International Journal of Technology Assessment in Health Care, 10:2 (1994), 273–281.

WOMEN, HEALTH, AND MEDICAL TECHNOLOGY

Inger Stauning
Roskilde University

Abstract

New medical technologies are often developed and diffused in health care without societal assessments or setting of priorities. This article discusses the driving forces behind the development of new technologies and asks how women as users and providers of health services can gain influence on the process. Technologies used in pregnancy and childbirth are discussed to reveal different interests in their development and use and to discuss the role of industry in the development of new medical technologies in general.

It seems obvious that women should have a great influence on the development of technology in the health care sector. Health care is often a women's job, both in the family and in health care services. Securing services for the health care of children, the elderly, families, and the community is the daily concern of women all over the world.

But the development of medical technologies seems to be governed by other rules than the daily concern for the health of the community. One example is the use of technology in pregnancy and labor. Becoming a mother or father is a normal process of life, not a disease. Medical care should be necessary only if complications occur. However, in industrialized societies, all phases of reproduction have been invaded by medical procedures and technology. And in many parts of the world, the basic needs of mother and child are not met.

This paper will discuss some of the factors that influence the development of new medical technologies. These medical technologies are the combined use of medical knowledge, work organization, and drugs, devices, and supporting systems in health care services.

To comprehend the dynamics of such development, it is important to understand the relationship between medical research and industrial interests in the development and use of technology in health care. Questions include:

- How is new medical technology developed, introduced, and diffused in the health care arena?
- What are the roles of health care administrators, health care professionals, consumers of health care, and industry?
- How can users and providers of health care services influence the use and development of medical technology in such a way that will contribute to the aim of improving health care for all?

These questions raise further questions about the concept of health. Positively defined by the World Health Organization, health is "a state of optimal physical, mental, and social well-being, and not only the absence of disease and disability" (19). A health policy in accordance with this definition should involve all sectors of society to improve living and health conditions in all respects.

IS MEDICAL TECHNOLOGY GOVERNED BY HEALTH POLICY?

In Denmark, the health care system is publicly planned. Eighty-six percent of all health expenditures are publicly financed by taxes. Hospitals are publicly owned. All citizens have free access to physicians and to any prescribed health services, including hospital care. There is general satisfaction with the system among the population, and it is one of the least expensive systems in Europe. Denmark's total health expenditure in 1987 was 6% of its gross national product, while total health expenditure in most western European countries was between 7% and 9% of the gross national product. In the United States, expenditures were as high as 11.2% (7).

Despite the high degree of planning of the budgets and organization of health care in Denmark, there is no overall planning of priorities and decisions about the use of medical technology. There is no legislation on the use and distribution of medical technology, except the regulation of drugs (15). Decisions about administration of hospitals and budgets are made on a decentralized level in the counties and at each hospital. Decisions about how to treat different health problems and which medical technologies to use are the responsibility of the consultants of the different departments, within the limits of the budget.

In Denmark, as in other industrialized countries, there is generally no setting of priorities for the overall development of health in society. The health care systems are built mainly around the traditional medical concept of illness as a malfunction of organs and body parts—the mechanistic view of illness. Hospitals are divided into departments and specialties, each treating a specific set of illnesses and special parts of the body. This highly decentralized decision-making procedure about the use of technology creates two important problems for the implementation of an overall health policy.

First, budgets and quality of health care are difficult to control. Despite efforts at cost containment in the past 20 years, new and often very expensive technologies are introduced into health care, such as computed tomography, magnetic resonance imaging, and transplantation of body parts. These technologies often cause great changes in working routines and carry high implementation costs. New medical technologies are difficult to control (15).

Second, new technologies enter the health care sector with no evaluation of risks, benefits, or costs. Investigations into the diffusion of new medical technologies have shown that many were introduced and their use widely promoted without ever being tested. In several cases, long trials have shown that the technologies were of no particular benefit or even were harmful (10).

The realization of these problems has led to many activities in techology assessment in the 1980s. Medical technology assessment has grown into a separate discipline, especially in the United States and in European Economic Community member states (15). In Denmark, consensus conferences and research projects have been carried out. These activities are relevant and important tools for the decision makers as well as for the public to obtain knowledge of the benefits and problems of new medical procedures.

However, there are three obvious problems in the way technology assessments are used:

1. Assessments are expensive; only a few technologies can be assessed.
2. Assessment is not connected to the decision-making process on a given technology's use.
3. Assessments are made too late—after the equipment is developed and already in use, when they have no power to initiate innovation.

