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## MEDICAL INFORMATICS ETHICS (SUBJECT AND MAJOR ISSUES)

**Abstract.** Application of information and communication technology (ICT) in medicine and healthcare is a source of ethical questions of practical importance. We argue that medical informatics ethics (MIE) is not a new branch of applied ethics. It is rather a name under which some problems of medical (ME) and computer ethics (CE) are gathered. Some questions of application of ICT in medicine belong to CE and others to ME. In MIE medical ethics meets computer ethics. The borderline between them is neither clear nor easy to draw.

### Introduction

Computer ethics (CE) has its beginnings in works of Norbert Wiener, the father of cybernetics. Around 1948 he started considering the impacts of information and communication technology (ICT) upon human values like peace, knowledge, health, education, justice. Published in 1950, his book *The Human Use of Human Beings* [16] established his position as the creator of CE. Since the middle of the sixties when Don Parker started an investigation of unethical and illegitimate use of computers, CE is still under development. Creation of the natural-language processing system ELIZA by Weizenbaum was the next important event for CE. ELIZA imitated a psychologist. Weizenbaum was appalled when psychiatrists suggested that the program might be an acceptable substitute for human therapy. Horrified, Weizenbaum began work on the philosophical problem presented by the mechanization of human characteristics and talents. His book *Computer Power and Human Reason* [15] published in 1976, is Weizenbaum's exploration of his own misgivings about technology and Artificial Intelligence (AI).

Healthcare is a very important area of application of ICT since the technology has been developed. ICT has many advantages and can deliver great hopes for better healthcare. Advances in ICT provide users with new capabilities without ethical policies having been formulated to guide those users in their conduct. The concern about ethical implications of the use of ICT in

medicine/healthcare is ongoing. Today it is the subject of conference papers (e.g., ETHICOMP), publications (e.g., *Ethics, Computing, and Medicine: "Informatics and the Transformation of Health Care"* [3]), teaching (the course "Ethical, Legal and Social Issues in Medical Informatics" MINF 515 – 2 credits – is offered by Department of Medical Informatics & Clinical Epidemiology, Oregon Health Sciences University<sup>1</sup>; Medical College of Wisconsin<sup>2</sup> offers the course in "Ethics in Medical Informatics" MI-13201<sup>3</sup>). There are established organizations with the aim of setting and observing ethical standards of using ICT in medicine, e.g., The Health On the Net Foundation (HON)<sup>4</sup>. This non-governmental organization was created in 1995 under the aegis of the Direction générale de la santé Département de l'Action Sociale et de Santé: République et canton de Genève, Switzerland). Porfirio Barroso Asenjo at the conference ETHICOMP 95 presented "Health Informaticians' Deontology Code" (HIDEC) which had already been accepted in Greece. In 2000 the eHealth Ethics Initiative introduced an international code of ethics for healthcare sites and services on the Internet<sup>5</sup>. There are working groups dedicated to investigations of ethical, and legal issues of medical informatics, e.g., the Working Group "Ethical, Legal, and Social Issues" (ELSI-WG) of American Medical Informatics Association<sup>6</sup>. In 2002

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<sup>1</sup> See <http://www.ohsu.edu/dmice/courses/offering.shtml>. The course comprises the following topics: The protection of confidentiality and privacy in an electronic environment; Implications of the use of telemedicine and decision-support tools in diagnosis and treatment; The implications of electronic communication for the physician-patient relationship; Principles for design and functionality of consumer-oriented Web sites.

<sup>2</sup> See <http://www.mcw.edu/display/Home.asp>.

<sup>3</sup> See [http://www.journeyofhearts.org/jofh/jofh\\_old/minf\\_528/intro.htm](http://www.journeyofhearts.org/jofh/jofh_old/minf_528/intro.htm). The following topics are included in the course: privacy, security, confidentiality, encryption, coding, reimbursement, conflicts of interests, reporting, protecting information.

<sup>4</sup> HON's mission is to guide lay persons or non-medical users and medical practitioners to useful and reliable online medical and health information. HON provides leadership in setting ethical standards for Web site developers. More on the site: <http://www.hon.ch/> The Code of Conduct for Medication and Health Web Sites is translated in Polish by Piotr Kasztelowicz (<http://www.hon.ch/HONcode/Polish>) and presented at the II Conference of Medical Internet in 1997.

