Medical Attitudes, Legal Implications, and a Viable Alternative." *Journal of Health Politics, Policy and Law* 1991;16(2):383-395.

Ginzberg, Eli. "More Care Is Not Always Better Care." *Inquiry* 1982;19 (Fall):187-189.

Goldberg, Allen I. "Life-Sustaining Technology and the Elderly. Prolonged Mechanical Ventilation Factors Influencing the Treatment Decision." *Chest* 1988;94(6):1277-1282.

Golding, A.M.B. "Decision Making in the National Health Service." *British Medical Journal* 1984;288 (January 21):203-206.

Grannemann, Thomas W. "Priority Setting: A Sensible Approach to Medicaid Policy?" *Inquiry* 1991;28 (Fall):300-305.

Gula, R.M. "Moral Principles Shaping Public Policy on Euthanasia." *Second Opinion* 1990;14 (July):72-83.

Haan, Ger. "Effects and Costs of In-Vetro Fertilization." *International Journal of Technology Assessment in Health Care* 1991;7(4):585-593.

Hadorn, David C. "The Oregon Priority-Setting Exercise: Quality of Life and Public Policy." *Hastings Center Report* 1991a(May-June):11-16.

Hadorn, David C. "The Role of Public Values in Setting Health Care Priorities." *Social Science and Medicine* 1991b;32(7):773-781.

Hakulinen, Timo and Matti Hakama. "Predictions of Epidemiology and the Evaluation of Cancer Control Measures and the Setting of Policy Priorities." *Social Science and Medicine* 1991;33(12):1379-1383.

Halstead, Scott B., Peter Tugwell, and Kathryn Bennett. "The International Clinical Epidemiology Network (INCLEN): A Progress Report." *Journal of Clinical Epidemiology* 1991;44(6)):579-589.

Hayry, M. "Measuring the Quality of Life: Why, How and What? *Theoretical Medicine* 1991;12 (June):97-116.

Ikegami, Naoki. "Health Technology Development in Japan." *International Journal of Technology Assessment in Health Care* 1988;4(2):239-254.

Institute of Medicine. "Assessing Medical Technologies." Committee for Evaluating Medical Technologies in Clinical Use, Division of Health Sciences Policy, Division of Health Promotion and Division of Health Promotion and Disease Prevention. Washington, D.C.: National Academy Press, (1985).

Jacobson, Peter D. and C. John Rosenquist. "The Introduction of Low-Osmolar Contrast Agents in Radiology." *Journal of the American Medical Association* 1988;260(11):1586-1592.

Jennett, Bryan. "Medical Ethics and Economics in Clinical Decision Making." In *Medical Ethics and Economics in Health Care*, edited by Gavin Mooney and Alistair McGuire. New York: Oxford University Press, 1988a:90-102.

Jennett, Bryan. "Assessment of Clinical Technologies." *International Journal of Technology Assessment in Health Care* 1988b;4:435-445.

Kaplan, Robert M. and John P. Anderson. "A General Health Policy Model: Update and Applications." *Health Services Research* 1988;23(2):203-235.

Kelly, Lucie S. "Survey of Health Care Executives Reveals Priorities for Allocation of Care." *Nursing Outlook* 1990;38(3):110.

Kelsey, Beverly. "Which Infants Should Live? Who Should Decide?" *Hastings Center Report* 1975;5(2):5-8.

Kilner, John F. "Age as a Basis for Allocating Lifesaving Medical Resources: An Ethical Analysis." *Journal of Health Politics, Policy and Law* 1988;13(3):405-423.

King, John R. "Bridging the Gap Between Ethical Theory and Practical Decisionmaking in Medicine." *Journal of Health Politics, Policy and Law* 1990;15(1):220-229.

Klein, Rudolf. "Research, Policy, and the National Health Service." *Journal of Health Politics, Policy and Law* 1990;15(3):501-523.

Klein, Rudolf. "From Global Rationing to Target Setting in the U.K." *Hastings Center Report* 1989;19(4), Special Supplement:3-4.

Koska, Mary T. "Can Outcomes Data Help Patients Make End-of-life Decisions?" *Hospitals* 1991 (June):42-44.

Krahn, Murrary D. and Allan S. Detsky. "Universal Hepatitis B Vaccination: the Economics of Prevention." *Canadian Medical Association Journal* 1992;146(1):19-21.

Lamm, Richard D. "High-tech Health Care and Society's Ability to Pay." *Healthcare Financial Management* 1990 (September):21-30.

Lamm, Richard D. "Critical Decisions in Medical Care: Birth to Death." *Southern Medical Journal* 1989;82(7):822-824.

Lamm, Richard D. "The Ten Commandments of an Aging Society." *Vital Speeches* 1987;54(5):133-139.

Lan, Chung-Fu. "Decision Making on the Adoption of Advanced Medical Technology in Taiwan." *International Journal of Technology Assessment in Health Care* 1987;(3):293-302.

Larson, Eric B. "The Relevance of Socioeconomic and Health Policy Issues to Clinical Research." *International Journal of Technology Assessment in Health Care* 1989;5(2):195-206.

Laupacis, Andreas. "How Attractive Does a New Technology Have to be to Warrant Adoption and Utilization? Tentative Guidelines for Using Clinical and Economic Evaluations." *Canadian Medical Association Journal* 1992;146(4):473-481.

Levey, Samuel. "A New Era for Health Services Research?" *Hospital & Health Services Administration* 1990;35(4):493-504.

Levkoff, Sue and Terrie Wetle. "Clinical Decision Making in the Care of the Aged." *Journal of Aging and Health* 1989;1(1):83-101.

Lomas, Jonathan. "Finding Audiences, Changing Beliefs: The Structure of Research Use in Canadian Health Policy." *Journal of Health Politics, Policy and Law* 1990;15(3):525-542.

Loomes, Graham and Lynda McKenzie. "The Use of QALYs in Health Care Decision Making." *Social Science & Medicine* 1989;28(4):299-308.

Maher, Walter B. "The Medical-Industrial Complex." *Business & Health* 1991;9(9):94-95.

Marmor, Theordore R. "American Health Politics, 1970 to the Present: Some Comments." *Quarterly Review of Economics and Business* 1990;30(4):32-42.

McCormack, Thelma. "Public Policies and Reproductive Technology: A Feminist Critique." *Canadian Public Policy* 1988;XIV(4):361-375.

McGivney, William T. and Andrea L. Schneider. "Pathways to Assessing Medical Technology." *Business & Health* 1988;5(12):32-34.

Mechanic, David. "Social Policy, Technology, and the Rationing of Health Care." *Medical Care Review* 1989;26(2):113-120.

Mechanic, David. "Rationing Health Care: Public Policy and the Medical Marketplace." *Hastings Center Report* 1976;6(1):34-37.

Menzel, P.T. "Public Philosphy: Distinction Without Authority." *Journal of Medicine & Philosophy* 1990;15(4):411-424.

Molloy, D. William et al. "Factors Affecting Physicians' Decisions on Caring for an Incompetent Elderly Patient: an International Study." *Canadian Medical Association Journal* 1991;145(8): 947-952.

Momeyer, R.W. "Philosophers and the Public Policy Process: Inside, Outside, or Nowhere at All?" *Journal of Medicine & Philosophy* 1990;15(4):391-409.

Morey, Dennis A.J. "Is Health Care a Right or a Privilege?" *Virginia Medical* 1988;115(8):380.

Murphy, Donald J. and David B. Matchar. "Life-Sustaining Therapy. A Model for Appropriate Use." *Journal of the American Medical Association* 1990;264(16):2103-2108.

Myers, Beverlee A. "Health Care for the Poor." In *Health Services The Local Perspective*, edited by Arthur Levin. New York, New York: The Academy of Political Science (1977):68-78.

Natiello, Thomas A. "Economic Aspects of Clinical Decision Making: New Perspectives." *American Journal of Hospital Pharmacy* 1988;45(March):540-542.

Neuhauser, Duncan and Kirstine Napier. "Moving Forward on Quality of Care: Role of Decision Modeling." *Journal of the American College of Cardiology* 1989;14(3):48A-50A.

O'Malley, Nora C. "Age-based Rationing of Health Care: A Descriptive Study of Professional Attitudes." *Health Care Management Review* 1991;16(1):83-93.

Omenn, Gilbert S. "Prevention and the Elderly: Appropriate Policies." *Health Affairs* 1990;9(2):80-93.

Oster, Gerry. "Economic Aspects of Clinical Decision Making: Applications in Patient Care." *American Journal of Hospital Pharmacy* 1988;45(March):543-547.

Paris, John J. and Kevin O'Connell. "Cost Containment Through Control of Services: Lessons From Oregon." *Trustee* 1991;44(10):15, 23.

Parker, Barnett R. "In Quest of Useful Health Care Decision Models for Developing Countries." *European Journal of Operational Research* 1990;49:279-288.

Peddecord, K.M., et al. "Substitution of Magnetic Resonance Imaging for Computed Tomography. An Exploratory Study." *International Journal of Technology Assessment* 1988;4(4)573-591.

Pena-Mohr, Jorge. "Distributing and Transferring Medical Technology." *International Journal of Technology Assessment in Health Care* 1987;3:281-292.

Read, Kevin. "Curing the System: What Ails Health Care?" *Healthcare Financial Management* 1990;44(9):32-38.

Reagan, Michael. "Health Care Rationing: A Problem in Ethics and Policy." *Journal of Politics, Policy and Law* 1989;14(3):627-633.

Reiser, Stanley, J. "Consumer Competence and the Reform of American Health Care." *Journal of the American Medical Association* 1992;267(11):1511-1515.

Relman, Arnold S. "Reforming the Health Care System." *New England Journal of Medicine* 1990;323(14):991-992.

Rettig, Richard A. "The Politics of Organ Transplantation: A Parable of Our Time." *Journal of Health Politics, Policy and Law* 1989;14(1):191-227.

Reynolds, R. Larry. "The Delivery of Medical Care and Institutional Change." *Journal of Economics Issues* 1989;23(1):215-229.

Rice, Dorothy P. "Health and Long-Term Care for the Aged." *American Economic Association* Papers and Proceedings of the Annual Meeting December 1988. May 1989;79(2):343-348.

Rodin, Judith and Aila Collins, ed. "Women and New Reproductive Technologies: Medical, Psychosocial, Legal, and Ethical Dilemmas." New Jersey: Lawrence Erlbaum Associates, Publishers (1991).

Ross, John Jr. "Matrices of Decision Making in Cardiology." *Circulation* 1991;84(2):924-927.

Rossiter, Louis F. "Health Policy Revolution: The Search for Minimum Supply Price." *Quarterly Review of Economics and Business* 1990;30(4):136-139.

Rothschild, Ila S. "Gruzan and Beyond." *Trustee* 1990 (October):22-23.

Russell, Louise B. and Jane E. Sisk. "Medical Technology in The United States." *International Journal of Technology Assessment in Health Care* 1988;4(2):269-286.

Rutten, Frans and H. David Banta. "Health Care Technologies in the Netherlands." *International Journal of Technology Assessment in Health Care* 1988;4(2):229-238.

Sabatino, Frank. "Easing Passages: A Hospital's Policy On Life-Sustaining Treatment." *Trustee* 1991(October): 4-5.

Salter, B. "A Difficult Choice." *Health Services Management* 1991;87(3):p111-13

Schweitzer, Stuart O. "Understanding the Flow of Health Policy in the United States: Self-Interest or Ignorance?" *Quarterly Review of Economics and Business* 1990;30(4):140-147.

Shannon, Thomas A. "In Vitro Fertilization: Ethical Issues." *Women & Health* 1987;13(1-2):155-165.

Sidel, Victor W. "Medical Technology and the Poor." *Technology Review* 1987(May/June):24-25.

Siegler, Mark. "Another Form of Age Discrimination." *Across the Board* 1985;22(2):7-10.

Sisk, Jane E. "Discussion: Drummond's "Resource Allocation Decisions in Health Care: A Role for Quality of LIfe Assessment?" *Journal of Chronical Disease* 1987;40(6):617-619.

Smith, Lee. "What Do We Owe to the Elderly?" *Fortune* 1989;119(7):54-62.

Starr, Paul. "A National Health Program: Organizing Diversity." *Hastings Center Report* 1975; 5(1):11-13.

Steinwachs, Donald M. "Application of Health Status Assessment Measures in Policy Research." *Medical Care* 1989;27(3): S12-S25.

Svanström, Leif. "Current Trends in Sweden: Implications for Public Health Policy." *Journal of Public Health Policy* 1988;9(3):429-433.

Tanneberger, Stephan. "When Must a New Approach to Treatment be Introduced?" *International Journal of Technology Assessment in Health Care* 1988;4:113-120.

Thompson, Mark and Aubrey Milunksy. "Policy Analysis for Prenatal Genetic Diagnosis." *Public Policy* 1979;27(1):25-48.

Tokarski, Cathy. "Policymaker Looks to the People." *Modern Healthcare* 1990;(February):64.

Torrance, George W. "Utility Approach to Measuring Health-Related Quality of Life." *Journal of Chronic Diseases* 1987;40(6):593-600.

Tugwell, Peter et al. "A Framework for the Evaluation of Technology: The Technology Assessment Iterative Loop." In *Health Care Technology: Effectiveness, Efficiency & Public Policy*, edited by David Feeny, Gordon Guyatt, and Peter Tugwell. Montreal: The Institute for Research on Public Policy (1986):41-56.

Tymstra, Tjeerd. "The Imperative Character of Medical Technology and the Meaning of "Anticipated Decision Regret"." *International Journal of Technology Assessment in Health Care* 1989;5(2):207-213.

Vilnius, Douglas and Suzanne Dandoy. "A Priority Rating System for Public Health Programs." *Public Health Reports* 1990;105(5):463-470.

Wagstaff, Adam. "QALYs and the Equity-Efficiency Trade-Off." *Journal of Health Economics* 1991;10:21-41.

Weinstein, Milton C. "Principles of Cost-Effective Resource Allocation in Health Care Organizations." *International Journal of Technology Assessment in Health Care* 1990;6:93-103.

Weinstein, Milton C. "Methodologic Issues in Policy Modeling for Cardiovascular Disease." *Journal of the American College of Cardiology* 1989;14(3):38A-43A.