In the following section, some examples show how new technologies are used despite problems with assessment. How and why these innovations are developed, how the interests of industry affect the development, and what the role of the recipients of the technology can be are explored.

DIFFUSION OF MEDICAL TECHNOLOGY

An example from childbirth care seems to give quite unambiguous results: electronic fetal monitoring during normal labor. This technology has been tested by nine randomized clinical trials involving 52,133 pregnant women, the first trial in 1976 and the last in 1987 (18). All trials show the same results as obtained by auscultation with stethoscope/fetoscope, the traditional tool of the midwife: there are no better results regarding the health of the babies, and there are more risks for the mother because of higher rates of cesarean sections and other operative deliveries. Furthermore, monitoring is highly disturbing to the woman in labor, because the procedure hinders her free movements and is noisy and alienating. Despite all these trials and a massive critique from women, electronic fetal monitoring during labor still is used routinely in many facilities in Europe and in the United States (18). How many years and how many trials are needed to convince physicians that other methods could be used?

The use of ultrasound scanning in prenatal diagnosis is another example of the rapid diffusion of a medical technology in general use. Ultrasound scanning has achieved the status of a routine procedure in the past 20 years without any assessment of either its risks or its efficacy. In 1982 in Denmark, 70% of all pregnant women were scanned (on average) twice during pregnancy (16). In England, 85% of all pregnant women were scanned in 1984 (5).

During the 1980s, several assessments and consensus conferences arrived at the same conclusions:

- Ultrasound examination is a valuable tool in certain situations;
- Benefits from routine scanning of all pregnant women cannot be documented, and eventual risks for fetus or mother cannot be excluded; therefore,
- Ultrasound screening as a routine procedure is not recommended (12;16).

Despite these conclusions, ultrasound scanning was still used as routine screening at 25% of all facilities in Denmark in 1988. The newest data show that almost 90% of pregnant women are scanned and that the rate of scanning is still rising (6). In other countries such as Sweden, France, and Germany, scanning is the usual procedure.

Why has this technology achieved such widespread use? In the debate about ultrasound diagnosis, two main arguments for its usefulness are made. First, it is useful in the diagnosis of certain problems. This argument is valid only in cases with

specific indications, not as an argument for scanning all pregnant women. Second, many women want to see their baby; parents feel reassured and convinced of the reality of their parenthood when they see the fetus. While this may be true, is this kind of argument enough to justify the purchase of equipment costing thousands of dollars? And should this argument be accepted in this case? A third argument can be raised that explains the interest in the use of ultrasound diagnosis more succinctly—ultrasound imaging allows examination of the woman's womb for further research in the growth of the fetus and for use in development of new diagnostic and therapeutic technologies.

Ultrasound examination early in pregnancy gives a relatively precise age of the fetus, which is necessary for many other invasive diagnostic procedures later in pregnancy—hence the logic of "just in case, we should scan all pregnancies." The most important use of ultrasound imaging for further research is that it can be used to guide the needle for invasive procedures such as amniocentesis. A number of techniques have been developed for the use of blood or tissue from the fetus, genetic testing being the most common. Some fetal therapies also have been developed, such as blood transfusions and operative procedures (5). Futher uses, such as gene analysis and gene therapy, are readily apparent.

Thus, ultrasound imaging could permit new and still unknown medical procedures on the fetus. In this way, women are made part of the experiments in the exploration of diagnostic and therapeutic technologies. This is a promising future—the promise of the perfect baby. But are perfect babies what we want the health care resources of society used for? Who asked for that? And who should decide the best use of health care resources? These questions have been central in the discussion of prenatal diagnostic methods (6;8). Patients were never asked whether they want research and development to go in this direction.

With the promise of better babies is the promise for physicians of new areas for research and for industry of more products to sell. It is important to explore the relations between industrial development and medical research in order to understand the forces behind the development (14).

THE MEDICAL-INDUSTRIAL COMPLEX

In the 1970s and the beginning of the 1980s, Danish production of medical equipment grew in a few highly specialized areas. This growth was strongly connected with hospitals and the expertise and specializations developed there during previous growth periods in the 1960s and 1970s. Ultrasound equipment serves as an example of the collaboration between hospitals and industry (14).

In the late 1960s, the work of Alice Stewart showed that the use of x-rays during pregnancy (a common procedure in the United Kingdom) carried a risk of cancer for the child. This finding created a market for ultrasound to replace x-rays for examination of pregnant women throughout the world. A number of firms, especially in Japan, took advantage of this market.

Danish firms were not competitive in this mass market, but the hospital sector contained possibilities for even more specialized markets:

- In the 1960s, a Danish physician began research on the use of ultrasound in the diagnosis of urinary tract diseases. In cooperation with a research institute, he built special equipment for this purpose.