<sup>5</sup> <http://www.ihealthcoalition.org/ethics/ehcode.html>.

<sup>6</sup> The mission of the Group is:

- To draw attention to and raise awareness of ethical, legal, and social issues (ELSI-WG) in health informatics.
- To serve as a resource to help AMIA members and others address ethical, legal and social issues in professional and academic endeavors.
- To identify additional resources and develop educational programs and curricular materials for AMIA members and others.
- To conduct and support scholarly research aimed at identifying ethical, legal, and social issues in health informatics and at expanding discussions and analyses of these issues.

See <http://www.amia.org/working/elsi/main.html>.

at Taipei the International Medical Informatics Association (IMIA)<sup>7</sup> endorsed “The Ethical Code of Practice”<sup>8</sup>. A working group “Ethical, Legal, and Social Issues” of IMIA is represented by Peter Winkelstein (AMIA)<sup>9</sup>.

In this paper the methodological status and major questions of medical informatics (computer) ethics (MIE) will be discussed.

There are at least two sets of issues. One set concerns existing problems of medical ethics (ME) which are exacerbated by the employment of ICT in medicine, e.g., the problem of privacy and anonymity. The second set concerns potentially new problems, problems which as yet have not arisen, at least not in any significant way, e.g., the existence of cyborg.

MIE comprises problems of CE that are related to health and healthcare and questions of ME that arise from applications of ICT. It means that MIE is not a separate scientific discipline. It is rather a conglomerate of CE and ME. For example, the question of sale of drugs via the Web belongs to CE, but the questions concerning treatment supported by an expert program belong to ME. We will try to establish a demarcation line between problems of MIE that are considered by CE and problems of MIE that are subject of ME. As we will see the borderline is neither clear nor easy to observe. The frontiers are fuzzy. Our coverage of the main themes is by no means intended to be exhaustive, and several of the issues raised here need further consideration.

## **1. Subject of medical informatics ethics**

We will try to determine the scope of MIE. We will argue that it comprises several subjects of study.

In order to achieve our aim first of all we have to distinguish between ethical problems of impact of ICT on health and ethical problems of application of ICT in healthcare and medicine.

Technology enhances productivity, expands functionality and improves quality of life. This statement is especially true about ICT. But it is only one side of technology. Technology has also another side. It is potentially harmful to the natural environment and in particular to health, physiologically and

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<sup>7</sup> <http://www.imia.org>.

<sup>8</sup> IMIA Code of Ethics for Health Information Professionals: [http://www.imia.org/English\\_code\\_of\\_ethics.html](http://www.imia.org/English_code_of_ethics.html).

<sup>9</sup> See [http://www.imia.org/2002\\_scientific\\_map.html](http://www.imia.org/2002_scientific_map.html).

psychologically<sup>10</sup>. Long hours spent at the computer can cause problems with sight, spine, wrist. Health may be threatened by radiation emanating from computer monitors. It is possible, for example, that users will feel stressed trying to keep up with high speed computerized devices. Addiction to computers and Internet is already a social issue. For example, in 2004 a center to help addicted young people was established in Elk, a Polish town of 60 000 inhabitants. Problems of ICT effects on individual and on public health are subjects of work safety. Their ethical aspects are being considered by CE.

Medicine in the broadest sense comprises organization and administration of health services, prophylaxis, treatment and rehabilitation, manufacturing and distribution of medical equipment and drugs, study and education. Ethical problems both in medicine and in application of ICT are common to all these domains. It seems that as in ME as well as in MIE the problems should be divided according to human values. If so the MIE has to be focused on human and his/her health or – quite generally speaking – on human life.

The Hippocratic Oath expresses the principal precepts of ME. It is not only the oldest professional code but a pattern of professional codes at all. In 1976 one of the creators of CE, Walter Maner,

while teaching a medical ethics course, noticed that, often, when computers are involved in medical ethics cases, new ethically important considerations arise. Further examination of this phenomenon convinced Maner that there is a need for a separate branch of applied ethics, which he dubbed ‘computer ethics’ (Wiener had not used this term, nor was it in common use before Maner.). ... By the early 1980s, the name ‘computer ethics’ had caught on, and other scholars began to develop this ‘new’ field of applied ethics. [1]

Maner noticed that some old ethical problems are made worse by computers, while others are wholly new because of information technology. He<sup>11</sup> defined CE as a branch of applied ethics which studies ethical problems “aggravated, transformed or created by computer technology.” For Deborah Johnson, CE studies the way in which computers

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<sup>10</sup> The same is true about medicine. The famous Hippocratic aphorism *primum non nocere* (first do no harm) reminds a physician that he or she must consider the possible harm that any intervention might do. It is most often mentioned when debating use of an intervention with an obvious chance of harm but a less certain chance of benefit.

