COMPUTER ASSISTED MEDICAL HISTORY TAKING

ANAMNESE MET BEHULP VAN EEN COMPUTER

PROEFSCHRIFT

ter verkrijging van de graad van doctor

aan de Erasmus Universiteit Rotterdam

op gezag van de Rector Magnificus

Prof. Dr. A.H.G. Rinnooy Kan

en volgens besluit van het College van Dekanen.

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Voor mijn ouders

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Voorwoord

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Introduction

The medical history is one of the cornerstones of medicine; no medical action is possible without having gathered sufficient and reliable patient data during the patient interview. The medical history is taken during the first encounter between the patient and a doctor, be the physician a general practitioner or a specialist. When data, gathered at this stage, are unreliable or incomplete, or when important patient complaints remain unobserved, there is a risk that a wrong decision may be made and the patient may be treated improperly.

In this Introduction, we shall first pay attention to the important process of gathering reliable medical data. Next, we shall make some general remarks about the role that the computer may play in this process. We conclude by giving an overview of the outline of this thesis.

Medical history-taking: a form of data collection

One of the central issues in clinical practice is the transfer of patient data from the patient to the physician. During the first encounter between patient and physician, such data either are offered by the patient orally, or are observed during a physical examination. The first type of datum is often referred to as *subjective*, whereas the second type is called *objective* (see, for example, the scheme of the Problem Oriented medical Record (P.O.R.), developed by Weed [1]).

Normally, when patients ask for help from a doctor, the doctor first starts asking questions about the main complaint. This first part of the history taking is also called the special anamnesis. Here, the patient tells about his complaints while the physician generates his first hypotheses about the possible disease. It has been shown in several investigations of clinical problem solving that the first hypothesis is considered almost at the onset of the patient encounter [2].
On the basis of this first idea about a possible disease (or at least about a direction for further questioning), more questions will be asked by the doctor, either to confirm some hypotheses, or to exclude other ones.

Depending on the amount of time that the doctor has available, and the expected relevance of the hypotheses that have been generated (which are often still rather vague) the doctor will also ask so-called routine questions. Experienced physicians will try to reduce the number of questions very quickly to the most relevant ones, in view of early hypotheses. Trainees more closely follow a standard list of questions.

During the interview, attention is paid to the organ systems (or tracts), such as the digestive, the respiratory or the cardiovascular tract. These organ systems are not only characterized by their anatomical properties, but also by their functional attributes. The latter apply, for instance, to the genito-urinary tract and the nervous system in particular.

Diseases are generally categorized by organ systems in most classification systems, such as the International Classification of Diseases (ICD, [3]). It is common usage in history-taking and in questionnaires that questions are based on these main organ systems, to check whether a disease is related to one of the organs. In The Netherlands the review of systems is therefore called the 'tract anamnesis'. Most of the time, attention is first paid to the tract related to the main complaint. For instance, when a patient has complaints about pain in the stomach, the doctor will first ask questions concerning the digestive tract. Questions regarding the other tracts are then asked as "routine" questions to exclude possible diseases of the other organs. Of course, this is a theoretical schematic division; in practice, complaints, diseases and tracts are interrelated, and the art of history-taking is to obtain in each situation a comprehensive insight into the whole nature of the disease or disease complex of a patient.

The same division is used during the physical examination. The main complaint gives the doctor indications as to which parts of the body to examine that are directly related to the location of the complaint. Subsequently, other parts will be examined more or less routinely, to obtain as complete a picture as possible of the patient's overall condition. The physical examination preceeds more technical examinations, such as laboratory analysis or X-ray examination.

Depending on the patient's complaints, and on the understanding and cognitive process of the doctor, invasive examinations may be performed by the doctor or by other departments in the hospital or elsewhere. The doctor then interprets and combines all data into medically accepted complexes such as symptoms and diagnoses, and summarizes them in the medical record. Thereupon, therapeutic actions will be carried out, and the patient will hopefully respond to them.

