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Computer Based Drug Therapy: Challenging More Than 700 Years of Traditions

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Abstract

In most medical regimens, drug therapy is essential. Drugs are used for preventing diseases, treating diseases as well as minimising the effects related to diseases that can not be cured. In Finland, three partners - the patient, the physician and the pharmacist - are needed for carrying out drug therapy. However, there is quite little co-operation between the three partners. The physician prescribes the drug, the pharmacist delivers the drug, and medication compliance depends on quite many things, e.g. on the drug information the patient has received.

This paper describes how computer-based information technology (IT) is used in a Finnish pharmacy and discusses how this kind of technology could be used in order to make drug therapy more effective and efficient than before. The structured nature of the information concerning prescriptions is an excellent starting-point for using IT. Deplorably, the structured nature of the information is not also the solution for changing the ancient old Finnish traditions in drug therapy.

1. Introduction

In Finland, around 2 million people of the total population of 5,1 million were using prescription medicines at a defined moment in 1995/1996. The proportion of users increased with age, in particular after 45. The proportion of the population that had used non-prescription drugs (OTC drugs; Over-The-Counter drugs) in the two days preceding the interview was 28%. [1] Costs of drugs in outpatient care are about 15% of the total healthcare budget of Finland [2]. In 1999, drug sales have grown by roughly 10% [3], which means that drug costs are escalating much faster than other healthcare costs, and it is very probable that without any actions the trend is going to be still more prominent in the future. The number of the old people is increasing and the old people use more drugs than the younger people.

For carrying out drug therapy, the three most important participants are the patient, the physician, and the pharmacist. In addition to authorities and drug industry, the three participants can also affect costs. For example, physicians can prescribe generic medicines, and pay attention to how new expensive drugs are used. In this case, we are reasoning out *possibilities to improve co-operation between the three partners in order to promote the accomplishment of drug therapy*. There is a rough hypothesis, that one third of drug therapy is accomplished as prescribed, one third is accomplished partly, and one third never comes true. It is not reasonable, that a patient visits a physician, who prescribes drugs to the patient, but the patient does not go to a pharmacy to get the drugs. It is very important, that the participants of drug therapy begin to work together in order to improve the total well-being of the patient, and also the patient is active to take care of her own health. This is also very important concerning the costs, as self-care is regarded as a mean with strong future potential to control demand for healthcare services and costs of healthcare [4].

Providing and sharing knowledge is one of the most widely used methods for encouraging self-care [5], and knowledge is important also for patient and medication compliance [6,7,8,9]. For providing and sharing knowledge, co-operation between the physician and the patient is important and a common language is needed. The patient must be able to tell the physician about feelings and emotions related to diseases, as well as about medical facts, e.g. drugs used, so that the physician can be confident of the information. It has been evaluated, that even 80% of physicians do not trust the medical information they get from their patients [10].

For enforcing co-operation and sharing knowledge, computer-based technology is a solution, but it is rather recently that primary healthcare has started to use computers as means of treatment support, at least in Finland. Nevertheless, one of the very first applications of expert systems technology was medical diagnostics MYCIN [11]. However little by little, the dramatic expansion in new technology will have profound effects also on practices of healthcare and on the relationship of the physician and the patient [12]. For example, patient education and adherence to treatment plans may be enhanced via e-mail between the physician and the patient. However, good co-operation and communication between the physician and the patient is not enough for enabling efficient and effective healthcare in general, and concerning drug therapy, the pharmacist is an essential partner to co-operate. Pharmacies are natural sources to give information and counselling in self-medication, and physicians need information of drug purchases. Pharmacy records contained 80% of all the prescriptions found at the home interviews of older patients, while physicians knew only 40% of the prescriptions [13].

The remainder of this paper is organised as follows. The next section presents special features of the Finnish practices concerning the prescription and the reimbursement system. The third section includes background information of computer-based communication and information systems that could be used in drug therapy. The following section describes, how a Finnish pharmacy uses computer-based systems in drug therapy, and the fifth chapter offers the evaluation of the pharmacy systems described. The final section discusses the future possibilities of computer-based systems in drug therapy. How the slow pace of changes in roles and activities of the three partners participating in drug therapy can be fitted together with the fast development of computers? Technical problems related to enhancing communication and information management are easily solved in the context of drugs, because most information is quite structured, but numerous other obstacles have to be overcome.