<sup>11</sup> Maner contributed not only to the theory of CE. Traveling around America he gave speeches and conducted workshops at conferences. He self-published *A Starter Kit in Computer Ethics* [9]. *Computer Ethics* [7], the first textbook – and for more than a decade, the defining textbook – in the field was published by Deborah Johnson of Rensselaer Polytechnic Institute.

pose new versions of standard moral problems and moral dilemmas, exacerbating the old problems, and forcing us to apply ordinary moral norms in uncharted realms. [7, p. 1]

James Moor taking into account that ICT provides us new capabilities and these in turn give us new choices for action, maintains that:

a typical problem in computer ethics arises because there is a policy vacuum about how computer technology should be used. [11, p. 266]

For Terrell Ward Bynum it is the best available definition of the field<sup>12</sup>. Krystyna Górnica-Kocikowska predicts that due to globalization of ICT, computer ethics will disappear. “Local” ethical theories will eventually be superceded by a global ethics evolving from today’s CE. “Computer” ethics, then, will become the “ordinary” ethics of the information age<sup>13</sup>. Deborah Johnson maintains that in information age CE will become ordinary ethics and ordinary ethics will become CE<sup>14</sup>. On Johnson’s view, in information age ICT will permeate all aspects of our everyday life. Its presence will no longer be noticed. Thus there will be no special CE problems. In all the ethical issues the questions of CE will be involved.

For the discussed concepts of CE, MIE is a part of CE that concerns ethical questions raised by application of ICT in medicine. ME is not proper to examine ethical problems of medicine implied by ICT technology. Moreover, in the future ME will be only a branch of applied CE (albeit – according to Górnica-Kocikowska and Johnson – the name CE may not be in usage).

Different approach to defining the field of CE is advocated by Donald Gotterbarn. For him CE is a branch of professional ethics. It concerns

the values that guide the day-to-day activities of computing professionals in their role as professionals. By computing professional I mean anyone involved in the design and development of computer artefacts. The ethical decisions made during the development of these artefacts have a direct relationship to many of the issues discussed under the broader concept of computer ethics. [5]

For this concept of CE we may maintain that as ICT engineers and medical doctors are different professions as CE and ME are different ethics. As long

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<sup>12</sup> Cf <http://plato.stanford.edu/entries/ethics-computer>.

<sup>13</sup> Cf [4].

<sup>14</sup> Cf [8].

as there is no such a profession as ICT medical doctor or medical ICT engineer, there is no MIE branch of professional ethics.

## 2. Major issues of medical informatics ethics

Even if we agree that MIE is not a separate branch of ethics, we should not negate that there are some issues involved as well in CE as in ME. The application of ICT in medicine posed a new set of ethical problems. These problems have been compounded by the increasing use of ICT for supporting clinical decisions, record keeping etc. These ethical problems have two dimensions, one of them is related to CE and the second one related to ME. MIE comprises such questions that need to be discussed as well by computer ethicists as by medical ethicists.

### 2.1 Code of ethics in medical informatics

In contemporary world to be professional means to have an ethical code. Medical doctors have the oldest code, rooted in antiquity, i.e., Hippocratic Oath. ICT engineers as any other engineers are challenged to be professional. In 1968 Donn Parker, whose work is the next important milestone in the history of computer ethics after Wiener, published *Rules of Ethics in Information Processing* [12]. The first code of professional conduct<sup>15</sup> adopted by the Association for Computing Machinery (ACM)<sup>16</sup> in 1973 was the upshot of his work. The IEEE<sup>17</sup> Computer Society<sup>18</sup> (IEEE-CS), the largest of so-

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<sup>15</sup> See <http://www.acm.org/constitution/code.html>. Its last version was adopted by ACM Council 92.10.16.

<sup>16</sup> See <http://www.acm.org> “ACM is the world’s oldest and largest educational and scientific computing society. Since 1947 ACM has provided a vital forum for the exchange of information, ideas, and discoveries. Today, ACM serves a membership of computing professionals and students in more than 100 countries in all areas of industry, academia, and government.” “ACM is dedicated to advancing the arts, sciences, and applications of information technology. With a world-wide membership ACM is a leading resource for computing professionals and students working in the various fields of Information Technology, and for interpreting the impact of information technology on society.”