Weinstein, Milton C. and William B. Stason. "Allocating Resources: The Case of Hypertension." *Hastings Center Report* 1977;7(5):24-29.

Wennberg, John E. "Outcomes Research, Cost Containment, and the Fear of Health Care Rationing." *New England Journal of Medicine* 1990;323(17):1202-1204.

Wetle, Terrie, Julie Cwikel, and Sue E. Levkoff. "Geriatric Medical Decisions: Factors Influencing Allocation of Scarce Resources and the Decision to Withold Treatment." *The Gerontologist* 1988;28(3):336-343.

White, Galdys B. "Ethical Analyses in the Development of Congressional Public Policy." *The Journal of Medicne and Philosophy* 1989;14:575-585.

Wikler, Daniel. "What Has Bioethics to Offer Health Policy?" *The Milbank Quarterly* 1991; 69(2):233-251.

Williams, Alan. "Priority Setting in Public and Private Health Care. A Guide Through the Ideological Jungle." *Journal of Health Economics* 1988;7:173-183.

Williams, Alan. "Who is to Live? A Question for the Economist or the Doctor?" *World Hospitals* 1987;23(2-4):34-36.

Wissema, Johan G. "Putting Technology Assessment to Work." *Research Management* 1981; 24(5):11-17.

Wray, Nelda et al. "Withholding Medical Treatment From the Severely Demented Patient. Cost Processes and Cost Implications." *Arch Intern Med* 1988;148(September):1980-1984.

Wright, Richard A. "Clinical Judgment and Bioethics: The Decision Making Link." *The Journal of Medicine and Philosophy* 1991;16:71-91.

Zajac, Barry M. "Legal Issues in Neonatal Intensive Care." *Hospital & Health Services Administration* 1989;34(4):578-590.

Zeckhauser, Richard and Donald Shepard. "Where Now for Saving Lives?" *Law & Contemporary Problems* 1976;40(4):5-45.

Ziporyn, Terra. "Medical Decision Making: Analyzing Options in the Face of Uncertainty." *Journal of the American Medical Association* 1983;249(16):2133-2141.

APPENDIX TO SECTION B

SEARCH STRATEGIES AND RESULTS

1. ABI\Inform
2. US Political Science Documents
3. Economic Literature Index
4. Sociological Abstracts
5. MEDLINE
6. Health Planning And Administration (Health Database)
7. Biobusiness
8. Mathsci
9. Health Periodicals Database
10. FRANCIS

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
ABI/Inform			
1986-Nov 1991	1	decision making models	497
		decision theory	433
		decision making models 'or' decision theory	850
	2	strategic planning	4,660
		technological planning184	
		strategic planning 'or' technological planning	4,817
	3	public policy	1,568
		social policy	680
		public policy 'or' social policy	2,224
	4	decision	8,598
		policy	15,577
		decision 'or' policy	23,700
	5	searches 1 'or' 2 'or' 3 'or' 4 = decision	28,214

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	6	searches 1 'and' 2 'and' 3 'and' 4 = decision	1
	7	health	7,877
		medical devices	266
		hospitals	4,238
		health 'or' medical devices 'or' hospitals = health care	10,921
	8	searches 5 'and' 7 = decisions related to health care	1,502
	9	epidemics	37
		diseases	427
		epidemics 'or' diseases	440
	10	illnesses	228
		population	639
		illnesses 'or' population	867
	11	incidence	12
		prevalence	0
		incidence 'or' prevalence	12
	12	population	639
		impact	8,145
		population 'and' impact	64
	13	demography	1,197
	14	searches 12 'or' 13	1,249
	15	searches 9 'or' 10 'or' 11 'or' 14	2,335
	16	lifetables	0
		statistical data	15,446
	17	searches 15 'or' 16 = population health/population impact	17,303

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	18	searches 8 'and' 17 = decisions related to health care and population health/population impact	149
	19	economics	22,370
		costs	11,162
		expenditures	5,017
		economics 'or' costs 'or' expenditures = economics	35,499
	20	searches 8 'and' 19 = decisions related to health care and economics	61
	21	research	7,179
		R & D	3,659
		research 'or' R & D	10,534
	22	technology	5,007
		technology transfer	517
		technology 'or' technology transfer	5,007
	23	appropriate technology	7
		high technology	1,140
		appropriate technology 'or' high technology	1,147
	24	technology diffusion	0
	25	searches 21 'or' 22 'or' 23 = technology	14,649
	26	searches 8 'or' 25 = decisions related to health care and technology	48
	27	justice	175
		law	16,665
		justice 'or' law	16,745

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	28	government	5,400
	29	searches 27 'or' 28 = law	21,534
	30	searches 8 'and' 29 = decisions related to health care and law	200
	31	politics	700
		political risk	320
		politics 'or' political risk	1,005
	32	power	2,217
	33	searches 31 'or' 32	3,183
	34	public opinion surveys	161
		polls	63
		public opinion surveys 'or' polls	196
	35	advocacy	44
		consumerism	115
		advocacy 'or' consumerism	154
	36	searches 34 'or' 35	349
	37	searches 33 'or' 36 = politics	3,525
	38	searches 8 'and' 37 = decisions related to health care and politics	29
	39	ethics	1,684
		social impact	131
		ethics 'or' social impact	1,810
	40	quality of life	115
	41	searches 39 'or' 40 = ethics	1,922
	42	searches 8 'and' 41 = decisions related to health care and ethics	28

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
US Political Science Documents (1975-1991)	1	Administrative policy making/DE	76
	2	Committee decision making/DE	50
	3	Administrative policy making/DE 'or' decision maker perception/DE	126
	4	Community decision making/DE	118
	5	Decision maker perception/DE	375
	6	Community decision making/DE 'or' decision maker perception/DE	493
	7	Decision making analysis/DE	758
	8	Decision making theory/DE	374
	9	Decision making analysis/DE 'or' decision making theory/DE	949
	10	Decision making process/DE	760
	11	Judicial decision making/DE	289
	12	Decision making process/DE 'or' judicial decision making/DE	1,045
	13	Legislative decision making/DE	139

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	14	Planning process/DE	201
	15	Legislative decision making/DE 'or' planning process/DE	339
	16	Policy analysis/DE	716
	17	Policy development/DE	518
	18	Policy evaluation/DE	2,611
	19	Policy analysis/DE 'or' policy development/DE 'or' policy evaluation/DE	3,462
	20	Policy evaluation process/DE	0
	21	Public choice analysis/DE	276
	22	Policy evaluation process/DE 'or' public choice analysis/DE	276
	23	Public policy analysis/DE	1,573
	24	Public policy planning/DE	284
	25	Public policy analysis/DE 'or' public policy planning/DE	1,678
	26	Science information policy/DE	14
	27	Policy evaluation research	294
	28	Science information policy/DE 'or' policy evaluation research	308
	29	3 'or' 6 'or' 9 'or' 12 'or' 15 'or' 19 'or' 22 'or' 25	7,093
	30	Health administration/DE	89

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	31	Health care agency/DE	38
	32	Health care agency/DE	38
	33	Health administration/DE 'or' health care agency/DE 'or' health care agency/DE	115
	34	Health care institution/DE	38
	35	Health care policy/DE	175
	36	Health care rights/DE	91
	37	Health care institution/DE 'or' health care policy/DE 'or' health care rights/DE	267
	38	Health care system/DE	298
	39	Medical care system/DE	142
	40	Medical education/DE	50
	41	Health care system/DE 'or' medical care system/DE 'or' medical education/DE	413
	42	National health insurance/DE	51
	43	Public health policy/DE	269
	44	Socialized medicine system/DE	3
	45	National health insurance/DE 'or' public health policy/DE 'or' socialized medicine system/DE	307

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
Economic Literature Index (1969 - December 1991)	1	Decision () making	1,424
	2	Search 1 'and' health() care	3
	3	Search 1 'and' assess? 'and' technolog?	3
	4	Search 1 'and' medic?	21
	5	2 'or' 3 'or' 4	24
	6	Search 1 'and' model?	379
	7	Search 6 'and' (cost? 'or' fund? 'or' spend? 'or' expend? 'or' financ?)	84
	8	Search 6 'and' (rationaliz? 'or' equitable 'or' inequitable	2
	9	7 'not' 8	84
	10	Search 1/TI, DE	1,046
		Search 10 'and' model? - Search 10	1,046
		Search 10 'and' model? - Model?	38,202
	11	Search 10 'and' model?	229
		11	229
		7	84
	12	11 'and' 7	23
Sociological Abstracts (1963 - December 1991)	1	Decision () making	8,006
	2	Search 1 'and' feminis?	199
	3	Search 1 'and' female	300

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	4	2 'or' 3	408
	5	Search 4 'and' reproductive 'and' technolog?	2
	7	Feminist/ID	1,133
	8	Feminist/DE	597
	9	7 'or' 8	1,402
	11	Policy/DE 'and' decision () making/DE	201
	12	Social() policy/DE	1,096
	13	Search 12 'and' decision() making/DE	42
	14	13 'not' 5	42
	15	9 'and' 11	0
	16	Government?/DE	3,588
	17	Search 1 'and' government?/DE	353
	18	Technology	22,027
	19	Search 17 'and' technology	23
	20	Technolog?	25,261
	21	Search 17 'and' technolog?	31
	22	21 'and' 9	0
	23	Politic?	53,339
	24	Search 1 'and' politic?	1,944
	25	Feminis?	11,995
	26	Search 24 'and' feminis?	38

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	27	26 'not' 5	38
		Assess (search limited to 64-85)	3,651
		Technolog?	25,261
	28	Assess (3N) technolog?	16
		Search 28 'and' decision - Search 28	16
		Search 28 'and' decision - Decision?	14,644
	29	Search 28 'and' decision?	2
MEDLINE			
(1987 - January 1992)	1	Decision making (all)	2,302
		Decision making (focus)	893
	2	Decision making, organizational (all)	319
		Decision making, organizational (focus)	145
	3	Decision theory (all)	101
		Decision theory (focus)	44
	4	Decision support Techniques (all)	424
		Decision support Techniques (focus)	275
	5	searches 1 'or' 2 'or' 3 'or' 4 = decision	1,334
	6	Health Policy (all)	3,234
		Health Policy (focus)	1,884
	7	Public Policy (all)	860
		Public Policy (focus)	458
	8	searches 6 'or' 7 = policy	2,338
	9	searches 5 'and' 8 = decisions related to policy	14
	10	Delivery of Health Care	3,049

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	11	searches 5 'and' 10	20
	12	searches 8 'and' 10(search limited to 1991 - 1992)	13
	13	Health Expenditures	340
	14	searches 5 'and' 13	1
	15	searches 8 'and' 13	10
	16	Health	1,126
	17	searches 5 'and' 16	3
	18	searches 8 'and' 16	13
	19	Health Care Rationing	416
	20	searches 5 'and' 19	16
	21	searches 8 'and' 19	27
	22	Health Facilities	722
	23	searches 5 'and' 22	7
	24	searches 8 'and' 22	12
	25	Health Planning	924
	26	searches 5 'and' 25	4
	27	searches 8 'and' 25(search limited to 1990 - 1992)	13
	28	Health Priorities	406
	29	searches 5 'and' 28	3
	30	searches 8 'and' 28 (search limited to 1990 - 1992)	8
	31	Health Resources	653
	32	searches 5 'and' 31	12

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	33	searches 8 'and' 31 (search limited to 1990 - 1992)	7
	34	Health Services	1,702
	35	searches 5 'and' 34	2
	36	searches 8 'and' 34 (search limited to 1990 - 1992)	24
	37	Health Services Research	1,670
	38	searches 5 'and' 37	14
	39	searches 8 'and' 37 (search limited to 1990 - 1992)	21
	40	Health Status Indicators	755
	41	searches 5 'and' 40	4
	42	searches 8 'and' 40	10
	43	Health Surveys	1,473
	44	searches 5 'and' 43	4
	45	searches 8 'and' 43	12
	46	Technology Assessment, Biomedical	473
	47	searches 5 'and' 46	14
	48	searches 8 'and' 46	11
	49	ethics, medical	4,411
	50	searches 5 'and' 49	86
	51	searches 8 'and' 49	63
	52	Population Surveillance	1,554
	53	searches 5 'and' 52	0

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	54	searches 8 'and' 52	4
	55	Technology, medical	672
	56	searches 5 'and' 55	8
	57	searches 8 'and' 55	6
	58	Technology, Pharmaceutical	298
	59	searches 5 'and' 58	0
	60	searches 8 'and' 58	4
	61	Technology, Radiologic	755
	62	searches 5 'and' 61	0
	63	searches 8 'and' 61	3
	64	United States Office of Technology Assessment (OTA)	21
	65	searches 5 'and' 64	0
	66	searches 8 'and' 64	4
	67	Cost Benefit Analysis	2,469
	68	searches 5 'and' 67	56
	69	searches 8 'and' 67	34
Health Database (1975 - January 1992)[1]	1	Decision making (all)	6,693
		Decision making (focus)	2,073
	2	Decision making, organizational (all)	826
		Decision making, organizational (focus)	423

[1]Overlap between Health Data-Base and MEDLINE has been eliminated in the Health Data-Base search.