2. Current practices of drug therapy

In Finland, OTC and prescription drugs are available only at community pharmacies. All or part of the costs of prescription drugs for the treatment of a disease is refunded by the Social Insurance Institution (the SII). There are three refund categories (the basic and the two specials) and the additional refund. The Council of State approves the list of the severe, long-term diseases conferring the right to the special refunds and the associated drugs. The additional refund means that a patient's out-of-pocket drug costs exceeding a specified annual limit are refunded in full. [14]

Refunds for the costs are normally deducted from the price of the products at the pharmacy, and the pharmacy takes care of the administrative issues with the SII. Direct refunds from pharmacy –practice demands patients present the SII card of the person for whom the drug is prescribed. Every Finnish person has a health insurance card, which consists of information of the owner of the card, e.g. the personal number. If necessary, there is also the information, whether a person has a disease conferring the right to a special refund. The personal number is presented in numeric/ alphabetic format and as a bar code, all other information is only in numeric/alphabetic format.

In Finland, the patient must visit a physician to get a prescription. Namely, the Finnish laws state that *the physician has to make the diagnose by herself* before prescribing medication and the diagnose has to base on medical examinations or some other relevant issues. The prescription is obligatory for delivering drugs in the pharmacy. Prescriptions issued on paper or via telephone are legalised, and from 1996, it has also been legal to send a prescription to a pharmacy either using fax or in electronic form. The prescription consists of six parts: (i) information of the patient, (ii) the word "recipe", (iii) the "praescriptio", (iv) the "subscriptio", (v) the "signatura", and (vi) the "inscriptio". Today, the "praescriptio" consists only of the name of a medicinal product in an original package. The "subscriptio" consists of the directives related to the delivery, the "signatura" consists of the instructions to the patient, and the "inscriptio" consists of the facts related to the physician prescribed [e.g. 15].

Face-to-face meetings between the physician and the patient offer one possibility to share information. Physicians are the persons from whom patients prefer to receive information about drugs [16,17]. Pharmacists are not regarded as important to give information [16] and nurses do not play a role in issues concerning medication [17]. Most patients say that they receive enough of information from a physician about the following issues: the name of the drug, the reasons of medication, the dosage, and the duration of the therapy. However, there are some issues from which patients experience that they do not receive enough of information: how the drug must be stored, how different OTC and prescribed drugs interact, what happens to the body, if a dose is missed, and how side-effects can be avoided. [18]

Most patients, especially the older people, do not have enough information about drugs. Many of them are not able to benefit from drug information offered at pharmacies, because they do not even know, that the pharmacist could offer them more the medication information they want [19]. For example, in Finnish pharmacies, information is given to patients mostly on pharmacists' initiative, and approximately 40% of the patients receive some verbal counselling, and 10% are provided with written information [20]. It is not strange, if especially Finnish people do not know that the pharmacist can inform of the proper use of drugs. Namely, informing patients in the pharmacy was forbidden in Finland up to the year 1983, stated in the law of 1688 with roots from the 13th century [21]. It took above 700 years to bring physicians and pharmacists to work together in drug therapy, and to give the pharmacist the permission to make sure, that the patient knows how to use drugs in a proper and safe way. Before the pharmacist only delivered drugs without saying anything about the use of drugs.

Another factor has also modified activities of pharmacists. Pharmacists do no more manufacture drugs at pharmacies, as most pharmaceutical products are delivered in original packages. So, the activities and roles of pharmacists have turned from product to patient orientation [22]. There is really need for patient orientation and guidance, because even OTC drugs may induce adverse effects, and different drugs used together may induce from harmless to dangerous interactions. In the USA during 1982-1994, the percentage of patients receiving written information at pharmacies increased

tremendously from 16% to 59%, and at a physician's office, spontaneous verbal counselling increased a little and the percentage receiving some written material increased from 5% to 15% [23].