<sup>17</sup> The IEEE (Eye-triple-E) is a non-profit, technical professional association of more than 360,000 individual members in approximately 175 countries. The full name is the Institute of Electrical and Electronics Engineers, Inc., although the organization is most popularly known and referred to by the letters I-E-E-E.

<sup>18</sup> <http://www.computer.org/> “With nearly 100,000 members, the IEEE Computer Society is the world’s leading organization of computer professionals. Founded in 1946, it is the largest of the 37 societies of the Institute of Electrical and Electronics Engineers (IEEE). The Computer Society’s vision is to be the leading provider of technical information and services to the world’s computing professionals. The Society is dedicated to advancing the theory, practice, and application of computer and information processing technology.”

cieties of IEEE, is engaged in several activities to advance the professionalism of, e.g., software engineering. “Software Engineering Code of Ethics and Professional Practice”<sup>19</sup> is a result of joint efforts of the ACM and IEEE-CS. The Code has been adopted by both the ACM and the IEEE-Computer Society in the official unanimous approval by the leadership of both professional organizations. In the preamble to the code we read:

Computers have a central and growing role in commerce, industry, government, medicine, education, entertainment and society at large. Software engineers, those who contribute by direct participation or by teaching, to the analysis, specification, design, development, operation, certification, maintenance and testing of software systems, have significant opportunities to do good or cause harm, to enable others to do good or cause harm, or to influence others to do good or cause harm. To ensure, as much as possible, that their efforts will be used for good, software engineers must commit themselves to making software engineering a beneficial and respected profession.

At ETHICOMP 95 Porfirio Barroso Asenjo presented “Health Informaticians’ Deontology Code” (HIDEC). The HIDEC is designed for the community of ICT engineers and users of the computers in the health sector. “The HIDEC will refer to the practices and behavior according to which health informaticians are expected to exercise their profession, offering their services, and also to the practice and behavior expected from the users.”<sup>20</sup> The primacy of wellbeing and quality of life of the public in all decisions is emphasized throughout the codes. What concerns the health, safety and welfare of the public is primary. “Public interest” is central to the codes.

## **2.2. Privacy and anonymity**

In the Hippocratic Oath there is a promise:

That whatsoever you shall see or hear of the lives of men or women which is not fitting to be spoken, you will keep inviolably secret.

One of the earliest CE topics to arouse public interest was privacy. In the comparative analysis of the codes of CE, we observe that “privacy” and “intimacy” are most frequently repeated. If we see on helmets of soldiers in Iraq the information about their blood group, we wonder where the borders

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<sup>19</sup> The code was distributed widely via *Communications* of the ACM and IEEE’s *Computer magazine*.

<sup>20</sup> See [http://www.ccsr.cse.dmu.ac.uk/journal/abstract/barroso\\_p\\_hidec.html](http://www.ccsr.cse.dmu.ac.uk/journal/abstract/barroso_p_hidec.html).

are between private and public information. It is a truism that the more relevant information about the patient the more effective treatment. Nowadays, more and more applications use sensitive and personal information. In the foreword to [10] Paul Davies writes that in the future:

there could be detecting devices so sensitive that they could pick up the equivalent of the drop of a pin on the other side of the world.

Monitoring and surveillance will become very easy. All the information does not have to be on “helmet”. It could be in an implanted chip. In such a case will our right to privacy be preserved? Will there be a place for intimacy, i.e., to that which is most reserved, most deeply felt by the human being? What does privacy mean in an information society? How our right to be alone, without being subjected to unsolicited and unwanted publicity should be conceived? What does intimacy mean in the information era? How the right to live in seclusion and anonymity can be understood? Respecting citizens’ privacy is becoming extremely important. Since the middle of the sixties the theory of privacy conceived as “control over personal information” has been elaborated. A stronger notion of privacy is defined in terms of restricted access. The concept of intimacy and private life in traditional social media focuses on the respect and the absence of interference in private lives of individuals. Since informaticians work with information, not with people who are the object of information, CE focuses more on personal intimacy, on private life, on anonymity and the confidentiality of information and data. Advances of ICT in compiling, storing, accessing and analyzing information, rapid growth of the Internet and the rise of world-wide-web have led to new privacy issues, such as data-mining, data matching, recording of “click trails” on the web and are forcing continual debate about the meaning of privacy.