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	3	Decision Theory (all)	153
		Decision Theory (focus)	61
	4	Decision Support Techniques (all)	250
		Decision Support Techniques (focus)	149
	5	searches 1 'or' 2 'or' 3 'or' 4 = decision (limited to articles with 'focus')	2,691
	6	Health Policy (all)	7,721
		Health Policy (focus)	4,835
	7	Public Policy (all)	2,854
		Public Policy (focus)	4,835
	8	searches 6 'or' 7 = policy (limited to articles with 'focus')	6,434
	9	searches 5 'and' 8	33
	10	searches 5 'or' 8	9,092
	11	Delivery of Health Care	12,209
	12	searches 11 'and' 10	599 (all)
		searches 11 'and' 10	33 (search limited to 87 - 92; MEDLINE eliminated)
	13	Health Expenditures	2,769
	14	searches 13 'and' 10	193 (all)
		searches 13 'and' 10	54 (search limited to 87 - 92; MEDLINE eliminated)
	15	Health	3,483

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	16	searches 15 'and' 10 searches 15 'and' 10	66 (all) 14 (search limited to 87 - 92; MEDLINE eliminated)
	17	Health Care Rationing	552
	18	searches 17 'and' 10 searches 17 'and' 10	58 (all) 11 (search limited to 87 - 92; MEDLINE eliminated)
	19	Health Facilities	4,283
	20	searches 19 'and' 10 searches 19 'and' 10	60 (all) 11 (search limited to 87 - 92; MEDLINE eliminated)
	21	Health Planning	4,718
	22	searches 21 'and' 10 searches 20 'and' 10	268 (all) 28 (search limited to 87 - 92; MEDLINE eliminated)
	23	Health Priorities	962
	24	searches 23 'and' 10 searches 23 'and' 10	101 16 (search limited to 87 - 92; MEDLINE eliminated)
	25	Health Resources	2,340

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	26	searches 25 'and' 10 searches 25 'and' 10	214 (all) 25 (search limited to 87 - 92; MEDLINE eliminated)
	27	Health Services	5,777
	28	searches 27 'and' 10 searches 27 'and' 10	196 (all) 4 (search limited to 87 - 92; MEDLINE eliminated)
	29	Health Services Research	4,273
	30	searches 29 'and' 10 searches 29 'and' 10	198 (all) 27 (search limited to 87 - 92; MEDLINE eliminated)
	31	Health Status Indicators	1,591
	32	searches 31 'and' 10 searches 31 'and' 10	38 (all) 4 (search limited to 87 - 92; MEDLINE eliminated)
	33	Health Surveys	3,949
	34	searches 33 'and' 10 searches 33 'and' 10	38 (all) 4 (search limited to 87 - 92; MEDLINE eliminated)
	35	Technology Assessment, Biomedical	1,406

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	36	searches 35 'and' 10	92 (all)
		searches 35 'and' 10	34 (search limited to 87 - 92; MEDLINE eliminated)
	37	Ethics, Medical	8,045 (all)
	38	searches 37 'and' 10	278 (all)
		searches 37 'and' 10	25 (search limited to 87 - 92; MEDLINE eliminated)
	39	Population Surveillance	1,314
	40	searches 39 'and' 10	8 (all)
		searches 39 'and' 10	0 (eliminated MEDLINE)
	41	Technology, Medical	2218
	42	searches 41 'and' 10	84 (all)
		searches 41 'and' 10	3 (search ltd to 87 - 92; MEDLINE eliminated)
	43	Technology, Pharmaceutical	211
	44	searches 43 'and' 10	8 (all)
		searches 43 'and' 10	2 (eliminated MEDLINE)
	45	Technology, Radiologic	1,215
	46	searches 45 'and' 10	4 (all)
		searches 45 'and' 10	1 (eliminated MEDLINE)
	47	United States Office of Technology Assessment (OTA)	32

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	48	searches 47 'and' 10 searches 47 'and' 10	4 (all) 0 (eliminated MEDLINE)
	49	Cost Benefit Analysis	7,007
	50	searches 49 'and' 10 searches 49 'and' 10	249 (all) 15 (search limited to 87 - 92; MEDLINE eliminated)
Biobusiness	1	Equitable Decision/TI, DE Making/TI, DE	43 2,440 2,118
	2	Decision () making/TI, DE 1 'and' 2 - 1 1 'and' 2 - 2	713 43 713
	3	1 'and' 2 Search 2 'and' (legislate? 'or' government? 'or' rationalize 'or' inequitable 'or' spending 'or' financ?) - Search 2	1 713
	4	Legislat?	50,086
	5	Government?	25,650
	6	Rationalize	22
	9	Spending	1,850
	10	Financ?	4,743
	11	Search 2 'and' (legislat? 'or' government? 'or' rationalize 'or' inequitable 'or' spending 'or' financ?) Search 2 'and' expend - Search 2	375 713
	12	Expend?	644

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	13	Search 2 'and' expend?	2
		13 'or' 11 - 13	2
		13 'or' 11 - 11	375
	14	13 'or' 11	375
		Search 14 'and' health () care - Search 14	375
	15	Health	33,929
	16	Care	9,083
	17	Health (W) care	4,094
	18	Search 14 'and' health () care	6
		Search 14 'and' drugs - Search 14	375
	19	Drugs	6,324
	20	Search 14 'and' drugs	5
		Search 14 'and' technolog? - Search 14	375
	21	Technolog?	22,633
	22	Search 14 'and' technolog?	28
		Search 14 'and' health () policy - Search 14	375
	23	Health	33,929
	24	Policy	8,246
	25	Health (W) policy	51
	26	Search 14 'and' health () policy	0
		Search 14 'and' health (3N) (policy 'or' policies'or' projects) - Search 14	375
	27	Health	33,929
	28	Policy	8,246

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	29	Policies	1,403
	30	Projects	1,021
	31	Health (3N) ((policy 'or' policies) 'or' projects)	95
	32	Search 14 'and' health (3N) (policy 'or' policies'or' projects) 18 'or' 20 - 18 18 'or' 20 - 20	0 6 5
	33	18 'or' 20	11
Mathsci	1	Decision () making/TI, DE	1,336
	2	Search 1 'and' model?/TI, DE	259
	3	Search 2 'and' (cost? or fund? or spending or expend? or financ?)	13
	4	Search 2 'and' health	1
	5	Search 2 'and' medi?	11
	6	Search 2 'and' medic?	9
	7	Search 2 'and' fund? 'and' projects	1
	8	Search 2 'and' assess? 'and' technology	0
	9	Assess? (F) technology	106
	10	Search 9 'and' decision?	18
Health Periodicals	1	Decision adj making.de.	707
	2	Reproduct$	3,046
	3	1 'and' 2	10

DATABASE	SEARCH #	SEARCH WORD(S)	# ARTICLES
	4	Technolog$.TI, DE.	4,685
	5	1 'and' 4	13
	6	3 'or' 5	23
	7	1 'and' investment	1
	8	1 'and' feminis$	3
	9	Technology adj assessment.de.	171
	10	1 'and' 9	1
	11	9 'and' decision$.TI,DE.	3
FRANCIS	1	Decision W making	1,383
	2	Decision/TI	2,214
	3	Decision/IT	3,379
	4	Health 'or' medicine	31,820
	5	Health 'or' medical	26,488
	6	Decision (W) making 'and' health	27
	7	Decision (W) making 'and' medical	24
	8	8 'not' 7	14,229

SECTION C

Framework for Technology Decisions: A Quantitative Model

1. PROJECT SUMMARY

Decisions regarding technology are made daily by practitioners, administrators and policy makers. Ideally, decisions regarding health technology should be based on evidence from comprehensive assessment, that is, information on the safety, effectiveness, costs and ethical/legal/social implications of the particular technology under consideration. Reality proves otherwise; the large majority of technological innovations in health care are in use long before any systematic assessment has taken place. While it would be prohibitive to undertake extensive technology assessment work every time a resource allocation or other policy decision had to be made, it would be desirable to make these decisions based on informed judgements about the clinical, fiscal, and social impact of the specific health technology before it is widely adopted and extensively used. While there are many known criteria for rational decision making, these are rarely used systematically for priority-setting in the health sector and there is no evidence to suggest that multiple criteria are used in concert. We suggest that even if health technology policy decisions are based on a sequence of events and information inputs, the parts are not usually integrated and consolidated into a cumulative process.

The overall purpose of this research is to delineate a process which will provide a rational, systematic approach to policy decisions about health technology. The outcome should yield a simple empirical model to estimate the weighted index for health technologies under consideration, whenever decision makers need to make choices in technology policy development. The proposed model is based on a framework (see Appendix) whereby the evidence on each dimension of a technology decision may be quantified and consolidated into a single weighted score. The application of the model to different technologies will allow the decision maker to rank the technologies in terms of their contribution to society along the above-discussed dimensions. It is hypothesized that decisions are most appropriate when supported by a multidimensional framework summarizing the sociomedical merit of the technologies under consideration.

The main focus of this project is the initial validation of the conceptual model, i.e. the gradual process of quantifying each of the dimensions, where possible, in a way to allow the estimation of their cumulative impact. This is a necessary first step in establishing the usefulness of the model to decisions about health technology.

The specific objectives of this project are to: 1) compile a list of indicators for the selected dimensions; 2) appraise the relevance of each indicator to decision-making; 3) develop a process to rank the relative importance of different indicators within each dimension; 4) identify appropriate quantitative and qualitative measures for each indicator; 5) consolidate the rank-ordered indicators into a measure for each dimension; 6) develop a process to define stakeholder-specific priority weights; 7) test the model for decisions on two technologies.

Methodological principles drawn from epidemiology, sociology, decision analysis and system dynamics are used to develop the study design. A combination of quantitative and qualitative measures, and objective and subjective approaches are used throughout all phases of this project. A comprehensive list of

indicators for each dimension of the model will be compiled and appraised regarding volume and strength of the scientific evidence, relevance to decision-making, and ease of application in modelling. Next, using a modified Delphi technique, expert opinion will be used to determine the relative merit of each indicator within the respective weights for each dimension. Finally, the model will be applied to two specific decision making contexts for separate technologies. The outcomes of these decision making processes will be validated from the perspective of expert decision makers.

2. THE QUANTITATIVE MODEL

The development of a quantitative model within the framework described in the Appendix is part of the process of technology assessment. As suggested in our framework, health technology decisions are not viewed as having only epidemiological and financial implications, but as affecting the broader social context. The immediate consequence of this fact is that a quantitative model would have to include measurements of qualitative and subjective variables. This is recognized to be a very arduous task (Duncan, 1984).

A quantitative model will be developed capable of estimating a technology index denoting the sociomedical merit of each technology. The application of the model to different technologies will allow the decision maker to rank the technologies in terms of their contribution to society along the above-discussed dimensions. The main desirable feature of such a quantitative model is that it should be an instrument easy to understand and to use, not requiring specialized technical background, nor complicated calculations. Also, the model should provide a quantitative measure capable of ranking technologies on some scale.

The model design is similar to the design of the priority score model suggested by the Institute of Medicine (1992) in that it is a multiplicative model but differs in purpose. Our proposed model is used in two stages and provides a technology index as opposed to a priority score for technology assessment. The advantages of a multiplicative model and its equivalent logarithmic expression have been described by the IOM (1992).

The model will be developed within the framework of that described in the Appendix, that is, it will take into account all the policy dimensions addressing different aspects of the health technology.

At the first stage, a policy dimension score is calculated using the following logarithmic expression:

$$D_i = \left(\Sigma_{j=1}^{J_i} V_{ij} \ln S_{ij}\right) / J_i \qquad \text{for } i=1,2,3,4,5$$

where
- D_i is the estimated score for policy dimension i
- J_i is the number of indicators used in the calculation of D_i
- Σ indicates summation over all indicators j
- S_{ij} is the value of indicator j for dimension i
- V_{ij} is the relative value of indicator J within dimension i
- ln indicates the natural logarithm of S_{ij}

The equivalent multiplicative expression is given by

$$M_i = \Pi_{j=i}^{J_i} (S_{ij})^{vij/Ji} \qquad i=1,2,3,4,5$$

where $D_i=\ln(M_i)$

In a more general form, when, for example, preventive and treatment technologies are compared, the J_i are rescaling factors whose specific expressions are to be determined. To the extent that suitable rescaling factors are successfully developed, considerably different technologies will be susceptible to comparison.

At a second stage, the values D_i are aggregated to a single weighted index of technology WIT:

$$WIT = \Sigma_{i=1}^{5} W_i D_i$$

where W_i is the assigned weight of dimension i

Since $D_i=\ln(M_i)$, WIT is also a logarithmic expression and the equivalent multiplicative expression is

$$T = \Pi_{i=1}^{5} (D_i)^{Wi}$$

where WIT=ln(T).

For each technology to be assessed, D_i are calculated first and then aggregated to obtain WIT.

The Weighted Index of Technology should be the necessary and sufficient tool for decision making. However, technologies could be compared at the level of each policy dimension in order to understand the issues that are of more or less relevance to a certain technology or to identify technologies that are more or less sensitive on a given issue. For instance, technology A may have a more favourable score than technology B in terms of the economic concern, but it could be more controversial (sensitive) in terms of its ethical ramifications.

The relative abundance of indicators, certainly in the area of epidemiologic and economic concerns, will be discussed below. Our task will be to obtain a comprehensive list of indicators describing their nature, source and relevance to the proposed model. In this process the quantitative model may be adjusted to accommodate the new findings.

The major challenge of the proposed project will be to reconcile the methodological concerns expressed in the literature (Porter, 1980). The goal of a comprehensive model, for example a model that could be generalized across the range of technologies, might be in conflict with the goal of objectivity and reproducibility. We take this challenge within the more recent view of the tenets of scientific inquiry (Barlas, 1990). According to this view, a model cannot be proved valid in an absolute sense but can be judged to be so within a given social context. In other words, model building and validation is considered to be an on-going process; models are not viewed to be true or false but to where they lie on a continuum of usefulness.

Finally, an algorithm similar to those used in decision analysis will be developed to guide the decision maker through the process of indexing the technology under consideration. The algorithm should be sufficiently detailed to cover all the necessary steps leading to the implementation of the quantitative model.

While many measures relevant to these dimensions are available in the literature, the selection of those appropriate to easy implementation of the model is the main concern of the study design. A comprehensive inventory of available indicators and their critical appraisal is a proposed objective of the study.

REFERENCES

Barlas, Y., Carpenter, S. (1990) Philosophical roots of model validation: Two paradigms. Systems Dynamic Review, 2 (summer): 148-166.

Battista, R. (1992). Healthcare technology assessment: Linking science & policy-making. Canadian Medical Association Journal, 146(4): 461-462.

Beauchamp, T. and Childress, J.F. (1989) Principles of Biomedical Ethics. 3rd Edition. New York, Oxford University Press.

Bowie, R. (1991) "Health Economics: A Framework for Health Services Decision-Making", New Zealand Med.J. 104(March): 99-102.

Drummond, M.F., Stoddart, G.L. (1984) "Economic analysis and clinical trials", Controlled Clinical Trials. 5: 115-128.

Duncan, O.D. (1984) Notes on Social Measurement - Historical and Critical. New York, Russel Sage Foundation.

