

| MANAGEMENT IN HEALTH CARE PRACTICE A Handbook for Teachers, Researchers and Health Professionals | |
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| Title | TECHNOLOGIES USED IN HEALTH CARE |
| Module: 3.1 | ECTS: 0.2 |
| Author | Želimir Jakšić, MD, PhD, Professor Emeritus Andrija Štampar School of Public Health, Medical School, University of Zagreb |
| Address for correspondence | Želimir Jakšić Andrija Štampar School of Public Health, Medical School, University of Zagreb Rockefellerova 4, 10000 Zagreb, Croatia zelimir.jaksic@zg.t-com.hr |
| Keywords | Health technology, Health planning, Public health |
| Learning objectives | After completing this module students should: <ul style="list-style-type: none"> • be aware of role of health technology in practice of health care; • know the criteria for assessment of health technology • know definition and characteristics of appropriate technology; • be familiar with the implementation of the technology into the practice of health care. |
| Abstract | The important role of technology is outlined and broader understanding of the term technology supported, i.e. including besides equipment also people's know-how. The kind, types and ways of application of technologies are discussed in relation to present practice of health care. Finally, the role of AT (adequate technology), TA (technology assessment) and TT (technology transfer) are presented. |
| Teaching methods | Introductory lecture, exercises – field visit, individual work and small group discussions. |
| Specific recommendations for teachers | <ul style="list-style-type: none"> • work under teacher supervision/individual students' work proportion: 30%/70%; • facilities: a computer room; • equipment: computers (1 computer on 2-3 students), LCD projection equipment, internet connection, access to the bibliographic data-bases; • training materials: recommended readings or other related readings; • target audience: master degree students according to Bologna scheme. |
| Assessment of students | The final mark should be derived from the quality of individual work and assessment of the contribution to the group discussions. |

TECHNOLOGIES USED IN HEALTH CARE

Želimir Jakšić

THEORETICAL BACKGROUND

Introduction

Health technology is a complex issue. It is the ground for effective health protection, prevention and treatment of diseases, diminishing of people's pains and sufferings, and above all supporting human development, economic prosperity and quality of life. In the same time it is important as powerful health industry, consuming considerable social and economic resources of all countries.

"Technology" has different meanings: *Techne* (Greek word) means art, skill, craft. The practical meanings today are: industrial science; applied science; any *practical art utilizing scientific knowledge*(1). In practice it is connected with physical objects (machines, mechanical tools, chemical agents, computers), sometimes called **hardware, equipment, instruments and gadgets**. Today the term includes also social methods and know-how (even people who work with them and organization of work) called also **software, procedures and techniques**. In the working material of the Alma-Ata Conference 1978, it was stated: "*Technology is the totality of methods, techniques and equipment together with the people using them*".

Health technology was and is now the basis of health culture, closely related with it. Historical development of technology is the consequence of general technical, economic social and cultural development and circumstances, but also contributing to understanding of human beings and supporting development of other technologies, especially biotechnologies. Historically one may differentiate big medical schools like Ayurvedic, Chinese, Unani, Arabic, African, South American, Cloister Medicine... Besides there always (and today) existed traditional and popular folk medicine. Traditional medicine and traditional healers are known as: herbalists, bone-setters, spiritual healers, traditional birth attendances. Broadly spread and more active is popular, folk, indigenous, fringe medicine and self-care, a combination of tradition, popular believes, interpretation of experiences of people with official health care, and at present also marketing messages about drugs, natural products, "healthy diets" etc. "Scientific", biomedical, medicine and professionally trained health workers today occupy the dominant official position, although their position is in practice shared with folk medicine, complementary and alternative medicine and trade of different kinds of healers. Basically contemporary health practice is based on an allopathic approach to medicine (treating abnormalities by procedures with opposite effect than the signs of disease are showing, aiming to reach normal balance). New big expectations are vibrant today by new scientific successes in genetics, bio-molecular techniques, nano-technologies and new knowledge about human genome. However, the big expectations should not stop small steps forward in medicine in all directions. Scientific dreams and realistic empiricism have to progress together.