- In the late 1970s, a Danish firm started production of equipment for the diagnosis of urinary tract disease as well as for scanning pregnant women. It took several years to develop and market the equipment before it could be sold on a broad scale.

In these situations, hospitals cooperated closely with industry. A contract was drawn up, including a payment of 2% royalties to the county. Thus, the use of scanning became both a part of testing the equipment as well as testing new research areas and clinical services for various medical departments. In the 1980s, new uses were found for scanning, such as examination of the heart and other organs, and the process of refinement and adjustment of equipment continued as even more uses for the technology were developed.

For the technical firm, contact with physicians is crucial. Medical research reveals the need for innovations, and the specialization of the research makes it possible to find specific markets. Communication of the research through articles, books, and conferences makes the technologies and equipment known all over the world; the technical firm then uses these articles as advertisements. At conferences, the equipment is advertised and promoted. Physicians from other countries come to the hospital to learn to use ultrasound in various diagnostic procedures. The international reputation of the research is the critical issue for the technical firm: the best seller is the reputation of the physician.

On the other hand, support from the firm is a great help for the physicians to further their research interests—new ways to observe organs and make diagnoses provide material for many more research articles. Access to new equipment and refinements of the equipment create possibilities for even more new research agendas. As state support and funding for research is reduced, contributions from industry become critical for young physicians to develop their research careers. In fairness, these additional resources for research and development often result in new diagnostic and treatment modalities for many diseases.

However, this direct relationship is not the only way that industrial interests influence medical research. Many research areas in medicine have rather little significance from a health perspective (such as artificial intelligence) but may have enormous significance for industrial purposes (such as artificial intelligence used in computers or for military purposes).

Thus, medical research serves industrial policy purposes as well as health care purposes. This observation can be seen in the large sums set aside in the European common market for research on the use of information technology and biotechnology in the health care sector (2). The explicit aim of these programs is to improve European industry's competitiveness against American and Japanese industry, over and above health care purposes.

For industrial purposes, medical research has many advantages. Industry obtains access to highly skilled researchers (physicians) who are connected to research on a high level that is financed by funds and state monies, earmarked for health care purposes. In investigations of the electronics industry, one finds close connections between medical research and industrial innovation. Health care sector monies contribute to these industrial innovations (14). There are many examples of this type of cooperation (1).

UNDERLYING PRIORITIES: WHICH TECHNOLOGIES ARE DEVELOPED?

One might think it possible to let health care policy govern innovations in the technical industry, but such a thing is difficult at best:

- In Denmark, industrial production for health care is such a specific activity (ultrasound, blood gas measurement, hearing aids) that it has little relevance to overall health policy.
- Competition in the industry sets narrow limits on what can be produced in Denmark so that only very specialized products, in which the large multinational corporations have no interest, are produced. At the same time, these products are of such generalized use that they can be sold rapidly all over the world.
- Above all, it is obvious that what is needed is not new products alone but new, overall ways of delivering health care—more general health care policy priorities.

From this perspective, a different question emerges: How do these relationships with industry influence medical technologies? The industrial interests in medical technologies research are structured to follow one of these criteria:

- Research must include product development;
- Research must open international markets; or
- Research must be of strategic relevance for industrial development, such as artificial intelligence or genetic research.

Research that meets one of these criteria will be supported by industrial resources, will obtain access to equipment and materials, funds, and grants, and will gain contact with international activities of a similar nature. The research might lead to results that improve health—but not necessarily.

Research that does not meet any of these criteria gets no further support. This often seems the case with what might be defined as women's ways of delivering health care. Nurses and midwives (predominantly female occupations) do not have international networks that are as large and as influential as physicians' and rarely research technologically advanced topics. Rather, they tend to rely on the process of care delivery, focusing on contact and caring rather than technology and products.

A hidden, underlying priority clearly has been set by industry regarding the kind of medical research that is supported and developed. Each problem in the health care process that can be solved by some kind of industrial technology will be attacked and pursued separately. The research and development process, which may go on for years and involve hundreds of people, yields only one solution to a specific problem. This approach is facilitated by medicine's mechanistic view of health care.

Professionals in health care who treat patients as whole people rather than as systems of organs try to develop other research agendas and methods. These agendas are based on more holistic principles, human contact, and caring but will be confronted with a medical-industrial agenda that stresses equipment, drugs, and technologies as better solutions to health care problems.