Eisenberg, J.M.)1989) "Clinical Economics: A Guide to the Economic Analysis of Clinical Practice", JAMA, 262(20): 2879-2886.

Fenny, D. and Torrance, G. (1992) Principles of Economic Evaluation for Health Care Technologies. Centre for Health Economics and Policy Analysis. McMaster University.

Fink, A., Kosecoff, J., Chassin, M. and Brook, R. (1984) "Consensus Methods, Characteristics and Guidelines for Use" Am. J. Pub. Health 74(9): 979-983.

Frenk, Julio (1992) Balancing relevance and excellence: Organizational responses to link research with decision making. Social Science and Medicine. 135(11): 1397-1404.

Garland, Michael J. (1992) "Light on the Black Box of Basic Health Care: Oregon's Contribution to the National Movement toward Universal Health Insurance", Yale Law and Policy Review, 10(2): 409-430.

Kazanjian, A., Cardiff, K. (1992) Framework for Technology Decisions: Literature Review. Report to the Royal Commission on New Reproductive Technologies. Ottawa, Canada.

Kazanjian, A., Friesen, K. (1990) "Technology Diffusion: The Troll Under the Bridge. A Pilot Study of Low and High Technology in British Columbia", Health Policy Research Unit, The University of British Columbia.

Kleinbaum, D.G., Kupper, L.L., Morgenstern, H. (1982) Epidemiologic Research: Principles and Quantitative Methods. Belmont, CA: Lifetime Learning Publications.

McDowel, I. and Newell, C. (1987) Measuring Health: A Guide to Rating Scales and Questionnaires. New York, Oxford University Press, 1987.

Mausner, J.S. and Kramer, S. (1985) Epidemiology: An Introductory Text. Philadelphia, W.B. Suanders Company.

Medical Care, Supplement (1990) Quality of life: Bibliography and Indexes. 28(12): 77 pages.

Nord, Erik (1992) "Methods for Quality Adjustment of Life Years", Soc. Sci. Med. 34(5): 559-569.

Porter, A.L. et al (1980) A Guidebook for Technology Assessment and Impact Analysis. New York, North Holland.

Sisk, J. (1987) "Discussion: Drummond Resources Allocation Decisions in Health Care: A Role for Quality of Life Assessment? J. Chronic Diseases 40(6): 617-619.

Stewart, A.L. et al (1989) "Functional Status and Well-being of Patients with Chronic Conditions: Results from the Medical Outcomes Study", JAMA 262(7): 907-913.

Torrance, G.W., Feeny, D. (1989) Utilities and Quality-adjusted life years. International Journal of Technology Assessment in Health Care 5(4): 559-575.

Torrance, G.W. (1992) Multi-attribute Health Status Classification Systems and Utility Functions. Centre for Health Economics and Policy Analysis. McMaster University.

Appendix to Section C
Matrix for Decisions on Technology in Health Care

DIMENSIONS	INDICATORS	SOURCE
1. POPULATION AT RISK (of problem/disease/health issue): - Epidemiologic orientation	i) Mortality: Death rates; cause-specific death rates; proportionate mortality ratio; case-fatality ratio ii) Potential years of Life Lost (PYLL) iii) Morbidity: Incidence rates; Prevalence rates	Local Databases (from Vital Statistics, HMRI, MSP, Census Surveys, etc.)
2. POPULATION IMPACT (of problem/disease/health issue): - Epidemiologic orientation	i) Disability: a) Functional b) Psychological or Quality of Well-Being The measures can be generic or disease-specific, Examples Include: Functional Assessment Inventory, Sickness Impact Profile, Nottingham Health Profile, Quality of Well-Being Scale ii) Potential Impact: "Etiologic Fraction"	i) Medical Care, Supplement, December 1990 ii) McDowell and Newell (1987) iii) Kleinbaum, P.G., Kuper, L.L., Morgenstern, H. (1982)
3. ECONOMIC CONCERN: - Compares the inputs of an intervention with some combinations of the outputs	Cost analyses CEA CBA CUA	Standard measures from literature, e.g. i) Feeny and Torrance (1989) ii) Drummond and Stoddart (1984) iii) Torrance and Feeny (1992)
4. ETHICAL/LEGAL/SOCIAL/POLITICAL RAMIFICATIONS FOR: - Individuals - Communities - Organizations and groups - Institutions and systems	Current or potential importance of issue value systems. Social indicators	i) Expert opinion ii) Stakeholder participation iii) Public participation
5. TECHNOLOGY ASSESSMENT ACTIVITY: - Role of scientific evidence	i) Comprehensiveness of assessment activity ii) Convergence of results	Adapted from the Institute of Medicine (1985)

SECTION D

A Framework for Health Technology Decision Making:
A Literature Review

Presentation at The International Society of Technology Assessment
in Health Care Conference Sorrento, Italy, June 1993

1. BACKGROUND

Decisions regarding technology are made daily by practitioners, administrators and policy makers. Ideally, decisions regarding health technology should be based on evidence from comprehensive assessment, that is, information on the safety, effectiveness, costs and ethical/legal/social implications of the particular technology under consideration. Reality proves otherwise; the large majority of technological innovations in health care are in use long before any systematic assessment has taken place. While it would be prohibitive to undertake extensive technology assessment work every time a resource allocation or other policy decision had to be made, it would be desirable to make these decisions based on informed judgements about the clinical, fiscal, and social impact of the specific health technology before it is widely adopted and extensively used. While there are many known criteria for rational decision making, these are rarely used systematically for priority-setting in the health sector and there is no evidence to suggest that multiple criteria are used in concert. We suggest that even if health technology policy decisions are based on a sequence of events and information inputs, the parts are not usually integrated and consolidated into a cumulative process.

Using the humanist perspective as theoretical underpinning a preliminary decision framework was developed using five key dimensions (see Table 1 below -- 'Matrix for Decisions'). The first four, population at risk, population impact, economic concern, and ethical/legal/social/political ramifications, are societal responses to the particular technologies of concern; the fifth component, technology assessment activity, is a descriptive element included to provide a 'quality of medical knowledge' perspective, incorporating information on the quality of the assessment evidence and its degree of convergence.

The rationale for the development of our health technology decision framework was centred around basic principles of justice in health care: equitable access to all effective health care which society can afford. This implies that the decision maker employs norms of utility as well as equity in making a decision. Neither of these lend themselves to easy formulation of policy. Some adjudication and interpretation is needed to translate principles into action: How much technology and for whom?

The purpose of this conceptual model is to provide an empirical, evidence-based foundation to technology decisions, thus de-mystifying a heretofore undefined and generally misunderstood phenomenon.

Table 1
Matrix for Decisions on Technology in Health Care

DIMENSIONS	INDICATORS	SOURCE
1. POPULATION AT RISK (of problem/disease/health issue) - Epidemiologic orientation	(i) Mortality: Death rates, cause-specific death rates; proportionate mortality ratio; case-fatality ratio. (ii) Potential years of Life Lost (PYLL). (iii) Morbidity: Incidence rates; Prevalence rates.	Local Databases (from Vital Statistics, HMRI, MSP, Census Surveys, etc.)
2. POPULATION IMPACT (of problem/disease/health issue) - Epidemiologic orientation	(i) Disability: (a) Functional (b) Psychological or Quality of Well-Being The measures can be generic or disease-specific. Examples include: Functional Assessment Inventory; Sickness Impact Profile; Nottingham Health Profile; Quality of Well-Being Scale. (ii) Potential Impact: "Etiologic Fraction"	(i) Medical Care, Supplement, December 1990 (ii) McDowell and Newell (1987) (iii) Kleinbaum, P.G., Kuper, L.L., Morgenstern, H. (1982)
3. ECONOMIC CONCERN - Compares the inputs of an intervention with some combinations of the outputs.	Cost analyses CEA CBA CUA	Standard measures from literature, e.g.: (i) Feeny and Torrance (1989) (ii) Drummond and Stoddard (1984) (iii) Tolerance and Feeny (1992)
4. ETHICAL/LEGAL/SOCIAL/POLITICAL RAMIFICATIONS FOR: - individuals - communities - organizations and groups - institutions and systems	Current or potential importance of issue/value systems. Social indicators.	(i) Expert opinion (ii) Stakeholder participation (iii) Public participation
5. TECHNOLOGY ASSESSMENT ACTIVITY - Role of scientific evidence	(i) Comprehensiveness of assessment activity (ii) Convergence of results	Adapted from the Institute of Medicine (1985)

2. THE LITERATURE REVIEW

2.1 Objective

The objective of the literature review was to provide a critical appraisal of the literature on each of the five dimensions described above, which will potentially, provide a framework to analyze decision making pertaining to the allocation of resources for health technologies. The critical appraisal of the literature examined the quality and volume of the evidence pertaining to the conceptual model and established the feasibility of its empirical application.

While it was beyond the scope of this particular study, the extension of this work will lead to the development of quantitative measures - new or already existing - which can be combined to develop a simple quantitative model to estimate a 'Weighted Index of Technology' for health technologies under consideration, whenever a decision necessitating a choice between technologies has to be made. The purpose of the quantitative model, once it is developed, is to facilitate the ways in which priorities can be established around health technologies through the application of this Weighted Index of Technology. Such a measure would indicate the broader socio-medical value of one technology relative to others which, although unrelated, may be competing for the same limited resources (see 'quantitative model' in a later section).

2.2 Methodology

The literature review proceeded in three phases:

Phase I: Identification of relevant sources of information about literature related to decision making in health care. Fifteen data-bases representing social science, biomedical, scientific, feminist and business literature were identified -- twelve of these were North American data-bases and three were European.

Phase II: Execution of extensive literature searches using Boollean logic. It should be pointed out that the terms decision making, health policy and public policy are the subject of many literatures; to ensure the applicability of the literature to our particular needs we limited our searching to articles where decision making, health policy and public policy were the focus of the article.

Phase III: Selection of relevant articles and critical appraisal of the literature. The appraisal considered a variety of factors including theoretical grounding, empirical evidence, methodological rigour, clarity of findings, and convergence of findings with other work.

2.3 Results

In total, the literature review yielded approximately 1300 abstracts related to decision making in health care (this is the result after overlap in articles was eliminated). Only a small proportion of these (13%) were relevant to the particular focus of this study i.e. decision making related to health policy and social policy. The final review examined, in depth 173 (13%) of the total number of abstracts captured by the original search. This presentation describes the results of this analysis for literature covering the five year period of 1987 - 1991 (N=149).

The appraisal took place in several stages. Figures 1 - 4 describe the results of the analysis. First, we looked at the quality of evidence; articles were categorized as being either theoretical, empirical, or personal opinion/editorial (See Figures 1 and 2). Overall, the majority of literature was either theoretical or personal opinion with only a very small proportion being empirically based. Figure 2 shows that the yield of articles for the years 1988, 1990 and 1991 was similar (n=33; n=38); however, the quality or type of literature varied considerably. In 1988 almost 70% of the literature was theoretical and only 20% of the literature was based on opinion. In 1991 47% of the literature was theoretical, 42% was based on opinion and 11% was empirical.

Figure 1
Literature Categorized by Type
1987 - 1991
(N=149)

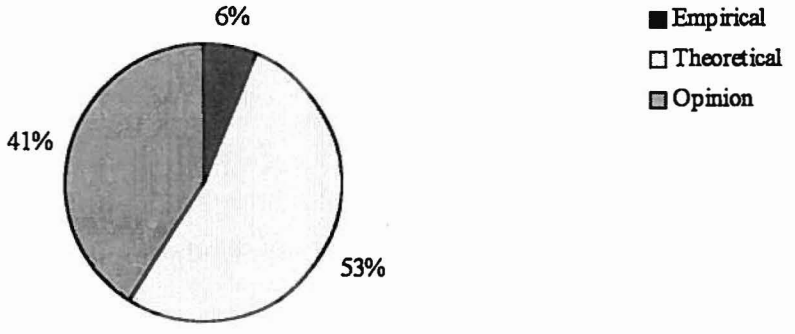
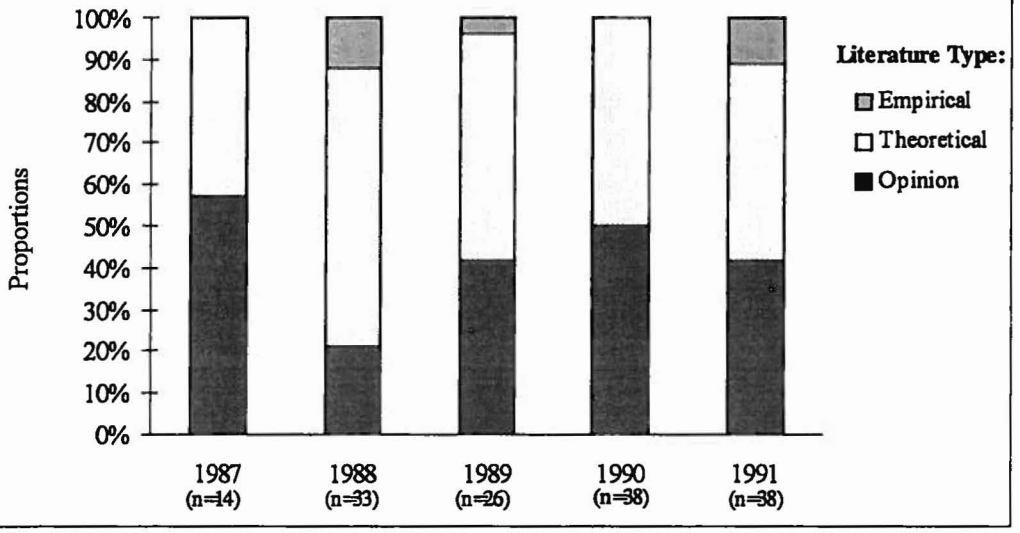


Figure 2
Literature Categorized by Type and Year
1987 - 1991
(N=149)



With respect to focus, the majority of the literature that we reviewed addressed more than one dimension. Figure 3 describes the breakdown of literature by the dimensions described earlier. It is important to point out that there has been a steady growth in the quantity of literature which discusses decision making in health and social policy. Interestingly, there has also been a shift in the focus of the literature itself. For example, in 1987 there were only 14 articles which discussed decision making in health/social policy; however, by 1991 there were 31 articles -- this represents almost a threefold increase. However with respect to focus, during this same time frame there was a 6 fold increase in the number of articles which addressed issues related to ethics (most frequently discussed as questions of equity) and there was a 10 fold increase in the number of articles which addressed legal issues. Finally, comparing 1990 (n=38) to 1991 (n=38), Figure 3 shows that there was almost a 50% increase in the number of articles which addressed ethical issues.