Anonymity can provide many of the same benefits as privacy, e.g., in obtaining medical or psychological counselling, or to discuss sensitive topics. We need anonymity to preserve values such as security, mental health, self-fulfillment and peace of mind.

For medical reasons all the information about us should be as complete as possible if it concerns our health and it should allow at least medical personnel full and easy access to our records. In 1964 electronic devices were used to monitor the location of patients with mental health problems. Due to technology, e.g., VeriChip<sup>21</sup>, our health can be steadily monitored

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<sup>21</sup> VeriChip is an inert, encapsulated microchip that is energized and transmits its

and the proper help may be offered. In the future, people with microscopic implants will be able to be tracked using Geographic Positioning Systems (GPSs) just as cars can be now, only more efficiently. One need never be lost again! This technology is already adapted for noncustodial penalties, e.g., in USA, UK, Germany and France. The appropriate bill is under discussion in the Polish parliament, Sejm.

The ease and efficiency to gather, store, search, compare, retrieve and share personal information make ICT especially threatening to anyone who wishes to keep various kinds of “sensitive” information (e.g., medical records) out of the public domain or out of the hands of those who are perceived as potential threats. Security and integrity of data is a serious problem. There are people who are interested in our privacy and intimacy not only just for amusement as it is in the case of “big brother” TV series but also to work against our interest and even life. Privacy and anonymity can be exploited to facilitate unwanted and undesirable activities in cyberspace. Hackers use ICT to break into data bases, to change and even to damage some data. New kinds of computer viruses are produced. In 2004 the number of viruses was about 50% higher than in 2003. Professor Kevin Warwick from Reading University expects that new kind of “wireless” viruses can be used to attack implanted chips and the same, similarly as biological ones, they can directly threaten to the health. We are astonished that computers can be used to do harm. Though computer and Internet users seem not to be ignorant because they are able to use the most advanced technology, some of them are unimaginably irresponsible and dangerous. While from all over the world the relief was sent to people undergone by the Tsunami disaster some internauts prepared bogus sites to collect relief money for themselves. They made profits. But what about these internauts who used e-mail to disseminate false information about allegedly dead people?

Confidentiality of electronically stored patient information is a crucial issue of MIE. Complete information about health of an individual is important for care institutions, health agencies, and insurance corporations. Electronic records differently from paper records allow unprecedented in-

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information when activated by a VeriChip reader. VeriChip is about the size of a pen point hence it is virtually undetectable and practically indestructible once inserted under skin. The chip has no battery and never “runs down”; its expected life is up to 20 years. VeriChip was originally intended to function in much the same way a medical alert bracelet does by giving medical personnel life-saving information about a patient’s history. It is now being used for security and automated data collection, as well as medical, purposes. In 2004 the Food and Drug Administration (FDA) approved an implantable computer chip that can pass a patient’s medical details to doctors. – see <http://www.adxs.com/prodservpart/verichip.html>.

sight into patient's health profile. The ethical implications of preparation of such records need special consideration. The rights and duties of physicians, health information professionals, as well as hospitals and other institutions, have to be regulated by appropriate ethical codes and laws based on it.

### **2.3. Intellectual property**

One of the more controversial areas of CE concerns the intellectual property rights connected with software ownership. In any country healthcare expenses are growing faster than economy. ICT has borne hopes for lowering these costs. The costs of hardware drops according to famous Moore law<sup>22</sup>. The price of Rolls Royce would be \$1 if the prices in car manufacturing were decreasing similarly. For the implementation of ICT, the costs of software are crucial. It is similar in pharmacy: the costs of manufacturing are relatively low compared to the costs of formulating drugs. Hence generic medication can be many times cheaper. Since the beginning of the computer era mainly young people have claimed that in order to develop ICT "information wants to be free", in particular all programs should be available for copying, studying and modifying. Richard Stallman's "Free Software Foundation" is based on this ideology. Due to these who believe that all people have the right to access to the Internet and to use computers there are free and open source programs as, e.g., Linux created by Linus Torvalds. In the discussion of intellectual property rights it is already a custom to point out section 8 of the first article of the United States Constitution (adopted by Congress: 17 September 1787, put into effect: 4 March 1789) that empowers the Congress to legislate:

To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries<sup>23</sup>.