3. Computer-based systems and drug therapy

Computer-based systems are used to improve information management and knowledge sharing. At least two main types of computer-based systems can be separated: communication systems and information systems [24]. Both of the systems are tightly related to the question of unambiguous interpretation of data. Computer-based interpretation of data is not possible, if the concepts used are not unambiguous [25]. Additionally, human-to-human communication via computers is not reasonable, if the information exchanged is not understood as meant. As to unambiguous interpretation of data, the context of drug therapy is excellent compared with most medical information. In itself, the form of the prescription is structured: the prescription consists of six parts and the order of the parts is always the same. Also, the content of the parts is strictly standardised and most concepts used are unambiguous. The data of pharmaceutical products is very structured and unambiguous. The data concerning diagnoses, allergies, medication, and physicians needed in prescriptions is also quite easy to interpret in one way only, e.g. compared with subjective symptoms of diseases, treatment or nursery practices, and prognoses that are not needed in prescriptions. In spite of the unambiguous nature of the language used in prescriptions, laymen do not understand the language. Thus, the most important partner as to the outcome of drug therapy - the patient – is an outsider without extra counselling from the physician, from the pharmacist or via computer-based delivery of information. Choosing the optimal way to inform depends on quite many things.

There are four ways to exchange information depending on the separation of the participants over time and distance (Figure 1). If the sender and the receiver of information can be face-to-face, communication enables interpretation. Also the origin of information is known, and there are no problems related to authenticity and privacy. On the other hand, it may take long time, before the participants can meet face-to-face. In order to help communication, if the participants can not be at the same

Separation of participants over distance	Separation of participants over time	
	Same time	*Different time*
Same place	Face-to-face	Local message
Different place	Remote conversation	Remote message

Figure 1. The ways to communicate in the four different types of interactions based on the separation of participants over distance and time [26].

place at the same time, different facilities can be benefited from. For synchronous communication, the use of telephone has been the solution in the context of prescriptions. Video-conferencing may be a solution of the future, especially patients could benefit from this solution, and the professionals could benefit from shared documents. There are many solutions also for asynchronous communication: sound can be transferred via voicemail and data via fax, e-mail, and newsgroups. Asynchronous e-mail [27] and voicemail [28] are suitable for routine communication, and voicemail may have significant future potential for improving the process of care [29]. Using the different facilities mentioned for non-face-to-face communication, the issues related to authorisation, authentication, authenticity, and privacy must be solved.

Abilities of information systems to assist in interpretation of data vary [24]. Interpreting data is essential for benefiting from the data, and when using computers, interpretation can be shared between the computer-based system and human. If the system has not much ability to interpret data and it is used only a repository for data, it acts as a database (Figure 2). Data viewers are systems that have abilities to retrieve from the database the data wanted e.g. by using special words like "and", "or", and "not". The burden of interpreting the data is shared between the computer and human. In expert systems, interpretation of data is mostly the task of the system. The system may use e.g. rules of formal logic, rules of mathematics, probabilities, fuzzy reasoning, and neural networks. Expert systems support the decision making actively, because they reason the general data and the patient specific data by the different models. The way data viewers and databases support the decision making is passive. The human must reason the data by herself, but the data needed for this reasoning is offered by the computer-based system [30].

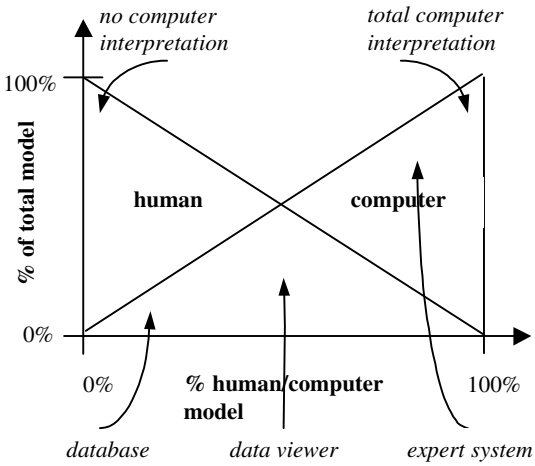

Figure 2. Humans and computers can share the burden of data interpretation [24].

The Internet is both for communication (e.g. e-mail, newsgroups) and for information interpretation being only a database or offering abilities of a data viewer.

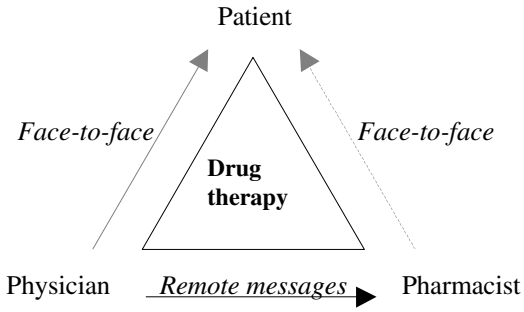

Figure 3. The most important ways to communicate and the main directions of communication in drug therapy in Finland since the year 1983.