Figure 4 describes the literature by both dimension and type.

Figure 3
Literature Categorized by Dimension and Year
1987 - 1991
(N=149)

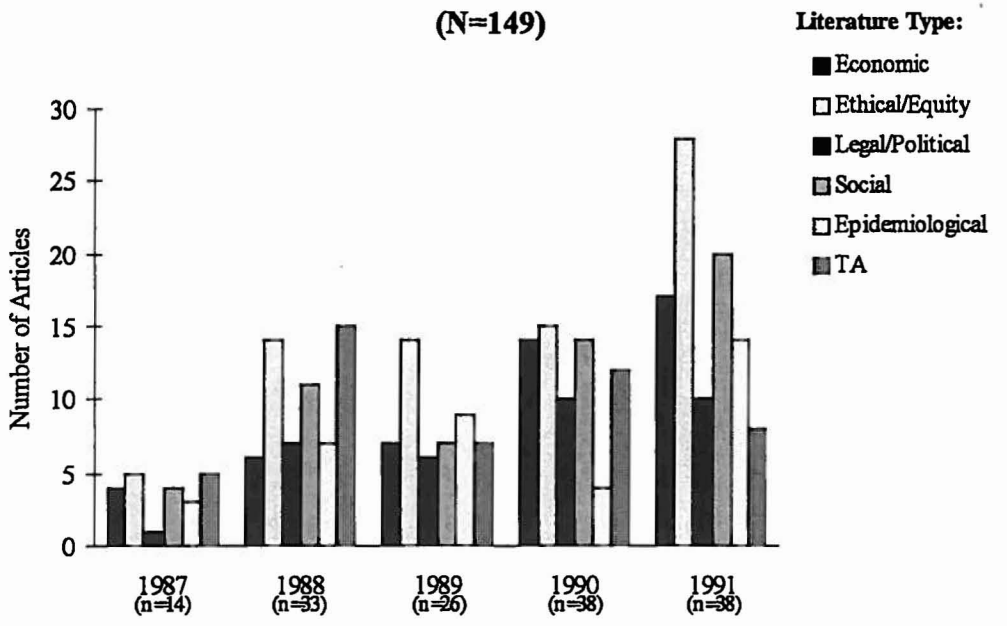
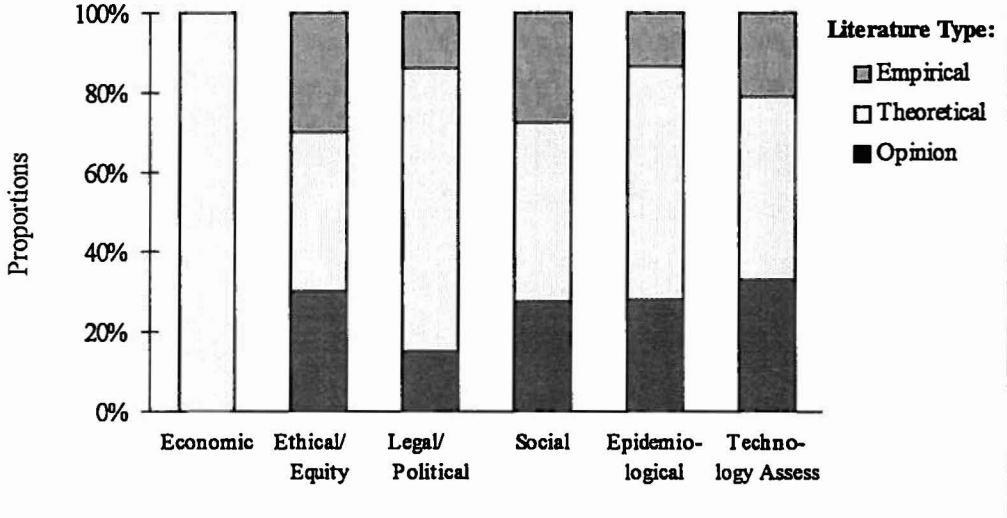


Figure 4.0
Literature Categorized by Type and Dimension
1987 - 1991
(N=149)



2.4 Conclusions

The purpose of the proposed decision framework (see Table 1) is the creation of a clear, precise, manageable, and replicable process designed to generate information about the consequences of the various decision options. Models are fundamental to policy analysis; while they may not predict consequences with the same assurance as the best scientific models, policy models tell us what the possibilities are, based on various assumptions about the factors of concern. Decisions are often made intuitively, without explicit models. However, in that case, a tacit model or an unconsciously calculated decision is being developed. Faced with a phenomenon that is too complex and too expensive to study directly, a natural inclination is to study a model, which resembles the phenomenon of framework interest in its essential features but is more manageable, less expensive, easier to study.

It is possible to test the predictions based on a model and determine the correctness and relevance of these predictions for real-world decisions. Our proposed conceptual model provided the broad parameters within which this literature review was conducted. A critical appraisal of the literature has provided an examination of the quality and volume of the evidence pertaining to health technology decisions; evidence pertaining to the attributes of health care technologies was not investigated. This literature review was undertaken primarily to establish the feasibility of the model's empirical application. Two general findings warrant brief discussion.

First, the literature we reviewed for this project clearly indicated that the dimensions of the proposed framework were the appropriate ones to include in a health technology decision model. While these factors were not always grouped similar to our particular grouping, singly or in multiples the same factors appeared in most of the literature we examined. In addition, the evidence from this literature review indicated that the decision making process, as described by the studies referenced here, is receptive to systematic inputs of information which enhance the potential for better decisions. Several of the articles reviewed proposed decision models with similar, but usually less comprehensive characteristics.

The second general comment about our findings pertains to the technical feasibility of developing the quantitative model based on the suggested conceptual one. The degree of difficulty in developing quantitative measures for each of the model dimensions will vary appreciably from one dimension to the next, but the task is not an impossible one. Economic and epidemiological measures are easier to compile from already existing ones than developing measures for ethical and social concerns, quantification of the political milieu may prove to be a challenging exercise. However, these methodological hurdles do not appear to be insurmountable, in light of the evidence on the importance of using norms of utility as well as equity in making health technology decision.

2.5 The Quantitative Model

A quantitative model will be developed capable of estimating a technology index denoting the sociomedical merit of each technology. The application of the model to different technologies will allow the decision maker to rank the technologies in terms of their contribution to society along the above-discussed

dimensions. The main desirable feature of such a quantitative model is that it should be an instrument easy to understand and to use, not requiring specialized technical background, nor complicated calculations. Also, the model should provide a quantitative measure capable of ranking technologies on some scale.

The model design is similar to the design of the priority score model suggested by the Institute of Medicine (1992) in that it is a multiplicative model but differs in purpose. Our proposed model is used in two stages and provides a technology index as opposed to a priority score for technology assessment. The advantages of a multiplicative model and its equivalent logarithmic expression have been described by the IOM (1992).

At the first stage, a policy dimension score is calculated using the following logarithmic expression:

$$D_i = \left(\sum_{j=1}^{J_i} v_{ij} \ln S_{ij}\right) / J_i \quad \text{i} = 1,2,3,4,5$$

where
- D_i is the estimated score for policy dimension i
- J_i is the number of indicators used in the calculation of D_i
- Σ indicates summation over all indicators j
- S_{ij} is the value of indicator j for dimension i
- V_{ij} is the relative value of indicator j within dimension i
- **ln** indicates the natural logarithm of S_{ij}

The equivalent multiplicative expression is given by

$$M_i = \prod_{j=1}^{J_i} (S_{ij})^{V_{ij}/J_i} \qquad \text{i} = 1,2,3,4,5$$

where $D_i = \ln (M_i)$

In a more general form, when, for example, preventive and treatment technologies are compared, the J^i are rescaling factors whose specific expressions are to be determined. To the extent that suitable rescaling factors are successfully developed, considerably different technologies will be susceptible to comparison.

At a second stage, the values D_i are aggregated to a single weighted index of technology WIT:

$$WIT = \sum_{i=1}^{5} W_i D_i$$

where W_i is the assigned weight of dimension i

Since $D_i = \ln(M_i)$, WIT is also a logarithmic expression and the equivalent multiplicative expression is

$$T = \prod_{i=1}^{5} (D_i)^{W_i}$$

where WIT= ln(T).

For each technology to be assessed, D_i are calculated first and then aggregated to obtain WIT.

The Weighted Index of Technology should be the necessary and sufficient tool for decision making. However, technologies could be compared at the level of each policy dimension in order to understand the issues that are of more or less relevance to a certain technology or to identify technologies that are more of less sensitive on a given issue. For instance, 'technology A' may have a more favourable score than 'technology B' in terms of the economic concern, but it could be more controversial (sensitive) in terms of its ethical ramifications.

REFERENCES

Institute of Medicine. *Setting priorities for health technology assessment: A model process.* National Academy Press, Washington, D.C. 1992.

Kazanjian, A., Cardiff, K. *Framework for Technology Decisions: Literature Review*, in New Reproductive Technologies and the Healthcare System: The Case for Evidence Based Medicine. Royal Commission on New Reproductive Technologies, Volume 11, Chapter 2, Canada Communications Group, 1993.

Kazanjian, A., Friesen, K. *Defusing technology: Technology diffusion in British Columbia.* International Journal of Technology Assessment in Health Care 1993;9(10):46-61.

SECTION E

Doing the Right Thing, Not Just Doing Things Right: A Framework for Technology Decisions

Report to The United Nations Commission on Science and Technology for Development (Gender Working Group)
September 1994

Also published as: "Doing the Right Thing, Not Just Doing Things Right: A Framework for Decisions about Technology" in Missing Links - Gender Equity in Science and Technology for Development, IDRC & UNIFEM, Ottawa & New York, 1995

1. INTRODUCTION: THE CHALLENGE OF TECHNOLOGICAL CHOICES AND POLICY

Interest in technological choices and their effects on health has accelerated in recent years; this is manifested through a global trend in bringing about health reform. Marked decline in overall economic growth and the consequent increased pressure on public budgets has been cited by public policy makers as reasons for reform initiatives pertaining to the appropriate and effective delivery of health care. Due to the globalization of world economies all countries have simultaneously experienced this phenomenon, albeit in different degrees. However, health reform is variously perceived (and implemented) by countries, states, and other jurisdictional levels. Governments have sought to deal with such pressures on health care budgets in different ways, often undertaking (or contracting) evaluative studies and technology assessment to provide them with direction in reducing publicly funded service costs. In contrast, changing public expectations and the proliferation of medical technology, two important "external" pressures frequently cited by health policy makers, are rarely examined in the broader context of technological development and diffusion. A critical approach and feminist analysis as expounded in this paper provide a different frame of reference.

New health technologies (drugs, devices, and procedures) are becoming available at an increasing rate. Unfortunately, the development and diffusion of technology is neither associated with its inherent attributes nor with the prevalence of disease. Furthermore, not much is known about the diffusion of health technology - new or old. Technology does not dictate its own range of applications, nor its price; societal reaction to the technology is a key determinant of its use. Electronic fetal monitoring provides an interesting elaboration. It was pointed out over 10 years ago that it had been adopted in the absence of any evidence as to its effectiveness and substantial evidence of harm to pregnant women. Subsequent epidemiological research confirmed that the device was of no specific value in improving fetal outcome while doubling the cesarean section rate (Bassett, 1993). The technique remains firmly established in obstetrical practice. This example also points out the vulnerability of all women in the health sector as nurses, midwives, technologists continue to use it, as well as birthing mothers, who expect it to be part of the obstetric routine.

The role of national governments in the development and diffusion of health technology is an influential one, and numerous opportunities exist for adopting a theoretical Framework with which technology decisions can be guided. In the absence of a national technology policy, decisions regarding health technology are often contradictory. How much technology and for whom? These decisions are usually made intuitively, without systematic consideration of possible alternatives and consequences of various decision options. A framework which puts technology in a social context and provides a critical analysis of the broad range of potential issues and interests would make the decision making process more transparent and equitable.

1.1 Policy Formulation and the Decision-Making Process

Decision support models are used to make explicit the process of thinking about alternatives and to make transparent to the decision maker available choices and consequences of such choices. Unless the decision process is made explicit and a stepwise activity, limited rationality will prevail; since the human mind is limited in attention, memory, calculation, and imperfect in perception, we tend to simplify, use limited viewpoints, highlight some not all aspects. Policy makers respond to situations as they interpret them, not as they exist in some objective reality; the same problem in a different frame can elicit a very different response. As well, decision making often involves making difficult trade-offs, and most people adopt a simple decision rule that does not require trading off incommensurables. Finally, the policy maker very rarely finds out the broad consequences of his/her decision or whether the decision was considered "good" or "bad" (Carroll and Johnson, 1990).

2. CONCEPTUAL FRAMEWORK: DESCRIPTION, APPLICATION AND GENDER IMPLICATIONS

The proposed conceptual Framework focuses on how alternative choices may have diverse consequences that stretch beyond immediate outcomes. The Framework provides a synthesis of the social dynamics of each situation; it adopts a critical perspective which delineates issues of power and dominance, as well as describing technological impact. Policy researchers erroneously assume that decision making always occurs in a series of fairly well-defined stages (that could also repeat and backtrack): 1) recognition of problem, 2) formulation of possible intervention, 3) generation of alternatives, 4) information search, 5) judgment or choice, 6) action, 7) feedback. Most often, however, decision making comprises only information search and choice (Payne et al, 1978; Svenson, 1979). A broader "problem solving" approach is the one adopted for the proposed Framework to ensure a comprehensive understanding of the specific problem/deficit as well as a thorough examination of the consequences of alternative courses of action. The Framework can be used during policy formulation as a proactive analytic tool that explicitly considers possible alternative courses of action and their respective consequences. This application also facilitates public consultation as well as solicitation of expert opinion. Alternatively, the Framework can be used to analyze and understand how a past (or current) situation has occurred, especially in the case of a "wrong" technology, delineating the reasons for the negative consequences of the technology.