Again, an example is electronic fetal monitoring. If this equipment is used during labor, many of the methods developed by midwives may be rendered impossible (e.g., movement, change of position, use of different positions). Another example is the use of anesthetics during labor. Anesthetics may prevent the woman from being in control of her own birthing experience and an active participant in the labor.

To date, physicians and technical companies and their view of health care research and development have governed innovations in health care. Others desire different priorities as a focus of such development.

PATIENT INTERESTS SUPPORT NEW TECHNOLOGY

What then is the role of the patient? Patients have little influence on the organization of the health care sector as a whole. The concept of the patient reveals a contradiction between an individual with a specific problem and an individual concerned with societal health as a whole. Individual patients will search for the best possible solution for their particular problems, but this solution might be in conflict with the priorities set for an overall health policy or with other priorities.

The interests of individual patients might be allies in the movement to medical technology with much broader perspectives. The controversies among women over in vitro fertilization (IVF) techniques reveal some of these conflicts. IVF technology gave new hope for infertile couples: they could be parents of their own child, borne by the woman herself. For the unhappy infertile woman, IVF technology offers a solution to a health problem. The individuals who want this solution will act as a pressure group to develop this technology further, to make it available in more places, and to make it less expensive. This process is similar to what happens with other patients who develop new hope when they hear about a new technology: they will be eager participants in the diffusion of the new technology in the early stages, together with industry and involved physicians.

Defined as a health problem, infertility can be treated in a variety of ways: adoption, treating the causes of infertility, or changes in culture or lifestyle. Women critical of the IVF method see it as a "bad" solution, a technical fix to the problem of infertility (9;13). Perhaps a societal decision about this problem will exclude IVF from public budgets; however, this will not stop people who are able to pay from having IVF treatment at private clinics or in another country. Thus, the IVF method will be sustained and developed in any scenario—and in reality the diffusion happened very fast (4).

The really controversial aspects of IVF lie in its possibilities to create humans not out of love and a desire for parenthood but for any purpose. Freeze an embryo—for how long? Let another woman bear the embryo—whose child is it then? Why not let it grow long enough to harvest the organs and other spare parts for use in transplants or other health care research or treatment (17)?

The production and use of embryos and fetuses independent of the original womb, research into the basics of life, genes and genetic engineering, hormones, growth of cells, diseases, pharmaceuticals, cosmetics—many uses are possible. And perhaps someone will use this research in industry to produce technologies beyond our imagination today. Such embryos give access to a unique source of genetic material; they are natural resources of unknown value to industry. Who will decide how they will be used?

Research related to women's health care problems can open new areas of nature for the purposes of production of commodities. Just like the exploitation of natural resources in the outer world, the inner world of women can be explored and exploited. Currently, the study of genes and genetics is the top priority of science. Approximately 5,000 genes already have been identified. This study of the methods of genetic engineering is not only a tool for gene therapy on humans but is also a tool for the industrial use of human tissue of all kinds. As Linda Bullard states, "Genetic engineering *as a whole* is a woman's issue. We must not allow ourselves to be 'ghettoized' into a struggle against only that which affects us most immediately—reproductive technologies" (3).

The industrial interests in these technologies are very powerful. They are partly the results of competition in economics and research and partly the results of conscious planning in industrial and military centers. In the case of reproductive technologies, women are the ones to express concerns about control over reproduction being put into the hands of others (11).

STRATEGIES FOR THE FUTURE OF HEALTH CARE

The prospects for further development of technology, especially in genetics and biotechnology, are tremendous, and call for all humans to control it and to turn development into a sustainable and healthy balance with nature. The basis for change lies in questioning, and the basis for questioning is values—visions of how relationships between humans and nature could be. What are the alternatives?

Since the early 1970s, there has been a movement that proposes alternatives in Denmark, as well as in other countries whose focus is better births and better care during pregnancy and childbirth. This movement, an organization called Parents and Birth (Foraeldre og Fodsel), includes men and women and has acted as a consumer group, sharing experiences and discussing methods that currently are used in diagnostics and delivery.

In this organization, new methods have been developed based on the experiences of the women themselves and on the experiences of midwives and physicians who practice alternative birthing methods. These methods take as their starting point the strength and ability of women to carry through the process of birth themselves, viewing childbirth as a natural healthy process, not an illness to be managed or treated. Examples of alternative methods include controlled breathing, the use of different positions for labor and delivery, and emphasis on continued personal contact and quiet surroundings. Also included are the presence of a psychologically and emotionally significant person during labor and decreased use of drugs and technologies. The introduction of these techniques is often the result of pressure from the women themselves. The development of these methods shows that medical technologies and medical expertise could be quite different and could follow different ideas and values with the same outcomes.