Many believe that this together with a free-market economy and adherence to it, also competition and diversity have decided about the role USA plays in science, technology and economy of the world. Creativity in the form of

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<sup>22</sup> Moore Law says that the number of transistors the industry would be able to place on a computer chip would double every year. In 1995, Moore updated his prediction to once every two years. While originally intended as a rule of thumb in 1965, it has become the guiding principle for the industry to deliver ever-more-powerful semi-conductor chips at proportionate decreases in cost.

<sup>23</sup> See <http://www.whatreallyhappened.com/RANCHO/POLITICS/DOCUMENTS//US.Constitution.txt.html>.

ideas, innovations and inventions, has replaced gold, colonies and raw materials as the new wealth of nations. Nevertheless, no right is absolute. The purpose of intellectual property rights is to promote economic efficiency, reward investment, access to information, for the benefit of all. The protection of intellectual property rights must be achieved in a constitutional setting which upholds other values for public good. Health is one of the most important values. Thus this value has to be crucial in conceiving of intellectual property rights in medical informatics.

Ownership of software is a complex matter. There are distinguished three types of ownership:

- copyrights,
- trade secrets,
- patents.

Several aspects of software can be owned:

- source code
- object code
- algorithm
- the way the program appears on the screen and interfaces with users.

In 2004 the Polish Government rejected a proposal of legislation that would make possible owning a patent on software. Many people (about 26 000) wrote letters of thanks. “Thank you, Poland” was put on the site of “Free Software Foundation”. Klaus Knopper, maker of Linuks distribution Knoppix, said that he would have to finish work since he had no possibility of paying for about 900 patents in Linux. According to Linus Torvalds if software were patented it would be the threat for future development of software that distribution is based on GNU<sup>24</sup> licence.

Mathematicians and scientists observe that monopoly for algorithms can deny others use mathematical formulas that are parts of these algorithms and – as a result – some parts of mathematics are removed from public domain.

ICT engineers support the idea of as wide as possible access to computers. Medical doctors support the idea of public healthcare. Both groups have to observe the intellectual property rights. MIE has to help to decide which understanding of these rights is true from the perspective of public good.

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<sup>24</sup> The GNU Project was launched in 1984 to develop a complete UNIX style operating system which is free software: the GNU system. (GNU is a recursive acronym for “GNU’s Not UNIX”; it is pronounced “guh-noo.”) Variants of the GNU operating system, which use the kernel Linux, are now widely used; though these systems are often referred to as “Linux,” they are more accurately called GNU/Linux systems. See <http://www.gnu.org/>.

#### **2.4. Responsibility for service reliability**

A few years ago in Białystok oncological hospital three patients were burned during radiological therapy. It was clear that if anyone was guilty it was one of the servicing personnel. The radiation apparatus is only a tool. But how it would be in the case of an accident when an expert system or a program was used? Is an expert system only a tool or rather is it a partner? The use of computer to support treatment implies a group of ethical questions: in what circumstances is it advisable to use an expert system? How can physicians determine if an expert system or a program is safe for human use? Who will be guilty in a case of an accident?

Many people naively believe that computers are infallible. But it is not the case. Programs are written by people. Even an often tested program may have a bug. Even lack of a comma may cause a catastrophe. Some faults are systematic as it was in the case of so called “the year 2000 problem”. Computers are electronic devices and even after many tests nobody can be certain a computer used to support medical decision has no material defect. The collection of accidents caused by computer systems and related technology is enormous<sup>25</sup>.

It is obvious that medicine supported by ICT is more efficient. The common truth that the more and better information, the better decisions are especially important in medicine. It is also confirmed by experience that intelligent systems provide better care than clinicians for patients.

That into whatsoever house you shall enter, it shall be for the good of the sick to the utmost of your power, your holding yourselves far aloof from wrong

is promised in the Hippocratic Oath. According to the principle of beneficence the patients should be treated to the best of clinicians’ abilities. Development of ICT for the purposes of medicine and its application in healthcare is a moral imperative.

Computers make errors. Who is responsible for their errors? Some authors say that it is inappropriate to hold computer responsible. Computers are not simply responsible beings. The answer seems to be acceptable for contemporary computers but it may not be the case for future ones. Computers based on learning algorithms and equipped with communication skills may be entirely able to learn interact appropriately with both its environment and its users.