Few would disagree that society seems to be unable to manage technological change to respect and serve the broad range of human interests and needs. On a global level, historic and continuing efforts to include women's needs and concerns in the way science and technology is developed and evaluated have not yielded discernible results. Over the last two decades, many official documents containing long lists of recommendations have been produced. In a 1979 United Nations document - The Vienna Program of Action on Science and Technology for Development - it was recognized that "modern technological developments do not automatically benefit all groups of society equally....and may have a negative impact on the condition of women and their bases for economic, social and cultural contributions to the development process". An appeal was made to strengthen support of national government efforts to

promote full participation of women in the application of science and technology for development. Some years later, the Report of the United Nations Panel of the Advisory Committee on Science and Technology for Development in 1984, postulated that the absence of women form the highest policy - and decision-making ranks in science and technology "affects the process, quality, and outcomes" of the latter. The Panel concluded that, although it is not clear how this would take shape, women should be given access to the process. Furthermore, "inadequacies of existing indicators of the impact of technological change on women" were noted and the need for better measurement of relevant concepts was identified.

Yet, science and technology policy, at national and international levels, remains unresponsive to women and their needs although there is recognition in these documents and in others that assessment, monitoring and measurement of the impact of science and technology on development is desirable. At present , it has to be recognized that any change in this regard can only occur as part of an intentional prescriptive process where goals are clearly defined at various levels and decisions are intended toward goals. The Framework developed in this paper stimulates the articulation of goals, enabling the systematic monitoring and broad assessment of technological change.

While most decisions do not follow the explicit stage-by-stage process, implicit rules of decision making are, nevertheless, operant. The literature in decision research indicates that, in making important decisions, general, formal, or complex rules of decision making are usually desirable. Furthermore, a combination and mix of general and specific, simple and complex rules give the best results in terms of better decisions (Gustafson, et al. 1992). The proposed Framework meets these criteria. Consistent dimensions, identified as policy concerns, are developed for application to all technology decisions. Clearly defined, accurately measured indices of each dimension may be combined with less specific ones, or qualitative measures, to develop composite measures, for each of the dimensions. The proposed model is comprised of several components (dimensions) and provides a comprehensive approach to decision making. However, it is designed with ease of application in mind and should not be too onerous to use.

Building on two previous studies on this subject (Kazanjian and Friesen, 1993; Kazanjian and Cardiff, 1992), the Framework for Technology decisions in health care was developed incorporating five key dimensions (see Table 1). The first four dimensions, population at risk, population impact, economic concerns and broad social context (including ethical, legal, and political concerns) are descriptive elements of the health problem in question and the social environmental context within which the problem is defined. The fifth component, technology assessment activity, is the scientific evidence about the health problem and/or the technologies used to alleviate the problem. It represents a "quality of scientific knowledge" perspective which provides information on the strength and quality of the evidence on a technology or health program. In order to elaborate, in a clear fashion, how the Framework can be applied to a health technology decision, a hypothetical situation for a policy decision is presented and examined. The use of ultrasound during pregnancy is the chosen example; it is widely used in developed countries and rapidly diffusing in developing countries with a moderate acquisition (purchase) price-tag. Thus, its discussion should be relevant to most countries (developed and developing). The hypothetical decision of concern is whether it should be publicly funded and under what circumstances. Ultrasonography is the imaging

technique that permits "seeing with sound" (Yoxen, 1987). Ultrasonography during pregnancy is a major (albeit not exclusive) application of this technology. Sound waves sent through amniotic fluid bounce off structures to produce a two-dimensional and cross-sectional picture of the woman and the fetus on a video display screen (Gold, 1984). It is used to assess the duration of pregnancy, position of the fetus in the womb so as to assist fetal/maternal diagnosis.

The first two dimensions of the Framework, population at risk and population impact, represent the epidemiological orientation in health research. Epidemiology may be defined as the study of the distribution and determinants of diseases and injuries in human populations. It is concerned with the *extent* and types of illnesses and injuries in *groups* of people and with the *factors* which influence their distribution (Steiner et al, 1989). Epidemiology is concerned primarily with three major variables : person, place, and time. *Person* characteristics include such factors as gender, age, race, marital status, and socio-economic status, among others. The *place* or geographic distribution of a health-related outcome of interest can also be important in understanding causal relationships or planning health services to meet the needs of a particular community. Geographic differences can suggest a role for factors such as climate or cultural practices, including diet, method of food preparation and food storage, in the incidence and prevalence of a particular disease. Alternatively, geographical differences may be due to differential access to health services. Variations in the *time* of occurrence of a particular disease can also indicate causal relationships along with the other factors that can account for the changes in disease distribution over time. The variables of person, place, and time are important in understanding the nature of person-environment fit, a key construct in assessing the risk and protective factors that determine health status in groups of people.

2.1 Population at Risk

Population at risk takes into account the magnitude of the problem. In health research this population is usually defined within epidemiological terms such as the number of new cases of the disease or problem (incidence), the numbers of existing cases with the disease/problem (prevalence) which are known as morbidity rates (Mausner and Bahn, 1974). These rates are usually available in varying degrees of precision in developed countries and may be more crudely estimated in developing countries; statistics may be compiled at national or local levels. Population at risk can also be defined in different terms such as general death rates or cause-specific death rates, known as mortality statistics. A comprehensive consideration of the population at risk includes relevant measures such as age, sex, socioeconomic status, access to health programs to mention a few individual characteristics, as well as natural history of the disease or health problem and relevant social indicators such as measures of income disparity or illiteracy rates, to describe collective characteristics.

The first step in this explicit process is to establish the population of interest. It is important to be inclusive at this stage in order to recognize the magnitude of the phenomenon under examination. In the case of ultrasound, for example, it is perhaps best to consider all women of childbearing age (say, 15 - 45) rather than only those who are pregnant.

To identify the size of this group, simple empirical evidence can be sought, such as the proportion of women in the age-groups of interest, and the fertility rates. More elaborate estimates of the potential population of interest could also be obtained by factoring in average family size, number of multiparous women, etc. with assistance from population demographers. The important point is to determine the level of empirical precision required then to seek this evidence with or without assistance from empiricists in the field. While accuracy and precision of data are desirable objectives, variations in data availability and accuracy should not become a major detriment to this approach. For example, the geographic or ethnic distribution of the population of interest are only important if services are delivered in a decentralized fashion, or if cultural factors contribute to risk. Otherwise, aggregate statistics, expressed as actual counts or estimated rates, are sufficient.

Other statistical indicators may be of interest depending on the intended use of the technology, that is, whether ultrasound will be made available as a screening tool to all pregnant women (current practice in developed countries), or whether (to contain costs) it will be used only as a diagnostic tool and available only to women identified by primary care providers as high risk pregnancies. Obviously, the issue under consideration would appear to be of a different magnitude if the technology were to be available only to certain sub-populations of interest.

In summary, the decision maker would raise two basic questions as a first step: who is the population at risk (i.e. those who need this technology) and what qualitative and quantitative empirical evidence is available to describe that population in epidemiological terms? The extent to which answers to these questions can be answered will indicate the clarity with which the problem at hand is defined, and the degree to which an empirical appreciation of the problem exists. Finally, a statistical profile of current service utilization and (if available/possible) the demand for such services completes the picture. All along, the decision maker may consult with researchers in this field to establish the relative quality of the empirical evidence, as well as consult with interested parties for assistance with broad or specific definitions of population at risk.

2.2 Population Impact

The purpose of this step is to examine and understand the burden of illness, and determine the known expected consequences of the intervention. The population impact is often measured by examining both functional ability (physical and social) and psychological status (quality of well-being). Measures of functional status and well-being can be either generic or system-specific (see Table 1, second column). A wide range of narrowly defined health status measures have been documented in the literature, and the discussion generally includes information about the purpose, reliability and validity of the measurement instrument (McDowell and Newell, 1987). However, these particular measures are not usually gender-specific and there is no feminist critique of such measures. Special effort would be required to address this obvious research gap.

In addition to the measurement of population impact described above, other measures of impact which are useful include Quality-of-Life, and the measurement of "potential" impact. Measures of potential impact reflect the *expected effect* of changing the distribution of one or more risk factors in a particular population. Although the utility of this measure may be somewhat limited, it has important value in decision making related to public health issues. For example, this measure would be valuable for proactive assessment of public health programs aimed at eliminating risk factors in a population.

If ultrasound is being used as a screening tool, then what are the expected consequences of this screening? Once again, it is more important to raise the appropriate question and attempt to obtain some quantifiable measure for its answer than to seek to be particularly precise in that answer. For example, if reliable statistics exist on maternal/infant morbidity then all the better informed the decision maker would be. The right question to consider is: how much of the burden of illness may be reduced by using ultrasound technology? Often, expert clinical opinion or consensus statements may be the only available information, therefore, this should be noted but the more important proper question should not be lost. In the case of ultrasound, good epidemiological information is available (Anderson, 1994).

Table 1 **Framework for Health Technology Decisions**

DIMENSIONS	INDICATORS	TARGET/GOAL
1. POPULATION AT RISK (of problem/disease/health issue): - Epidemiologic orientation	i) Mortality: Death rates; cause-specific rates; proportionate mortality ratio; case-fatality ratio ii) Potential years of Life Lost (PYLL) iii) Morbidity: Incidence rates; Prevalence rates	e.g. Minimize the number at risk
2. POPULATION IMPACT (of problem/disease/health issue): - Epidemiologic orientation	i) Disability: a) Functional b) Psychological or Quality of Well-Being The measures can be generic or disease-specific. Examples Include: Functional Assessment Inventory, Sickness Impact Profile, Nottingham Health Profile, Quality of Well-Being Scale ii) Potential Impact: "Etiologic Fraction"	e.g. i) Improve functional status ii) Arrest further deterioration
3. ECONOMIC CONCERN: - Compares the inputs of an intervention with some combinations of the outputs	Cost analyses i) Cost-effectiveness ii) Cost-benefit iii) Cost-utility	e.g. i) Capital and operating costs ii) Opportunity costs
4. ETHICAL/LEGAL/SOCIAL/POLITICAL RAMIFICATIONS FOR: - individuals - communities - organizations and groups - institutions and systems	i) Current or potential importance of issue/value systems. ii) Social indicators	e.g. i) Increased autonomy ii) Equity
5. TECHNOLOGY ASSESSMENT ACTIVITY: - Role of scientific evidence	i) Comprehensiveness of assessment activity. ii) Convergence of results	e.g. Improved relevance of research

Another important impact-related query for a screening or diagnostic intervention is about the availability of therapeutic or curative intervention. Once problems have been identified by ultrasound, are there possible health care or other measures able to attenuate the burden of illness? Does ultrasonography provide the type of diagnostic information that, if acted upon (treatment), would make a difference to women's and babies' health and quality of life? As direct intervention to treat the fetus in utero is unusual, identification of abnormalities may not be of great value except to offer abortion. Finally, questions regarding the potential health risk of the technology, and whether that is offset by potential benefits, should be raised. This is similar to undertaking risk assessment; for example, there are no known major medical or health risks associated with the use of ultrasound imaging itself; but problems of false diagnosis (due to machine or human error, or both) and subsequent investigation and treatment cannot be overlooked.

It is also important to note that the particular statistical indicators and quantitative measures chosen by researchers to depict the epidemiological dimension can portray the same situation very differently. For example, maternal mortality rates are usually cited, expressed as maternal deaths per 100,000 (or 10,000) live births; rates at between 100 -200 (in the late 1980's) which are considered very high pale in comparison to a different expression of the same situation, expressed as Years-of-Life Lost (YLL). The YLL statistic would take into account age at death and the average life expectancy for women of that age and present the cumulative figure for the 200 women at, roughly, 7 - 8,000 Years-of-Life Lost.

2.3 Economic Concerns

The economic component of the decision Framework considers what society can reasonably afford. How society arrives at decisions about what it can afford is a very important but opaque question. How a government agency arrives at that same decision appears to be based on the fact that finite financial resources set the parameters. Those who plan, deliver and pay for health services are constantly faced with the fact that the supply of professionals, hospitals and other facilities, and technologies cannot meet the demands or needs of all patients (Sackett et al, 1985). The question for decision makers is how to apply limited resources where the most good will be the result. This question involves both costs and consequences, and because it implies a choice between alternative courses of action, it constitutes an economic evaluation. In such a comparative analysis, money may be the unit of measurement but the real or "opportunity" cost of any health program or technology is the sum of effects or benefits foregone by committing resources to this program rather than to another one.

The economic dimension of the decision Framework compares the inputs to a health care program with some combination of the outputs. The inputs of a health care program usually include:

a) Direct costs to the health care sector and to patients and their families; in aggregate, they correspond to the portion of the gross national production spent on health care.

b) Indirect costs are expressed in terms of production losses because of morbidity, mortality, and use of health care.

c) Intangible costs are costs of pain, suffering, grief, etc., they correspond to any non-financial outcomes of disease and medical care.

The outputs of a health technology can be summarized into three categories:

a) Conventional clinical outcomes such as number of cases treated or number of life years saved. When compared with inputs, this type of analysis is referred to as cost-effectiveness analysis (CEA). It considers the possibility of improved outcomes in exchange for the use of resources. It cannot be used to choose between technologies with different outcomes, or to determine what weights should be put on human life, but gives an indication about the quantity of life of a person with a given health condition (Eisenberg, 1989; Bowie, 1991; Feeny and Torrance, 1992).

b) Monetary value of different health effects. When technology costs are compared with its effects defined in monetary terms, it is referred to as cost-benefit analysis (CBA). This type of analysis attempts to link cost information with medical evidence on the outcomes of treatment, but forces an explicit decision about whether the costs are worth the benefits by measuring both in the same unit of currency (Drummond and Stoddart 1984, Sisk 1987).

c) Outcome is expressed not only in terms of quantity of life, but also in terms of quality of life, and includes such indices as Quality-adjusted-life-years (QALYs) and Disability-adjusted-life-years (DALYs). Cost-utility analysis is yet another method of weighting for quality of life variations (Drummond, 1987).