Advocates of this movement do not reject traditional medical technologies, but they question their use, especially "universally," and they demand that women be viewed as the subject of the birth process and that birth be viewed as a normal process of life.

Other examples of developing health care in relation to pregnancy and birth could be the prevention of health hazards on the job and improving living conditions, nutrition, hygiene, and daily workloads to prevent miscarriages and preterm births. Such interventions certainly would improve pregnancy outcomes in developing countries, where the specialized diagnostic tools of Western medicine seem to be of little use.

Creating these kinds of solutions to health care problems often demands struggle —for money, for development of appropriate technologies, and for competition with more powerful socio-politico-economic interests. This struggle must involve not only the question "How do we want health care to be?" but also "How do we control the technologies that invade and control human life processes?"

We must demand assessments of new medical technologies before they are introduced into large-scale use. We must demand influence over the control and direction

of research in human life processes, and we must demand legislation to limit exploitation of our inner nature—human life itself. Above all, we must discuss and demand influence on health care services in cooperation with health care providers.

REFERENCES

1. Andreasen, P. B. *Industri og sygehuse* (Industry and hospitals). Copenhagen: Dansk Sygehus Institut, 1990.
2. BICEPS. *Centre National de l'equipement hospitalier: Report presentation and methodology.* EEC, 1986.
3. Bullard, L. Killing us softly: Towards a feminist analysis of genetic engineering. In P. Spallone & D. L. Steinberg (eds.), *Made to order.* Oxford: Pergamon Press, 1987, 110–19.
4. de Witt, A., & Banta, D. Diffusion of in-vitro fertilization in the Netherlands and England. An exploratory study. *International Journal of Technology Assessment in Health Care,* 1991, 7, 574–84.
5. Ellis, C. Routine ultrasound in pregnancy. In J. A. D. Spencer (ed.), *Fetal monitoring.* Oxford: Oxford University Press, 1991, 37–40.
6. Houd, S. *Foedselguide—hvor og hvordan* (Guide to birth places). Copenhagen: Forbrugerradet, 1992.
7. Jönsson, B. What can Americans learn from Europeans? In *Health care systems in transition,* Social Policy Studies no. 7. Paris: OECD, 1990, 87–118.
8. Knudsen, J. L. *Fosterdiagnostik—for og nu* (Fetal diagnostics—before and now). Copenhagen: Dansk Sygehus Institut, 1990.
9. Koch, L. *Oenskeboern: Kvinder og reagensglasbefrugtning* (Wanted children: Women and IVF technology). Copenhagen: Rosinante, 1989.
10. McKinlay, J. From "promising report" to "standard procedure": Seven stages in the career of a medical innovation. In J. McKinlay (ed.), *Technology and the future of health care.* Cambridge, MA: MIT Press, 1982, 233–70.
11. National Action Committee on the Status of Women (Canada). The new reproductive technologies: A technological handmaid's tale. *Issues in Reproductive and Genetic Engineering,* 1991, 4, 279–96.
12. National Institutes of Health (U.S.), Consensus Development Panel. *Consensus statement: Diagnostic ultrasound in pregnancy.* Bethesda, MD: National Institutes of Health, 1984.
13. Pfeffer, N. Artificial insemination, in-vitro fertilization, and the stigma of infertility. In M. Stanworth (ed.), *Reproductive technologies.* Minneapolis, MN: University of Minnesota Press, 1987, 81–97.
14. Stauning, I. *Teknologi i sundhedssektoren—Mellem branchestrategi og brugerinteresser* (Technology in the health care sector—Needs of users and producers). PhD dissertation. Roskilde, Denmark: TEKSAM-forlaget, Roskilde Universitetscenter, 1990.
15. Stocking, B. (ed.). *Expensive health technologies. Regulatory and administrative mechanisms in Europe.* Commission of the European Communities, Health Services Research Series no. 5. Oxford: Oxford Medical Publications, 1988.
16. Sundhedsstyrelsen (National Board of Health [Denmark]). *Untralydscreening af gravide kvinder* (Ultrasound screening of pregnant women). Copenhagen: Sundhedsstyrelsen, 1986.
17. Testart, J. *L'oeuf transparent.* Paris: Ed. Flammarion, 1986.
18. Thacker, S. B. Effectiveness and safety of intrapartum fetal monitoring. In J. A. D. Spencer (ed.), *Fetal monitoring.* Oxford: Oxford University Press, 1991, 211–17.
19. World Health Organization Committee on Health Research. *Health research strategy for health for all by the year 2000.* Geneva: WHO, 1986.