Figure 3 presents, how communication and information management has been organised in drug therapy in Finland. For centuries, communication between the patient and the physician has been face-to-face. Face-to-face communication between the patient and the pharmacist was enabled by the Medical Act in 1983. The patient has not been active in these communications. The physician and the pharmacist have communicated via remote messages using prescriptions issued on paper, and sometimes via remote conversations using telephone, but no feedback has been given. Information management has been manual, with the exception of some trials. A smart card was tested by the SII during the years 1989-1993. The SII was interested in, whether smart cards can be used in the reimbursement process of medical expenses, in which process there is need to transfer both medical and financial information from one organisation to another, need to emphasise secrecy, and the process is customer focused. [31] In the beginning of the 1990s, electronic patient records were not used in Finland, but 25% of all Dutch physicians had electronic patient records as the only media to store documentation in 1993. Especially they liked to prescribe electronically. [32] If the prescription system is compatible with the electronic patient record system, the data of the prescription can be transferred automatically from system to system, and data has to be inputted only once. In spite of these new possibilities offered by computer-based systems, the interactions between the three participants in drug therapy were mostly the same in Finland in the 90s as they had been for centuries.

4. A Finnish pharmacy using computer-based systems for enabling drug therapy

The pharmacy of the case has two outlets and also a small stand for selling drugs. In the year 1998, the total sales of the pharmacy were FIM 47 million, and the breakdown of the total sales was the following: prescribed medicines 76%, OTC drugs 17%, and other products 7%. The number of prescriptions delivered was 181000, of which amount the proportion of medicines compounded in the pharmacy was under 0,5%. In 1998, the number of personnel was 39. The strategy of the pharmacy is patient oriented professional pharmacy. This means that patients are the first priority in the pharmacy and the pharmacy focuses on all activities related to delivering drugs. It shares information and gives advice about drugs: their dosages, effects, possible adverse effects, and costs. In addition to verbal guidance, the pharmacy provides written information. IT is used for this purpose, too. The pharmacy is interested also in health promotion and prevention of diseases in general.

The pharmacy has been quite active to develop and benefit from modern information technology, and it has had computer-based systems since the year 1986. It was one of the pharmacies, which participated in the smart card –trials of the SII during the years 1989-1993. The information technology used in the pharmacy in the year 1999 can be described as follows. The main pharmacy and the stand are connected with an ethernet solution, and ISDN (Integrated Service Digital Network) provides connection for the subsidiary pharmacy. The computer-based systems of the pharmacy offer possibilities both for communication and for information management. Communication is enabled via different e-mail applications, and information systems have different abilities for data interpretation from working as a database to being an expert system. The systems are not real time, but run in batches every five minutes. The concrete

interaction between the systems and the pharmacist is via function keypads. The data consists of three different types of data: the data related to drugs, the data related to patients, and the data related to physicians.

The pharmacy receives in electronic form the information related to all pharmaceutical products, to which the marketing authorisation for Finland is granted. The product number and the ATC (the Anatomical Therapeutic Chemical classification) code are the two most important details of the information of a pharmaceutical product. The product number identifies every pharmaceutical product, also different package sizes, sold in the Nordic countries. The ATC code divides the drugs into different groups according to the organ or system on which the drug acts and/or according to therapeutic and chemical characteristics. The pharmacy modifies this basic data for its own use by doing e.g. the following actions: (i) the data of some drugs is activated in order to form the assortment of drugs of the pharmacy, (ii) pharmacy specific data is inserted to the data of the activated drugs, (iii) the mathematical formulas of the system are used for pricing, and (iv) values are given to the parameters that are needed in the computer-assisted interpretation of the data.

The data of patients consists of information of the valued customers of the pharmacy. A patient who wants to be a valued customer subscribes a contract with the pharmacy and gets a card of a valued customer. The aim of this contract is to improve the well-being of the patient: the contract authorises the pharmacy to store data of the patient, and permits communication between the pharmacy and the patient's physician concerning drug therapy. The data of patients is received either from the personal SII card or from the patient. The SII data is confirmed and consists of the name, the personal number, and the stamping, if the person has a disease conferring the right to the special refunds. All other information is received from the patient: information about chronic diseases except those on the SII card, allergies, medication and physicians. There is also details concerning methods of paying. Workplace sickness funds or social authorities can take part in paying the costs of drugs. It is also possible for a valued customer to make a contract that the pharmacy can charge to the bank account of the valued customer with purchases of drugs. Of course, the drugs purchased at the pharmacy make one part of a valued customer's information.