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<sup>25</sup> To find more information about this see e.g., <http://www.mirrors.wiretapped.net/security/info/textfiles/risks-digest/illustrative.html>.

The question of responsibility for a casualty in a treatment supported by an intelligent system – such an eventuality could never be excluded<sup>26</sup> – is one of the most important and complicated problems of MIE and its significance will increase as ICT employment augments medicine. AI system has two components: knowledge-base and inference engine. In medicine both these components should be based on experience of physicians. Is it possible to express this experience in computer language? For at least three reasons the answer seems to be negative: first, particularities of each individual patient; second, sociocultural and, third, axiological character of this experience.

In 1968 Marvin Minsky defined Artificial Intelligence as:

...the science of making machines do things that would require intelligence if done by men.

If machines behave in much the same way as humans do, the issue will arise of whether or not they are things with moral rights and responsibilities. If they behaved like us, would we be justified in treating them differently? We ask if an intelligent system is responsible or at least participates in responsibility of a man that it employs. We ask if a system with learning capabilities is a tool, a partner or a hybrid of the two? A tool could not be responsible but a partner is co-responsible. May it be co-guilty, too?

## **2.5. Medical ethics and Internet**

The Internet is the discovery that changes life and culture, science and medicine more than any earlier discovery. Its significance for healthcare and medicine cannot be overestimated. To take advantage of it we have to understand its nature.

First of all we have to take into account anarchic nature of Internet. What does it mean in the case of medical Internet?

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<sup>26</sup> A. Turing, one of the fathers of informatics, wrote:

[I]f a machine is expected to be infallible, it cannot also be intelligent. There are several mathematical theorems which say almost exactly that. But these theorems say nothing about how much intelligence may be displayed if a machine makes no pretence at infallibility. See [14, p. 124]

My contention is that machines can be constructed which will simulate the behaviour of the human mind very closely. They will make mistakes at times... and on the whole the output of them will be worth attention to the same sort of extent as the output of a human mind. The content of this statement lies in the greater frequency expected for the true statements, and it cannot, I think, be given an exact statement. See [13, p. 129]

Prophylaxis is one of *prima facie* employment of the Internet. There are many sites with such a task, e.g.,

<http://www.telezdrowie.pl/>,

<http://diagnoza.sccs.pl/>.

The first website is one of the best medical portals in the world. It offers an interactive service for diagnosis and rehabilitation of the senses responsible for communication. How can we distinguish reliable sites from unreliable ones? Anybody may have their own site. We may find sites dedicated to homeopathy, bioenergotherapy etc. Moreover, people without any license may offer medical advice. Patients have to be protected from sub-standard care. Any kind of censorship is excluded. Internet is a decentralized medium, thus the idea of an institution to ensure quality seems to be unrealistic.

About a third part of spam<sup>27</sup> that I receive deals with pharmaceuticals. Some of them are available at pharmacies only with doctors prescriptions. Some of them are legally available in, e.g., USA but not admitted in Europe. Here is an example of such a spam:

*Online pharmacy – Visit our online store and save. Save up to 80% compared to normal rates. All popular drugs are available, including Vicodin and Hydrocodone! – World wide shipping – No Doctor Visits – No Prescriptions – Next Day Priority Shipping – Discreet Packaging – Buy in Bulk and Save! We make it easier and faster than ever to get the prescriptions you need. Go here: <http://ziagra.net/rx/phrm/> Simply Rx is your convenient, safe and private online source for FDA approved pharmacy prescriptions. We sell brandname and exact generic equivalents of US FDA approved prescription drugs through our fullylicensed overseas pharmacy. Upon approval of your medical information, a licensed physician will issue a free prescription which can be filled and shipped to you in one business day.*

Is it possible to control these dealings?

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<sup>27</sup> Spam - according to standard definition – is an electronic message if:

(1) the recipient's personal identity and context are irrelevant because the message is equally applicable to many other potential recipients; AND (2) the recipient has not verifiably granted deliberate, explicit, and still-revocable permission for it to be sent; AND (3) the transmission and reception of the message appears to the recipient to give a disproportionate benefit to the sender. See <http://www.nospam-pl.net/standard.php>.

The name is in honour of Monty Python sketch that was first broadcast in 1970. In the sketch, two customers are trying with no result to order a breakfast without SPAM. SPAM was one of the few meats excluded from the British food rationing that began in World War II.