Kinds and types of health technologies

The *kind* of technology one may divide according to purpose of their use: from supporting longevity and promoting health to cure and rehabilitation, restoring of functions. The tendency today is to speak about prevention and mostly cure of illnesses. Notion of social

determinants of health is and was suppressed long time for political reasons, particularly in practical health activities. The same is with a dream about longevity, asking for more years to be added to life, instead of looking for more life to be added to years. The same is shown by orientation towards diseases contributing to mortality, and not enough attention paid to rehabilitation and diseases producing handicaps and poor quality of life.

The mixture of *types* of health technologies is of great interest for practice of health services. Within the complex health technology one could identify three broad types of interventions using very different approaches and run increasingly by specialists (medical specialists and healers who a very far one of another (e.g. psychiatrists and priests from biochemists and cytologists). However, often and even usually, these different types of health technologies have to be combined together and integrated, if one would try to achieve best results. The broadly defined types of health technologies are:

1. **Human care** and support, including psychotherapy and spiritual medicine;
2. **Drugs**, biological and chemical medicaments, including biochemical diagnostics;
3. **Physical medicine and surgery**, including “imaging” diagnostics.

In a way this division is following the division of traditional medicine: magicians (spiritual healers), herbalists and bone-setter. Today the second group (particularly pharmacological treatment) absolutely predominates in health practice, particularly because the first type of technologies (human care and support) is diminishing in spite of growing needs and requests. The first type of technologies is therefore increasingly more present in all kinds of alternative medical services as well as in all kinds of malpractices (2-6).

Another useful division of health technologies is according to *objects of application*: individuals; groups; communities; general public and environment. For instance, to solve the problem of alcoholism one may choose and combine individual treatment, group work, familial approach, health education of community and/or change in environment (production and prices of alcoholic beverages, new social way of entertainment etc).

Very important division of health technologies is according to *cost of equipment* per workplace. The economist EF Schumacher(7) stated in his book “Small is beautiful: economics as if people mattered” (1973): “If we define the level of technology in terms of “equipment cost per workplace”, we can call the indigenous technology of a typical developing country – symbolically speaking – a one-pound technology, while that of developed countries could be called a 1,000-pound technology. The gap between these two technologies is so enormous that a transition from one to the other is simply impossible. In fact a current attempt of developing countries to infiltrate the 1,000-pound technology into their economies inevitably kills off the one-pound technology at an alarming rate, destroying traditional workplaces much faster than modern workplaces can be created, and thus leaves the poor in a more desperate and helpless position than ever before. If the effective help is to be brought to those who need it most, a technology is required, which would range in some intermediate position between the one-pound technology and 1,000-pound technology. Let us call it – again symbolically speaking – 100-pound technology”. This statement written many years ago is still valid, and not only for very poor countries, than also for middle developed countries. The technology used at the primary level (in primary health care), both in developed and developing countries, should be an intermediate cost technology, 100-pound technology.

There are three additional questions important for appropriate use of technologies in practice: AT (Appropriate technology for actual needs), TA (Technology Assessment and monitoring its use), TT (Technology transfer and its influence).

Appropriate technology (AT)

Appropriate technology is [technology](#) that is designed or chosen with special consideration to the environmental, ethical, cultural, social and economical aspects of the community it is intended for. Such technology usually requires fewer resources, is easier to maintain, and has a lower overall cost and less of an impact on the environment compared to industrialized practices. Appropriate technology usually prefers in developing countries [labour-intensive](#) solutions over [capital-intensive](#) ones, and it is quite opposite in developed countries. (Labour-saving devices should be used when this does not mean high capital or maintenance cost.) In [industrialized nations](#), the term appropriate technology often refers to engineering that takes special consideration of its social and environmental ramifications. In practice, it is often solution that might be described as using the simplest level of technology that can effectively achieve the intended purpose in a particular location.