The data of physicians consists of information about the physicians whose prescriptions have been delivered at the pharmacy. The main points are the name of the physician, the social security number related to the physician's profession, the telephone number, and the bank account number. The bank account number is needed, if the physician wants to have fees from prescriptions via telephone. The pharmacy charges the fee, when the patient visits the pharmacy in order to get the drug. The patient pays only the part of the fee not reimbursed, but the pharmacy takes care of all the money transfers needed.

The process of delivering the prescription drug begins, when the pharmacist gets the prescription mostly issued on paper or via telephone. Thus, the pharmacist must first digitise the prescription for the SII in order to manage the reimbursement process. After having sent to the SII the information of the prescriptions, the pharmacy is allowed to store the information concerning valued customers, but not the prescriptions of others. Digitising the prescription means, that the pharmacist does exactly the same activities as the physician prescribing the drug, but with a different media. The first part of the prescription is digitised as follows. The pharmacist can handle the name and the personal number of the patient by using a bar code reader and the card of a valued customer or the personal SII card. The right to special refunds must be inserted manually, if the patient is not a valued customer. If the patient to whom the drug is delivered is a valued customer, the right to special refunds is inserted automatically. The possibility of basic refunds must be inserted manually in all cases. If wanted, the information of a valued customer can be searched also by using three alphabets of the surname and the first name. The second part of the prescription is digitised automatically, and the third part (the "praescriptio") is digitised using search function. The number of alphabets used in the search key is not defined, and the more alphabets are used, the less alternative pharmaceutical products are offered by the search function. The "subscriptio" must be inserted using the keyboard, and digitising the "signatura" has solved in an analogous way as digitising the "praescriptio". Namely, the pharmacy has digitised the most commonly used instructions for the patient into a database. If the information needed for the "inscriptio" is found in the database of the physicians, the rest of the digitising process goes on quickly. Otherwise, the information of the physician must be inserted manually.

If the prescription is issued on paper, the digitising process is ready, and the drug can be delivered to the patient. The system has printed the "signatura", and it has also calculated the costs of the patient enabling to get direct refunds from the pharmacy. If the patient is a valued customer and has some agreement of the paying, the system has interpreted also these details automatically.

If the prescription is via telephone, five parts of the digitising process are exactly the same as with prescriptions issued on paper but the sixth part, the "inscriptio", consists of the facts of the pharmacist and is done automatically with the pharmacist's alphabets. In addition to digitising the prescription, the pharmacy must digitise the monetary issues needed in prescriptions via telephone. If the information of the physician prescribed is in the data of physicians, digitising is done quite

automatically, in other cases information must be inserted via the keyboard.

About 1-2% of the prescriptions is not unambiguous and the pharmacist must communicate with the physician about the details concerning the prescription. In most cases, the communication model is remote conversation via telephone, which is not always very attractive. The pharmacist can not take a direct call to the physician, but must first call the call central. At the call time, however, another patient may visit the physician, and in this case the physician has a very limited possibility to talk with the pharmacist. A process via telephone is needed also, if the patient visits the pharmacy in order to get her prescription repeated (repetitio) by the physician.

Physicians do not get any feedback of their prescriptions from the pharmacy, but the SII, to which the pharmacies send information of all prescriptions delivered, informs every physician about the prescriptions of the physician and the prescription practices of the whole country in an aggregate form. So, physicians can benefit from this information when reasoning their own general medical guides, but reasoning the medication compliance of a single patient is not possible.

In this pharmacy, the Internet is used in an excellent way for delivering information. The pharmacy has a Web site, which offers possibilities both for communication and information sharing. Patients can send feedback to the pharmacy either with one's own name or without any name. Patients can also ask questions about use of drugs and one of the pharmacist answers the question within 24 hours. The information of the site consists of facts about the pharmacy outlets, a link to the pharmacy chain Hyvan Mielen Apteekit and the table of contents of the customer publication of Hyvan Mielen Apteekit. The site of the pharmacy chain mentioned contains information about the prescription, medical instructions for a journey, first aid guidance by the Red Cross of Finland, information of OTC drugs, the Pharmaca Fennica (information of all drugs in Finland), and links to the sites of the SII and the FiMnet (the Finnish Medical Network). All the information and links offered are of very high quality and produced by professionals. However, the patient must be the main interpreter, but the links work as data viewers.