Medical practice without licence of a given state is a subject of criminal prosecution. We may wonder if it is permissible for a doctor from USA to consult via Internet a patient in Europe. As we know, there is no problem with such a consultation in the case of alternative medicine.

There are many ethical and legal restrictions of employment of Internet in medicine and healthcare. These restrictions do not concern the alternative medicine. MIE has to elaborate ethical standards for the Internet respecting the nature of this medium.

## **2.6. Cyborg**

Ethical questions raised by transplantation, genetic manipulation or – generally – the questions of bioethics are subjects of many current discussions and common knowledge. Using of abiotic devices does not seem to have any ethical implications. Is anyone asked about ethical implications of wearing glasses? Are there any ethical problems with denture or an artificial limb? Professor Religa’s program of construction of an artificial heart seems to escape the ethical problems raised by transplantation.

Humans dream of being immortal and perfect. For believers the accomplishment of the dream is possible in heaven. Everybody strives to accomplish this dream on the earth. ICT may help to repair imperfections and improve and lengthen human life.

The idea of the organic-artificial creature has existed in human culture. It has old roots in Indian, Chinese, Japanese, and Western culture. In the middle ages the alchemists tried to grow homunculi, “little men”. Frankenstein is the commonly known name a monster animated by a man who, then abandoned his creation because its appearance horrified him. Since the 19th century the advances of science and medicine began to make the realization of such fantasies possible. In 1926 J. D. Bernal, the great British scientist, described humans involved in colonizing space. Interfaces between humans and machines allowed them to attach a new sense organ or a new mechanism to operate. The emergence of cybernetics began scientific consideration of this old idea.

In 1960 Nathan Kline from Rockland State Hospital’s Research Laboratory had been asked by NASA to participate in a conference about human space exploration. Together with his colleague Manfred Clynes<sup>28</sup>, they proposed a number of ways humans could be modified to survive in

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<sup>28</sup> Clynes combines the artistic sensibility of a world-class pianist with a relentless technical genius powered by a restless intelligence and an exuberant enthusiasm for knowledge. It is a unique combination.

space. “Cyborg”<sup>29</sup> refers to the conception of an enhanced human being who could survive in extraterrestrial environments. Cyborg is a creature which is a mixture of organic and artificial parts. Generally, the aim is to add or enhance the abilities of an organism by using technology. It is a creature that combines informatics, mechanics, and organics. Clynes and Kline concluded their seminal article with the comment that cyborg developments:

will not only make a significant step forward in man’s scientific progress, but may well provide a new and larger dimension for man’s spirit as well. [2, p. 33]

There are good reasons to maintain that cyborg transformations will continue and become more profound and on some day in the distant future will end with even disembodied intelligence (by Clynes labelled Cyborg V).

Advances in medical cyborg research are changing the meaning of death and life, for example. Doctors no longer speak of death plain and simple. Patients are “single-dead”, “double-dead”, or “triple-dead” depending on if, or how, their organs can be harvested for transplantation [6]. Our senses, memory and even such capabilities as creativity and reasoning ability can be enhanced by ITC products. Professor Kevin Warwick from Reading University deems that in future people not equipped with computer parts will belong to a subspecies. The distinction between human and machine is ever more unclear. From the ethical angle it is acceptable and even desirable to help people to be “normal”. The making of a superman is ethically dubious. But where is the difference? What does it mean to be “normal”?

There are prohibited experiments with atomic, chemical and biological weapons. In many countries some biotechnology experiments are prohibited. Ought it to be the same in the case of ICT? To answer this question we have to answer some other questions: Is there any pure research that should not be undertaken?, Is there any technology that should not be developed?, Are there any limits of use of a technology?

### **3. Conclusions**

The answers to these raised questions are not simple. ICT as any other technology can be put to both beneficial and harmful uses. The beneficial consequences are not sufficient to justify any research. One thing is sure:

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<sup>29</sup> The term “cyborg” was coined by Clynes from “cybernetic” and “organism”, marrying the reality of the organic body with the idea of cybernetics.

we have to have a profound respect for life. For physicians, human life is the highest value. The human being is not only a biological entity. We have exceeded the pure biological world. Human spirit is the value that has to be protected, too. Human dignity needs to be respected. Here ME meets with any technology in particular with ICT. Medical ethics and informatics ethics have joint problems. The problems can be gathered under the name “medical informatics ethics”.

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