The choice of measure would depend on the health outcome of interest. A cost-effectiveness ratio would be used when there is only one health outcome of interest. For example, comparing two technologies in terms of their costs per life-years gained, such as in an immunization program. A cost-benefit ratio would be applied when there are multiple health outcomes of interest such as level of hypertension versus cholesterol measure. Monetary values are given to outcomes in order to be able to compare the merits of each intervention. Finally, a cost-utility ratio would be used when the interest is on quality of health outcome and not just on quantity.

There are several problems with economic analysis, related to both theory and measurement. The theoretical underpinning of cost-benefit analysis is based within new welfare economics, and is designed to

identify those conditions in the economy which will maximize the social welfare under various resource restrictions. Changes in social welfare are not easily amenable to evaluation; CBA cannot tell whether the objective is worth achieving, it just examines the much narrower question pertaining to payoff of using a technology. Similarly, for measures of cost, social costs are usually omitted from consideration due to measurement problems. As CBA for a single technology can be undertaken from the different perspectives of each interested party (or constituency), the decision maker will possibly be able to identify potential opposition but will not have an understanding of the reasons. Cost-effectiveness is not grounded in theory, and does not assist in the identification of policy direction. It does provide a comparison of cost for a selected outcome or desired effect. Thus, neither CEA nor CBA are advisable as primary tools for decision making.

However, efficiencies in health and health care are particularly important during times of economic constraint. Society and public funds can pay only what they can afford. To apply limited resources where at least some good will result, the decision maker has to raise the question of cost-effectiveness. However, it is often very difficult to arrive at this information, as discussed above. A number of fundamental cost and benefit questions should, nevertheless, be raised and empirical measures examined carefully.

To begin a narrow fiscal analysis, costs beyond that of capital or acquisition costs should be ascertained: operating costs *vis-à-vis* various levels of throughput (productivity). For example, once ultrasonographs are purchased what are the costs for services provided in hospitals (public or private), in community clinics, in urban centres only or across country to reach remote areas? What are the costs for service provision during regular business hours and for additional hours of service, and multiple shifts? The higher the acquisition cost, the higher the level of productivity required to offset such costs. Further to operating costs, costs associated with human resource requirements should also be carefully considered. For example, payment of technologists and specialist physicians are important expenditures. But, additional costs incurred to the system may include those for credentialing of professionals, academic research interests of clinicians, continuing education for staff, etc.

Once costs of a single imaging unit are ascertained, estimates of total cost can be computed for the entire population at risk and for sub-populations. This information coupled with non-priced (human) cost information on population impact can begin to provide the decision maker with a sketch of the economic dimension of possible decision options. Of course, in some situations, full scale cost-effectiveness or cost-utility evidence would be possible, which would examine costs for alternative and complementary interventions, and health outcomes. To fully appreciate cost implications, opportunity costs should also be examined. The key question to be raised in this instance is: for equivalent expenditures, what other services can be purchased or are being forgone. This can be articulated either in terms of other services to the population of interest or to another population. For example, what level of services can be purchased and what results can be obtained if the same amount of money was allocated to nutrition or to infection control for pregnant women? The evidence on the effectiveness of prenatal care with a focus on nutrition is indisputable Or, what would be the yield on a monetary investment similar in amount to that for ultrasound toward assistive devices for handicapped women?

The final synthesis of empirical cost-estimate data should at least strive to establish the value-for-resources expended ratio to women, service agencies, and to the health care system for a specified quantity of fetal ultrasonography services. It should be noted that value could be expressed in other than monetary or health outcome measures and pertinent socioeconomic factors may also be appropriate indices for such analysis.

2.4 Social Context (including ethical, legal, and political concerns)

As the health care system is a sub-system of the larger social system, the diffusion of a technology in health care should be analyzed in that context. The development or diffusion of a single health technology has implications for consumers, health professionals, public payers, service agencies, educational institutions, and industry but also for social institutions such as the family, the community, and the economy (to name a few). The reason and direction of these relations have not been well investigated in health assessment.

Social impact analysis is a method used to understand, explain, and predict the potential impact of technology on social systems. Social indicators are the quantitative measures of interest and they can be expressed at the individual/family unit, community, organization, or system level. However, the boundaries between social and ethical, or ethical and legal, or legal and political are not always clear and certainly there are interactive effects among these dimensions (Duncan, 1984). For example, the use of health technology could result in a demographic change which may interact with an altered economic base in a region to change the power of the regional political institutions. Conversely, understanding the relationship between social structure or social values and health technology is equally important in the assessment of that technology. For example, why is the Electronic Fetal Monitor firmly established in obstetrical practice despite the evidence of harm to pregnant women? Legal implications are often cited; yet, does litigation influence medical practice or is it vice versa? The value of a "perfect" child from every birth is a socially determined phenomenon; technology that is perceived to promote such "perfection" is wholeheartedly adopted. Ethical implications are focal points in all reproductive technologies, as often questions are raised about the commodification of women and babies. In addition, ethical implications of genetic testing and the enormous powers vested in that type of knowledge are of ultimate importance from a social policy perspective as well as from a health care delivery perspective.

An increasingly important component of health care evaluation concerns the anticipated effects of new technologies, or technology transfers, within the spheres of medical ethics and social justice. Appropriate indicators within each of these dimensions can be compiled from the literature and ranked for relative importance using panels of experts, then taken to the community (or interested parties) for consultation. This approach considers the role of social values and technical expertise to be complementary in a process that strives for justice and fairness (Garland, 1992).

Specifically, constituencies and interested parties should be consulted for their input on the relative importance of the four major tenets of medical ethics; autonomy, beneficence, non-malfeasance, and justice (Beauchamp and Childress, 1989). Autonomy refers to the extent to which patients and their families are able to remain in meaningful control of their care, including decisions about which interventions to undergo

(or to refrain from undergoing) as part of their care plan. Beneficence refers to the extent to which technologies provide true health benefits in the areas most favoured by patients, such as enhanced quality of life and prevention of disease. Non-malfeasance refers to the potential for certain technologies to produce a net harmful effect on patients. Certain painful or risky procedures of dubious or minimal benefit may fall into this category. Finally, considerations of justice are increasingly important in the health care technology assessment arena because of the growing tension in some countries between a tradition of egalitarianism in health care delivery (universal public coverage) and the shrinking pool of resources available to pay for all effective services. This consideration is of particular importance when new technologies are expected to be very expensive and of potential benefit to small numbers of patients, or specific subpopulations.

While several distinct dimensions are subsumed under this one category of social context, it is not the intent of the Framework to simplify these complex phenomena. For the sake of parsimony, and because all provide the context within which public policy decisions ought to be examined, these dimensions are presented collectively. Depending on the situation, some permutation among these may be relevant. More likely, all these concerns may be of relevance in varying degrees.

To illustrate, in the case of fetal ultrasonography, the social as well as the ethical dimensions may be more important than the legal and political. A basic question, for grounding the technology in its social context, is to ask: To what social uses will this technology be put? In obtaining an answer to this query both empirical (objective) and subjective information should be sought. For example, social scientific research on whether ultrasound technology social values characterize the use of ultrasound in the care and welfare of pregnant women. In the Western world, for example, ultrasonography, by providing visual access to the fetus, fits with a growing trend in obstetrics to give the fetus patient status, somehow separate from its mother (Mattingly, 1992). This may or may not be the case in the developing world. Ultrasound has also be used to make a "media spectacle" of pregnancy (Petchesky, 1987), and has contributed to a change in women's and men's experience of pregnancy and expectant motherhood and fatherhood (Sandelowski, 1994). The impact of technological change on social relations can vary greatly from one group to another, instigating different degrees of social change. At the same time, the inverse may be the case; different types of social change can culminate in different levels of technological development. Critical feminist analysis has provided important information on general issues of power, control and dominance common to all countries and cultures (Wajeman, 1991; Lindenbaum and Lock, 1993).

In addition to the empirical evidence, the decision maker should consult with women and/or women's groups to obtain their assessment of the issues and their particular perspective on the subject of ultrasound. Again, using the Framework facilitates this process of consultation because the decision maker can approach the interested parties with a set of criteria (the previously discussed dimensions) already elaborated and documented. Those being consulted can follow the decision maker's process of thought through the material presented and can take issue with any or all of the foregoing logical arguments, if they wish. Without an explicit decision Framework, it is simply a guessing (and outguessing) game when communication occurs between policy makers and others.

Another important aspect of the social context is the concern with equity: would all those who would benefit from the technology have equal access to it? In the case of fetal ultrasonography, two basic questions regarding equity can be raised. First, a question of eligibility: would this technology be available to all pregnant women? If so, particular attention should be given in designing a service delivery structure that will reach all pregnant women and allow equal access. Secondly, if the decision is to make this publicly funded technology available only for certain medical indications, i.e. previously defined high risk pregnancy, the question on equal access becomes even more important, especially for rural or isolated areas or disadvantaged groups. In this instance, since a gatekeeper to the technology has to be consulted first, requiring perhaps initial travel or forgone earnings, and further displacement for the subsequent services of interest.

For ethical concerns, two of the major tenets of medical ethics are particularly relevant for the decision on ultrasound: autonomy and beneficence. The recent social scientific literature on ultrasound indicates that this technology can be used to commodify the fetus and pregnant woman (Sandelowski, 1994) while it maximizes the male role and expectant fatherhood. Seeing and getting a picture of the fetus is made to be as significant as carrying the fetus, thus reducing a woman's control over the situation. This is a hindrance to the pregnant woman's autonomy, as defined by medical ethics.

The extent to which ultrasonography provides true health benefits to the pregnant woman and her fetus has been seriously challenged (Oakley, 1986). Ultrasound use becomes even more problematic if it is consistently and routinely misused or abused. The use of ultrasound for sex selection (undertaken routinely in some countries) has now been documented (Wertz and Fletcher, 1993; Global Child Health News and Review, 1994; Canadian Royal Commission on New Reproductive Technologies, 1993). The ensuing abortion of female fetuses raises serious questions regarding beneficence as well as morality. The availability of a technology that is potentially exploitative of women and contributes further to their subjugation should be curtailed immediately until further policy action to stop such undesirable practice is fully implemented. If there is evidence of potential and possible abuse by the health care provider, or the consumer of the services, regulatory mechanisms to remedy this situation should be concurrently developed, and legal implications fully explored and documented.

General and specific questions regarding government regulation of facilities and service organizations, as well as the professionals who provide these services are often desirable and always necessary steps in the decision making process. Speaking at the opening of the 19th Session of the Program Committee of the WHO Executive Board, Dr. Nakjima, the Director-General, stated that "in the field of health, technology cannot be left to govern ethics on an empirical basis. Decisions must be made consciously by us all" (Global Child Health News and Review, 1994).

Political concerns may vary widely among health care systems and countries. However, in a rational stepwise approach to decision making, political implications of technological development and change should be raised and considered as one among the many concerns. If the political imperative will, ultimately, be the only factor driving the decision, at least the decision maker should be fully aware of the

consequences of the decision along all the other dimensions. Finally, it may be desirable to weight each dimension as opposed to attributing equal importance to all of them.

2.5 Technology Assessment Activity

Health technology assessment is the systematic evaluation of a technology. In a narrow sense, it involves the evaluation or testing of a technology for safety and benefits when used under ideal conditions (efficacy). In a broader sense, it is the process for policy research that examines the short- and long-term consequences of the technology in question. Health technology has been defined (US Institute of Medicine, 1985) to include the drugs, devices and medical/surgical procedures used in health care and the organizational/administrative and support systems within which health care is delivered.

The assessment of a technology sometimes combines concerns from the clinical, epidemiological, economic and socio-legal perspectives. These aspects are usually specific to the technology in question as compared to the broader context of the aforementioned dimensions of the decision model. The assessment would take into consideration:

a) the safety of the technology which is a judgment of the acceptability of risk in a specified situation which may include comment on the quality of provider or type of facility within which the technology is used;

b) the benefit of using a technology or procedure for a particular clinical problem under ideal conditions of use (efficacy) such as within a study environment in a laboratory or at a teaching hospital;

c) the benefit of using a technology or procedure for a particular clinical problem under general or routine conditions of use (effectiveness) such as in a field situation or within a rural or non-teaching hospital;

d) considerations of costs, volume of services and benefits in terms of cost savings and other factors such as lives saved or serious illness prevented; and

e) the implications of using the technology in the context of societal norms and cultural values and social institutions and relationships.

Some (and on rare occasion, all) of these concerns form part of the analytic frame which is used to approach the technology assessment activity.

Assessments usually incorporate one or more evaluative methods into the research design. The first step is a thorough search of the published literature through library databases as well as a search for all fugitive information - that which does not appear in peer-reviewed scientific sources. The information is then examined for strength and quality. Research which has been conducted using rigorous methods is generally

seen as producing stronger evidence than research using weaker methods of study. For example, evidence obtained from at least one properly designed randomized controlled trial is seen as stronger than evidence from non-randomized studies or descriptive studies. The power of an assessment can be improved when methods of assessment such as meta-analysis or reports of expert committees are used in the synthesis of the information. Systematic evaluation of a technology can draw on research using any assessment method, but most technology assessments that currently exist use primarily literature synthesis, expert opinion and cost analysis.

Most technology falls under one of six categories of application: prevention, screening, diagnosis, treatment, rehabilitation and palliation. The application of the technology is particularly important as the assessment usually focuses all efforts on this aspect. Clear criteria exist for evaluating technologies or health programs for screening, diagnosis and treatment and the application of these criteria would be central to the technology assessment activity. Technologies may be assessed at different stages of diffusion. Technology diffusion is defined as the process by which a technology enters and becomes part of the health care system (OTA, 1976). These stages include: emerging, new to practice, established, almost obsolete or outmoded.

Under ideal conditions, a technology should be assessed prior to diffusion into the social system. However, in the real world, most technology is adopted prior to examination of its efficacy and/or effectiveness. The costs to the system and society are sometimes enormous as was the case with the drug thalidomide for the treatment of nausea in pregnancy. Health technology assessment attempts to make sense of the information available on technology regardless of its source. An evaluation of the technology is based upon the analysis of the evidence and strength of the findings. Logical and defensible conclusions about the technology are formulated in reports prepared usually for the decision makers. Generally, assessment is undertaken to examine only the effectiveness of health care and to provide information in a timely manner for more informed decision making by policy makers, industries, health professionals, and consumers. It is also undertaken to critically re-examine technology at different stages of diffusion. Technology assessment may be used to slow the adoption of emerging or new technologies but, most often, it is to assist decision makers in better resource allocation decisions among established technologies.