E-mail, is used very rarely for communication and knowledge sharing between physicians and the pharmacy.

5. Issues learned from the pharmacy case

The pharmacy has used computer-based communication and information systems over 10 years. At first, the technology made it easier to manage the reimbursement affairs with the SII. The options to automate data input in digitising the prescription and to use mathematical formulas for data interpretation decreased the time needed for administrative processes and fewer mistakes were made than before. Thus, the pharmacist had more time for face-to-face meetings with patients than before. Since the valued customer system was launched in 1991, patient oriented view in using the systems has still been emphasised (Figure 4).

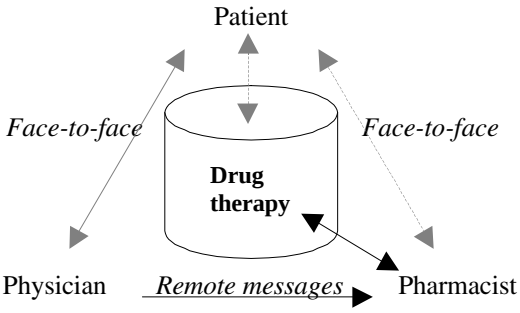

Figure 4. In the case, pharmacists benefit most from computer-based information and communication systems.

In counselling the valued customer, the information system is used as a database and this interpretation ability alone makes face-to-face communication more effective than with other patients. For example, when choosing an OTC drug for headache, the pharmacist can check the other drugs the patient has and base counselling on the facts of the database. Because the pharmacy delivers information on its Web site to everyone who is interested in, also the patient may know more about use of drugs than before. This means that the patient can also communicate with the physician more effectively than before. The possibility to communicate via e-mail with the pharmacy enables more specific counselling via remote messages than information delivering via the Web. Empowerment of the patient is a necessity in order to make her an active partner in taking care of her own health.

On the other hand, media and models used in communication between physicians and the pharmacy has not changed during the years. Remote messages still mean prescriptions issued on paper, and the messages are one-way transfer. Physicians send prescriptions to the pharmacy via the patient, but they do not get any feedback messages from the pharmacy. Sometimes, remote conversation is used for communication between a physician and the pharmacy. This works, if it is the physician who calls. If the initiator is the pharmacist, remote conversation may be a poor alternative, as the nature of the physician's work activities with patients does not favour synchronous communication between the pharmacist and the physician.

Prescriptions in electronic form are not used in Finland, though the structured nature of information of prescriptions offers almost ideal possibilities for

benefiting from computer-based information and communication technology. One fairly good explanation for this non-utilisation is that every pharmacy and physician ought to have compatible technical solutions that the patient's right to choose free the pharmacy would not be threatened. On the other hand, the quite clumsy technology used in the SII smart card trial in 1989-1993 did not assure physicians of the thing, that prescriptions in electronic form would enable both better communication and information management of prescriptions than before [31].

6. Visions of computer-based drug therapy of the year 2005

The year 2005 is not in the far future. It is five years ahead, and five years is a very short period of time compared to the very slow pace of changes in the Finnish pharmacy practice. It took above 700 years to change the co-operation between the physician and the pharmacist and to allow the pharmacist to counsel the patient of the proper use of drugs. The trend to activate the patient to take care of her own health began to sprout very soon after this change. As to development of IT, many changes have time to happen during five years.

The evaluation of the computer-based communication and information systems of a Finnish pharmacy revealed, that the systems support quite well the activities of the pharmacy. However, the objective to make drug therapy more effective by benefiting from IT is not realised, and co-operation between the three partners is still a remote idea (Figure 5).

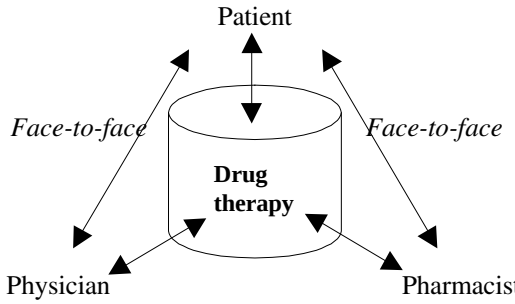

Figure 5. The use of computer-based information and communication technology in drug therapy in the future.

In the future, the patient is the key-actor of her own health. Besides the physician tries to manage diseases that need professional cure, she takes care of that the patient has information and medical equipment needed for self-care, e.g. electronic systems to remind of the use of the drug. The pharmacist is the main counsellor in self-medication, and supports also self-care in general. The roles described are very important for changing the current escalating trend in costs of healthcare.