In deciding about appropriateness *seven main dimensions* have to be observed: safety, efficiency, efficacy, technical properties, organizational impact, social consequences and ethical implications.

Observations and experiences in practice as well as research have shown that appropriate technology will have the following characteristics:

- *Should be scientifically verified;*
- *Adaptive to local needs;*
- *Acceptable to those who apply it;*
- *Acceptable to those who use it;*
- *Easy maintenance;*
- *It must be economically affordable.*

Technology assessment (TA)

In order to evaluate the level of appropriateness of applied or a new technology, it has to be reviewed by a process known as **technology assessment**. The term "technology assessment" was introduced in 1965 during deliberations of the Committee on Science and Astronautics of the US House of Representatives and it was emphasized that the purpose of TA is to serve policymaking. In case of health technologies the first ("old") approach that it has to serve professionals in health practice, and only later when the problem of rising costs became unavoidable the "new" assessment went into hands of health politicians and financial authorities. The tension about for whom technology should be assessed is present even know as a well-known struggle of clinicians and administrators about professional autonomy. The third player started to be visible in shape of powerful industries producing equipment, biological products and drugs. As a judge, finally, public and users have been asked to join, but even now, although "need-based" principles have been established they remain weak partner.

Table 1. Methods of assessment of health technologies (8-11)

| | “OLD ” 1970-90 | “NEW” 1980-now | “NEED-BASED” |
|--------------------------------|--|--|--|
| For whom? | For clinicians and experts | For government and politicians | For public and users |
| <i>Measures: main criteria</i> | <ul style="list-style-type: none"> • safety • efficacy | <ul style="list-style-type: none"> • quality of life • feasibility | <ul style="list-style-type: none"> • relevance • social impact |

The procedure, by which the given technology is systematically examined if it is appropriate for existing health needs and other in accordance with other circumstance, includes the following pertinent questions and ways how to answer them:

- Is it necessary? Answer by estimating prevalence and priority of needs.
- Is it effective? Consider efficacy (potentials under optimal circumstances), coverage and compliance (acting of patients in accordance with the rules) in practice.
- Is it efficient? Answer by estimating cost in relation with effects (is it affordable and sustainable?)
- Is it safe? Answer by measuring adversary reactions and consequences.

There are also experienced suggestions what are the main issues in assessment (see more by Eisenberg JM, 1999) (12):

1. Health practitioners should give a lead what and how might be implemented. The assessment has to be done in circumstances in which it will be applied
2. The assessment has to be performed repeatedly, once is not enough
3. The last and most important goal of assessment should be improvement of existing health practice.

The technology assessment is an activity ensuring quality of care and progress of services. It is under strong pressure of economic constraints, producers, professionals and public opinion. A balance has to be found between conservative tendencies toward standardization, restrictions and de-stimulation, and innovative policies stimulating and propagating new technologies. The abbreviation STI means: science + technology + innovation.

The new technology has to be connected with new training of people and also often with reorganization of work itself. It is important not to forget that the management itself has its own technologies which can also be judged as appropriate or inappropriate for the given circumstances.

Transfer of health technology (TT)

Globalization is increasing the processes of technology transfer. Many producers of medical equipment and drugs are now big multi-national health companies. However, the system is biased so that technology, as well as science, are oriented towards needs of more

developed and more powerful part of the World. It can be illustrated by a quotation from WHO document (2004):

Gaps in pharmaceutical research and innovation

The World Health Organization released a groundbreaking report, which recommends ways in which pharmaceutical research and innovation can best address health needs and emerging threats in Europe and the world. The 17 priority conditions identified by the report are:

Future public health threats: 1. infections due to antibacterial resistance, 2. pandemic influenza;

Diseases for which better formulations are required: 3. cardiovascular disease (secondary prevention), 4. diabetes, 5. postpartum hemorrhages, 6. paediatric HIV/AIDS, 7. depression in the elderly and adolescents;

Diseases for which biomarkers are absent: 8. Alzheimer disease, 9. osteoarthritis;

Diseases for which basic and applied research is required: 10. cancer, 11. acute stroke;

Neglected diseases or areas: 12. tuberculosis, 13. malaria and other, 14. tropical infectious diseases such as trypanosomiasis, leishmaniasis and Buruli ulcer, 15. HIV vaccine;

Diseases for which prevention is particularly effective: 16. chronic obstructive pulmonary disease including smoking cessation, 17. alcohol use disorders (alcoholic liver diseases and alcohol dependency).