The technology assessment dimension incorporates into the decision process a different type of factor: the weight of scientific evidence specific to the health technology. Methodologic rigour and the application of rules of evidence to what is known about the technology under consideration provides arguably the most reasoned of decisions. However, it is very rare when such complete scientific evidence is available, or even possible to undertake concurrent with the decision making effort. The diffusion of health technology proceeds at a rate much faster than the time-frame required to undertake good, scientific research. The inclusion of this dimension in the Framework yields new information about the interplay between research/scientific evidence and health technology diffusion.

While this dimension of the Framework introduces an objective scientific component into the overall information package, its importance is dependent on its preference weight, which is subjectively assigned by the decision maker. As a final step in the proposed rational process, the decision maker should consider the availability and quality of scientific evidence regarding the technology under consideration, ultrasonography. Although there is appreciable research on the efficacy of this medical imaging technology in prenatal care, information on its effectiveness and cost-effectiveness is very scant and may be much less conclusive.

All the above mentioned dimensions of the Framework are dependent on reliable indicators (empirical measures) to define and accurately describe the specific policy issues of importance to the decision maker. The potential contribution of research to policy making in the health sector is made more evident through the use of the Framework and its explicit deliberation of each policy dimension separately, as well as of overall, integral consequences from a societal perspective. The availability and quality of the scientific evidence are, therefore, important factors for using a critical approach; the lack of accurate data, however, should not lead to the abandonment of the conceptual Framework, since raising some appropriate questions about the broader context of health and human needs is itself a desirable objective.

3. MAKING CHOICES WITHOUT TAKING CHANCES

The dominant institutions which structure technological options in health, historically, have been controlled by the church, the state, the medical profession, research bodies and funding agencies, and drug companies. These technologies develop within a science culture that defines women by their biological function (child bearers) and their social function (child rearers), and scientific research priorities are identified by male scientists. For example, research on contraceptive technologies has examined only clinical efficacy and effectiveness; the question of why particular contraceptive technologies have been developed in preference to others remains unanswered. Also, we know very little about the influence of social institutions on the development of reproductive and other health technologies. Decisions about who will get how much of what in health care are made daily, mostly in an ad hoc fashion that tends to be biased in favour of those in power; women are absent from these circles Policy mechanisms pertaining to health technology and its diffusion are neither coordinated between local, regional, national, and international levels, nor applied consistently to ensure allocative efficiency (that is, doing "the right thing") in addition to technical efficiency ("doing things right"). Women's concerns and needs would be better met if technological choices are more informed choices.

The Framework provides the guidelines within which the appropriate information is sought and examined. This is achieved through raising several questions for which there may or may not be answers at the time. Due to the Framework's explicit and stepwise approach, it can expose the ideological and social power of those who make decisions during the development and diffusion of technology. By focusing on the analysis of the dynamics of the social context, women's technological concerns as well as their absence from decision making roles becomes evident and can be corrected.

Where there is any evidence indicating possibility of harm to women's health and wellness, the analysis using the Framework exposes conflicting interests that may attempt to mask that situation. In addition, even where the technology of concern is not directly related to women's health, the consultative capacity of the Framework invites the participation of women in the decision process.

That decision process, in the hypothetical example of ultrasound imaging for pregnant women, can be rapidly demystified. To begin with, the policy maker will become aware of the bias in the language of clinical practice, where ultrasound measurements during pregnancy are known as "fetal" measurements, not pregnant women measurements, showing a male, medical bias. The information gleaned from epidemiological evidence indicates that screening of all pregnant women through ultrasound imaging, on balance, does more harm than good. While it is desirable and necessary to reduce maternal/infant morbidity and mortality rates, such evidence is not forthcoming in developed countries where there is widespread use of this technology. The evidence indicates that programs of prenatal care, such as nutrition education and food distribution, are effective in reducing slow development and other problems of pregnancy. As for economic concerns, the adoption of inappropriate technology at any cost is unacceptable.

Within the social context, the evidence points to altered social relations, not just between mother/child and father/child units, but among members of larger groups: health care providers, facilities and communities. The autonomy of the expectant mother is appreciably reduced by the use of this technology, disregarding a major tenet of medical ethics. Finally, the overt misuse of the technology for sex selection is regarded as immoral and would incur political costs to the present authorities.

The right decision for the policy maker (in a developing country, most likely, where this technology is starting to push its way) would clearly be not to purchase ultrasound technology.

In summary, the Framework is being proposed not as a substitute for Health Technology Assessment (HTA), but in conjunction with it. Others have discussed the methods and limitations of HTA (Banta and Luce, 1993; Morgall, 1993); they observe that there is almost unanimous agreement on the need for technology assessment in general. However, there is very little mainstream HTA that is context-oriented and gender-specific; technology is rarely viewed in a social context of conflicting human interests; and an attempt to make HTA more directly relevant to policy-making is very recent (Battista, 1992). The proposed theoretical Framework addresses these important issues.

For its theoretical grounding, the Framework draws on a number of disciplinary perspectives, incorporating theories of epidemiology, sociology, economics, and systems science; and combines a critical feminist approach with that of health services research. Application of the Framework generates a package of information which includes social values. The Framework identifies possible choices by providing an evaluation of the relative sociomedical merits of technological alternatives under consideration; the decision maker still makes the choice, cognizant of its many and often far-reaching consequences.

4. FUTURE RESEARCH NEEDS

The recognition that empirical evidence can contribute enormously to health policy and planning has not been uniformly espoused and promoted across time as well as across countries. Funding available for health systems research has been very small relative to that spent on health services, and has not been forthcoming in a predictable, stable pattern. This paper, through a detailed discussion of health policy issues, highlights the many areas where there is a lack of knowledge and lack of understanding of population health needs in general, and in women's health issues in particular. This information deficit can be appreciably reduced through special, targeted funding of priority areas and continued, stable funding of all areas.

Three thematic areas, or types of research, can be delineated from the discussion of issues and decision making contained in this paper:

1) Epidemiological research which expounds on the distribution and types of illnesses and injuries in human populations and the factors which influence their distributions. Particularly lacking are studies on women's health, as previously discussed.

2) Health systems and population health research which are multidisciplinary fields of research and recognize that health is more than medicine. For health systems research the focus is on system organization and delivery of care recognizing that these are at least as important as the content of care. Research on the social indicators of health and illness constitute the major focus for population health research; both would contribute enormously to understanding women's health issues.

3) Health policy development and analysis research which expounds specifically on how health decisions are made, who makes decisions, and how best to incorporate empirical evidence into health policy decisions, given a better understanding of the process and the people. Research on decision support models or frameworks that facilitate a rational and integrated approach to health policy is a relatively new field. A rational, explicit approach to health policy would, at least in the long-term, be useful by bringing women's experiences to the policy-making arena.

Some official international efforts do exist to promote the use of research evidence in the health sector. An international consultation convened by the WHO in 1993, in Geneva, discussed and presented studies identified as "health futures" research. This area of research is being promoted and supported by the WHO because it is perceived to be essential to evolve and develop new approaches that will assist in formulating public health action aimed at accelerating progress toward health for all. The importance of futures research in this context was recognized by the World Health Assembly in 1990 (Taket, 1993).

While the "health futures" label is a comparatively recent phenomenon, the studies identified as such by the WHO are concerned with the future of health or health services using methodologies more broadly defined as epidemiology, systems research, strategic planning, or modeling. The major international network in the field of health futures is the International Health Futures Network (IHFN). This body of work contains some projects on modeling futures; however, these are generally described as projection or simulation

models based either on the status quo or using hypothetical scenarios for the future. A rational, prescriptive, prospective model, such as the Framework proposed in this document, has not existed previously, but is particularly supported by the existing related "health futures" research as a possible and desirable tool.

REFERENCES

Anderson GM. Use of Prenatal Ultrasound Examination in Ontario and British Columbia in the 1980s. Journal SOGC, February 1994;1329-1338.

Bassett KL. Taming Chance and Taking Chances: The Electronic Fetal Monitor in a Rural Canadian Hospital [Ph.D. Dissertation]. Montréal, Quebec, Canada: McGill University, 1993.

Banta HD, Luce BR. Health Care Technology and its Assessment - An International Perspective. Oxford: Oxford University Press, 1993.

Battista R. Healthcare Technology Assessment: Linking Science and Policy Making. Canadian Medical Association Journal 1992;146(4):461-462

Bowie R. Health Economics: A Framework for Health Services Decision-Making. New Zealand Medical Journal 1991;104(March):99-102.

Beauchamp T, Childress JF. Principles of Biomedical Ethics. 3rd ed. New York: Oxford University Press 1989.

Carroll JS, Johnson EJ. Decision Research - A Field Guide, Applied Social Research Methods Series. Vol.22. Newbury Park, California: Sage Publications Inc. 1990.

Drummond MF. Economic evaluation and the rational diffusion and use of health technology. Health Policy 1987;7(3):309-324.

Drummond MF, Stoddart GL. Economic analysis and clinical trials. Controlled Clinical Trials 1984;5:115-28.

Duncan OD. Notes on Social Measurement - Historical and Critical. New York: Russell Sage Foundation 1984.

Eisenberg JM. Clinical Economics: A guide to the economic analysis of clinical practice. Journal of the American Medical Association 1989;262(20):2879-2886.

Feeny D, Torrance G. Principles of Economic Evaluation for Health Care Technologies. McMaster University, Hamilton, Ontario, Canada: Centre for Health Economics and Policy Analysis (CHEPA), 1992.

Garland MJ. Light on the Black Box of Basic Health Care: Oregon's Contribution to the National Movement Toward Universal Health Insurance. Yale Law and Policy Review 1992;10(2):409-430.

Global Child Health News and Review, A Quarterly Publication of the Global Child Health Society Vol. 2, No. 1, 1994, Vancouver, Canada

Gold RB. Ultrasound Imaging During Pregnancy. Family Planning Perspectives 1984;16:240-243.

Gustafson DH, Cats-Baril WL, Alemi F. Systems to Support Health Policy Analysis - Theory, Models and Uses. Ann Arbor, Michigan: Health Administration Press, 1992.

Institute of Medicine. Assessing Medical Technologies. Committee for Evaluating Medical Technologies in Clinical Use, Division of Health Sciences Policy, Division of Health Promotion and Disease Prevention. Washington, D.C.: National Academy Press 1985.

Kazanjian A, Cardiff K. Framework for Technology Decisions. New Reproductive Technologies and the Health Care System: The Case for Evidence-Based Medicine. Research Studies of the Royal Commission of New Reproductive Technologies 1993.

Kazanjian A, Friesen K. Defusing Technology: A Pilot Study of Low and High Technology in British Columbia. International Journal of Technology Assessment in Health Care 1993;9(1):46-61.

Lindenbaum S; Lock M. (eds.) Knowledge, Power and Practice: The Anthology of Medicine and Everyday Life. University of California Press, Berkeley and Los Angeles, California, USA, 1993.

Mattingly SS, The Maternal-Fetal Dyad: Exploring the two-patient obstetrical model. Hastings Centre Report 1992;22:13-18.

Mausner JS, Bahn AK. Epidemiology - An Introductory Text. Philadelphia, Pennsylvania: WB Saunders Co., 1974.

McDowell I, Newell C. Measuring Health: A Guide to Rating Scales and Questionnaires. New York: Oxford University Press, 1987.

Morgall JH. Technology Assessment - A feminist Perspective. Philadelphia: Temple University Press, 1993.

Oakley A. The Captured Womb: A history of the medical care of pregnant women. New York: Basil Blackwell 1986.

Oakley A. Ultrasound in Obstetrics. Telling the Truth about Jerusalem. New York: Blackwell 1986:43-51.

Office of Technology Assessment. Development of Medical Technology: Opportunities for Assessment. Washington, DC: U.S. Government Printing Office 1976.

Payne JW, Braunstein ML, Carroll JS. Exploring pre-decisional behavior: An alternative approach to decision research. Organizational Behavior and Human Performance 1978;22:17-34.

Petchesky RP. Fetal Images: The power of visual culture in the politics of reproduction: Stanworth M, eds. Reproductive Technologies: Gender, Motherhood and Medicine. Minneapolis: University of Minnesota Press, 1987.

Sackett DL, Haynes RB, Guyatt GH, Tugwell P. Clinical epidemiology: a basic science for clinical medicine. 2nd ed. Toronto: Little, Brown and Company, 1985:379-91.

Sandelowski M, Separate, But Less Unequal: Fetal Ultrasonography and the Transformation of Expectant Mother/Fatherhood. Gender and Society, 8(2):230-245, 1994

Sisk J. Discussion: Drummond Resources Allocation Decisions in Health Care: A Role for Quality of Life Assessment? Journal of Chronic Diseases 1987;40(6):617-19.

Steiner DL, Norman GR, Monroe Blum HM. PDQ Epidemiology, Toronto: B.C. Decker Inc., 1989.

Svenson O. Process descriptions of decision making. Organizational Behavior and Human Performance 1979;23:86-112.

Taket A. Health Futures in Support of Health for All. Report of an international consultation convened by the World Health Organization, Geneva, 19-23 July 1993. Geneva: World Health Organization, 1993.

United Nations - The Vienna Programme of Action on Sciences and Technology for Development, The United Nations Conference on Science and Technology, 1979.

United Nations - Consideration of the Reports of the 1983 Panels of the Advisory Committee: Science and Technology and Women; Report of the Ad Hoc Panel of Experts on Science and Technology and Women, South Hadley, Massachusetts, United States of America, 12-16 September 1983.a/cn.11/ac.1/IV/4 9 December 1984.

Wajcman J. Feminism Confronts Technology. 1991. The Pennsylvania State University Press, University Park, Pennsylvania, USA

Wertz DC; Fletcher,C. Prenatal Diagnosis and Sex Selection in 19 Nations. Social Science and Medicine, Vol. 37, No. 11, pp. 1359-1366, 1993.

Yoxen E, Seeing with sound: A study of the development of medical images. The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology, WE Bijker, TP Hughes, and TJ Pinch (eds.). Cambridge, MA: MIT Press

Women's Environment & Development Organization - Official Report, World Women's Congress for a Healthy Planet. November 1991.