In 2005, medical Web sites with data viewers and expert systems offer laymen information for self-care and advice for minor medical problems. The sites are certified that laymen can be sure of the validity of the medical information of the sites. Contents of these sites are produced either by national or local actors depending on contents, e.g. national authorities of medicines offer information of general facts of drugs, and local pharmacies produce local information. It is not efficient, if many local pharmacies produce sites that are the same.

The new information technology helps also professionals in the context of medication. When a patient needs prescription drugs, the physician has not to do a lot manually to write a prescription in electronic form. The data for the prescription is retrieved quite automatically from the electronic patient record and the database of drugs. In the electronic patient record, the physician can find out both the medication history of the patient and information of the drugs delivered to the patient. Besides the information systems support actively decision making, e.g. they warn, if a drug has interactions with the other drugs that the patient uses. The reasoning model uses the code of the pharmaceutical product, the ATC code and the data of the patient. Prescriptions in electronic form mean also that time for manual information management at the pharmacy decreases and the pharmacist has more time to be a personal coach for the patient in self-medication.

The new technology makes communication easier than before. Different Web sites enable discussions between different groups of patients, which discussions often offer strong social support. Patients can communicate asynchronously also with physicians and pharmacists via secured e-mail, and patients are active partners in communication, because the information asymmetry situation is history. Via e-mail, patients can be supported in self-care and helped in minor medical problems, e.g. a prescription can be repeated. The patient sends e-mail to her physician or pharmacist about the repetition, and the physician and the pharmacist communicate with each other so, that the drug is ready to be delivered when the patient enters the pharmacy or the pharmacist can visit the patient's home to deliver the drug.

The pharmacy gets prescriptions in electronic form via secured channels. Allowing patients to choose the pharmacy, the physician does not send the prescription directly to a pharmacy but to a database, from where the prescription can be fetched. If the details of the prescription demand communication between the pharmacy and the physician, electronic communication either via asynchronous e-mail or shared documents is a good choice. In every case, the pharmacist informs the physician, when drugs are delivered to her patient. Thus, the physician and the pharmacist have two-way communication.

We have not forgotten possibilities of E-commerce via the Internet, but either, we have not forgotten that even OTC drugs may induce serious adverse effects. If the objective is to promote the proper and safe use of drugs, is it reasonable to sell drugs via the Internet? So far, we do not know the answer.

References

[1] Stakes [the National Research and Development Centre for Welfare and Health], *Health and the use of health services in Finland*, Stakes, http://www.stakes.fi, 1999.

[2] SII [the Social Insurance Institution], *Cost and financing of health care in Finland 1960-1997*, Publications of the Social Insurance Institution T9:56, Helsinki, 1999.

[3] H. Wahlroos, "Escalation of medicine cost must be curbed in the long term", *Tabu*, The National Agency for Medicines, Helsinki, 1999 Vol 7(5), p. 41.

[4] Moore, J.F., *The death of competition: leadership & strategy in the age of business ecosystems*, John Wiley & Sons, Chichester, 1996.

[5] C.H. Smee, "Bridging the gap between public expectations and public willingness to pay", *Health Economics*, 1997 Vol 6(1), pp. 1-9.

[6] E.M. Kaplan, "Antidepressant non-compliance as a factor in the discontinuation syndrome", *Journal of Clinical Psychiatry*, 1997 Vol 58(7S), pp. 31-35.

[7] B. Karakoc, and M. Erenus, "Compliance considerations with hormone replacement therapy", *Menopause*, 1998 Vol 5(2), pp. 102-106.

[8] J.M. Mallion, J.P. Baguet, J.P. Siche, F. Tremel, and R. de Gaudemaris, "Compliance, electronic monitoring and anti-hypertensive drugs", *Journal of Hypertension*, 1998 Vol 16(1S), pp. S75-S79.

[9] C.M. Smith, D. Barzman, and C.A. Pritasch, "Effect of patient and family insight on compliance of schizophrenic patients", *Journal of Clinical Pharmacology*, 1997 Vol 37(2), pp. 147-154.

[10] C.F. Green, D.R. Mottram, M. Pirmohamed, R. Horner, and P.H. Rowe, "Communication regarding adverse drug reactions between secondary and primary care: a postal questionnaire survey of general practitioners", *Journal of Clinical Pharmacy and Therapeutics*, 1999 Vol 24(2), pp. 133-139.