The successful technology transfer by itself presents problems for which the solutions are not always easy. The UN Millenium Project on Science, Technology and Innovation, Background Paper (2003) reviewed literature concluding that *messages are pessimistic, but in the same time full of hope*. The important problems in technology transfer are:

- *intrusive influence of political and economic relations with domination of powerful;*
- *impossible transfer if local capacities to whom technology is transferred are not developed;*
- *conflicts of interest between and inside countries, inside and between professional groups;*
- *local policies such as protecting autarchy of countries, autonomies of experts, and control of outs of transfer by powerful groups, criminal organizations and corrupted administration.*

CASE STUDY

The estimates of use of technologies in Europe and problems of drugs management in Croatia

There are estimates that in Europe might be spent 30-50% of health expenditures for performed health procedures and applied technologies without evidence of their effectiveness and only 15-20 % interventions in daily use were proven by controlled experiments. Poly-pragmatic use of drugs, misuse of antibiotics, overuse of pain-killers and all kinds of sedatives, are convincing examples. There is also evidence that there are socially determined differences, what is particularly evident in diagnostic and high-tech technologies. Some studies indicate that eve 40-60 % of technologies is irrelevant or applied and used in inappropriate way. The poor compliance with drug prescriptions is documented in many cases. The symbolic use of technologies is described in cases when

results of expensive laboratory tests and diagnostic examinations were never used for medical decisions. Misuse of technologies is also seen in the opposite situations when many useless tests, screening procedures and diagnostic procedures are ordered unnecessary. In routine health services the ineffective technologies are applied and systematically protected (see Banta HD. Eurohealth 1996).(13)

The health care expenditure is yearly in Croatia less than 500 € per capita out of which about 100 € for pharmaceuticals. Since it is not probable that health care resources will raise faster than BNP (about 7 500 € per capita) some measure to decrease deficit of the state, i.e. Croatian Institute for Health Insurance (CIHI) are inevitable.

Comparison of health care utilization in I-VI 2006 and I-VI 2007 shows the following: In case of same amounts the presented index would be 100, but in specific services it was:

| | |
|-----------------------------------|--------|
| Primary health care consultations | 100.37 |
| Specialist consultations | 95.84 |
| Number of prescriptions | 110.45 |
| Hospitalized patients | 99.49 |
| Days in hospitals | 98.56 |

Decreasing rights of patients and citizens covered at present by the insurance might increase their out of pocket participation payment for health care. The Basic drug list (completely covered by Insurance) must be reduced. Education of health workers and general public should increase awareness of the need to rationalize the use of pharmaceuticals, diagnostic tests and referral to specialist examination. Family medicine should take place if 75 % of their patients' health needs and not only of estimated 50%, what is now the case. Finally the studies on functioning of various parts of health service are of utmost importance. (Quotations and extracts form Vrhovac B, 2008).(14)

EXERCISES

Exercise 1: Mixture of medical technologies at present in primary health care practice

Task 1

Your task is to estimate by observation and by interviews with primary health care teams the share of types of technologies in their daily routine practice

Consider comparison of time taken to speaking with patient and total duration of consultation. Differentiate administrative part, diagnostic part and treatment part of consultation separately. Trace interesting combinations of various types of technologies and concentrate on treatment part. In case of the first type (human care) try to differentiate (timing is tentative): one-minute short advice (recommendation), 5-15 minutes supporting interview, structured counselling (several meetings of 15-30 minutes) and “small psychotherapy”(a lasting procedure). How much is therapist concentrated on patient himself and how much on his family, colleagues at work, neighbours, friends, or community at large? In case of second type of technology look what is prescribed and what is applied in clinic, was it recorded how drugs were used, how was the prescription explained etc.

It is not expected to make a complete survey but to get an impression with as many qualitative (narrative) observations as it is possible.

You are expected to prepare notes about your observations and reflections and then report them to the group and discuss findings. Is it necessary to change something in observed practice?

What you have learned during this exercise?

Reflect on your experience and discuss it with colleagues.

Exercise 2: Reflection on causes of present situation and possibilities to change them

Task 2

Your task: Using previous experiences (Exercise 1) and additional sources (articles, statistics, consultation with teachers and experts) in a group discussion discuss the following questions:

Is it true that some types of techniques are in practice over presented and some not used enough. Hypothesis might be: too many drugs and not enough physiotherapy and psychological support.

What might be the reason: is it poor education of health workers, wrong expectation of patients, influence of public media (what and how?), commercial marketing by industries? How could you explain the front page of BMJ published in 2003 with the title: “Time to untangle doctors from drug companies”?

Why it appeared when apparently both sides are having benefits: most of postgraduate training and almost all professional congresses and other meetings are sponsored by drug companies?

Other causes influencing the structure of technologies- Hypothesis might be: one could find causes in management and organization of health services, or general health policy? How are performed supervisions in-service instructions? Do “quality circles” (QC) exist?

What should and what could be done to improve the situation, if it is at all necessary? *Present essentials of your findings in a short written statement.*

What you have learned during this exercise?

Reflect on your experience and discuss it with colleagues.

Exercise 3: Technology assessment

The technological development essentially contributes to correct diagnosis and treatment, savings and quality of care. However, technology is useful only if it is applied in a relevant, reliable and accurate way. In many places it is used less than it would be necessary, but in others in the same country it can be over-used leading to unnecessary costs and inconveniences to people. Technology should be appropriate to local priority problems and to local conditions; adequate to personnel and to existing resource, acceptable to people. Permanent maintenance and logistic support, supervision and quality control are necessary.

Task 3

Your task: Select examples of technologies: chose as the first option an often used technology in health practice and as the second option a possible substitute which could replace the first one. Choose two example of “human care technologies” (e.g. history taking, consultation, motivational interview, psychological support, counselling, “small psychotherapy”) and two examples of technical equipment (diagnostic, therapeutic, surgical). Assess the following:

Position in the health care system (P): decide whether and where it should be placed in the health care system, e.g. primary health care, hospital, open to public etc.

Relevance (R): frequency of diseases and problems, severity and urgency, priority, relation to other problems, demand of people, contribution to common health.

Effectiveness, efficacy (E): diagnostic validity and reliability, acceptability and compliance, fringe benefit (how much is added to other existing technologies).

Safety (S): adversary reactions and discomfort for patients, safety for health professionals who work and servicing them.

Maintenance (M): possibility and cost for maintenance, local self reliance.

Acceptability (A): acceptance by people and professionals.

Cost and efficiency): direct and indirect cost, intangible (non-material) costs, maintenance, cost/benefit ratio.

Fill in the following form:

Table. Technology assessment - working table for comparisons

| Description | P | R | E | S | M | A | C | Choice and arguments |
|-------------------------------------|---|---|---|---|---|---|---|----------------------|
| HUMAN CARE Chosen example | | | | | | | | |
| Chosen substitute | | | | | | | | |
| EQUIP-MENT Chosen example | | | | | | | | |
| Chosen substitute | | | | | | | | |

Reflect in the group on differences of recorded assessments and practical consequences of your findings.

What you have learned during this exercise?

Reflect on your experience and discuss it with colleagues.

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RECOMENDED READINGS

1. International Journal of Technology Assessment in Health Care