[11] Waterman, D. A., *A guide to expert systems*, Addison-Wesley Publishing Co, Reading (Mass), 1986.

[12] K.D. Mandl, I.S. Kohane, and A.M. Brandt, "Electronic patient-physician communication: problems and promise", *Annals of Internal Medicine*, 1998 Vol 129(6), pp. 495-500.

[13] E.R. Heerdink, H.G. Leufkens, C. Kopperdraaijer, and A. Bakker, "Information on drug use in the elderly: a comparison of pharmacy, general-practitioner and patient data", *Pharmacy World and Science*, 1995 Vol 17(1), pp. 20-24.

[14] SII [the Social Insurance Institution], *Sickness and disability*, SII, http://www.kela.fi, 1999.

[15] Vartiainen, A., *Reseptioppi*, WSOY, Porvoo Helsinki, 1973.

[16] L. Lisper, D. Isacson, P.O. Sjoden, and K. Bingefors, "Medicated hypertensive patients' views and experience of information and communication concerning antihypertensive drugs", *Patient Education and Counseling*, 1997 Vol 32(3), pp. 147-155.

[17] J. Watson, T. Mitchell, C. Decrespigny, C. Grbich, and A. Biggings, "Older women, medication use and nursing care", *International Journal of Nursing Practice*, 1998 Vol 4(3), pp. 189-196.

[18] R.F. Lyons, M.M. Rumore, and M.R. Merola, "An analysis of drug information desired by the patient. (Are patients being told everything they wish to know under OBRA '90?)", *Journal of Clinical Pharmacy and Therapeutics,* 1996 Vol 21(4), pp. 221-228.

[19] R.E. Grymonpre, and J.W. Steele, "The medication information line for the elderly: an 8-year cumulative analysis", *Annals of Pharmacotherapy*, 1998 Vol 32(7-8), pp. 743-748.

[20] M. Airaksinen, R. Ahonen, and H. Enlund, "The "questions to ask about your medicines" campaign. An evaluation of pharmacists' and the public's response", *Medical Care*, 1998 Vol 36(3), pp. 422-427.

[21] Turakka, H., and J. Lilja, *Turun kauppatorin apteekin historiikki*, Turun kauppatorin apteekki, Turku, 1989.

[22] H.L. Lipton, P.J. Byrns, S.B. Soumerai and E.A. Chrischilles, "Pharmacists as agents of change for rational drug therapy", *International Journal of Technology Assessment in Health Care*, 1995 Vol 11(3), pp. 485-508.

[23] L.A. Morris, E.R. Tabak, and K. Gondek, "Counseling patients about prescribed medication: 12-year trends", *Medical Care*, 1997 Vol 35(10), pp. 996-1007.

[24] Coiera, E., *Guide to medical informatics, the internet and telemedicine*, Arnold, London, 1997.

[25] P. Spyns, and G. De Moor, "A Dutch medical language processor", *International Journal of Bio-Medical Computing*, 1996 Vol 41(3), pp. 181-205.

[26] Johansen, R., A. Martin (Contributor), and D. Sibbet (Contributor), *Leading business teams: how teams can use technology and group process tools to enhance performance*, Addison Wesley, Reading (Mass), 1991.

[27] R.E. Rice, "Task analyzability, use of new media, and effectiveness: a multi-site exploration of media richness", *Organizational Science*, 1992 Vol 3, pp. 475-500.

[28] B.S. Caldwell, S. Uang, and L.H. Taha,, "Appropriateness of communications media use in organizations: situation requirements and media characteristics", *Behaviour and Information Technology*, 1995 Vol 14, pp. 199-207.

[29] J. Constable, "Active voice", *British Journal of Healthcare Computing and Information Management*, 1994 Vol 11, pp. 30-31.

[30] A. Hasman, R. Haux, and A. Albert, "A systematic view on medical informatics", *Computer Methods and Programs in Biomedicine*, 1996 Vol 51(3), pp. 131-139.

[31] SII [the Social Insurance Institution], *Kelan toimikorttikokeilut*, SII, Helsinki, 1993.

[32] J.J. van Overbeeke, and H.P. Westerhof, "The Dutch 'Benefit-II' project: do physicians benefit from using an electronic medical dossier?", *International Journal of Bio-Medical Computing*, 1996 Vol 42(1,2S), pp. 91-96.