After the first data exchange between patient and doctor, a second visit usually follows, which is often just a follow-up evaluation. New history questions may be asked and new examinations done, generating more medical data. This second evaluation may lead to a third visit, and so on, until a stable situation is reached and the patient is hopefully cured, or when the patient leaves the medical-care process otherwise. Thus, the data

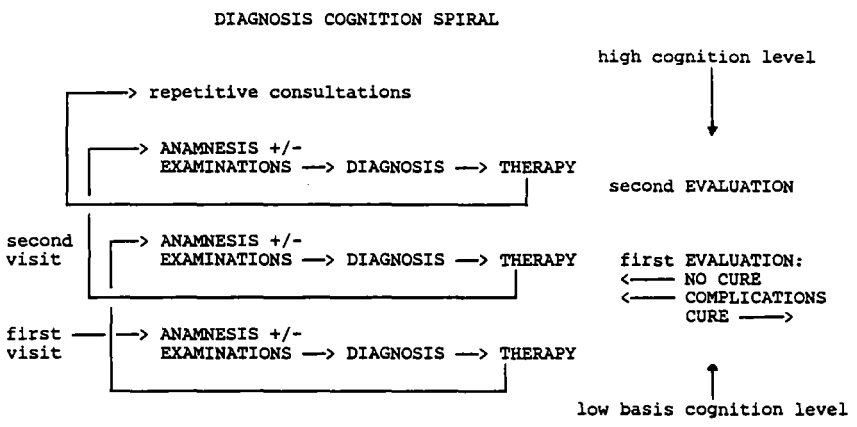

Fig. 1. Diagnosis cognition spiral

handling actions - medical history-taking, patient examination, hypothesis generation, and therapeutic advice - are repeated, while the level of knowledge rises in an iterative manner.

This data handling may be considered as a spiralling movement upwards with respect to knowledge about an individual patient (see figure 1). The spiral starts with the first encounter and the first history taking. The resulting increase in knowledge holds for the doctor as well as the patient, who may also get more insight in his or her medical condition and disease picture. Too many data, however, may blur the picture and hamper the upward spiralling knowledge about the disease [4].

In summary: the first encounter between the patient and the doctor forms the basis of all knowledge about the patient's condition, on which all further actions depend. It may be clear now that taking the initial history represents a vital part of the collection of patient data.

USE OF COMPUTERS IN MEDICAL CARE

In medical care, computers may be used in several ways. First, of course, computers may be used for purely administrative activities such as the registration of name, address, birth date, sex, and insurance information. Computers may also be used for the support of medical actions, such as laboratory analysis, the classification of blood cells, and the analysis of electrocardiograms. Here, the medical data are not only stored in a computer, but are also processed by it. A further way of processing data may involve the use of a diagnostic support system, such as an expert system.

Knowledge about diseases, encoded in knowledge bases of computers, forms the basis for such expert systems. Expert systems may generate diagnostic or therapeutic advice on the basis of medical data, entered into the computer. By interpreting patient data using a knowledge base, diagnostic and therapeutic suggestions may be extracted and presented to the physician. The doctor may use these as valuable alternatives for his own interpretation and planning, or to strengthen his own hypotheses.
However, expert systems are still in their infancy. It is unknown how inference machines must be build properly to get conclusions based on a large fuzzy dataset. A major problem is that in the medical field it is not well known how diagnoses should be generated on the basis of limited medical data. The existing medial knowledge concerning diseases is not very usable; the nosology is far from complete, making it impossible to give an exhaustive description of all related phenomena for most diseases, let alone that a computer could be programmed to diagnose an extended set of diseases.

Nevertheless, much research is being done on these aspects. It is foreseeable that one day computers will be used routinely to assist (but not replace) a doctor in treating patients. Whenever this situation will be reached, one of the major problems to be solved first will be how to obtain reliable medical data to be used properly by the computer.

ENTERING MEDICAL DATA INTO A COMPUTER

The problem of obtaining reliable data in a computer, looks straightforward. It may be solved, for instance, by entering medical record data into a computer. But we should first study the primary source of these data carefully. Most of the time, the written medical record is drafted by one or more physicians while examining and treating the patient. The primary data in particular (i.e., the medical history) contain many rather subjective observations in natural language, which are not well transferable to a computer in coded form. The primary data could also be the result of an interview taken by a paramedic, a trainee, or a nurse, who has recorded the patient's answers, most probably with much less subjective interpretation and more thoroughness than when a physician takes the interview.

Both ways of data entry are used in practice; the latter is used most frequently in screening situations. A doctor will primarily write down data that are related to some diagnostic hypothesis that came into his mind while questioning and examining the patient, as we have already remarked earlier. For that reason, the physician may easily overlook other important information if it is not directly related to the main complaint. When a

computer program, such as an expert system processes such data the system is only able to generate diagnostic hypotheses on the basis of the medical data that were already partly interpreted ("filtered") by the physician. In a similar way, when a medical trainee interviews the patient, one may wonder what will be the resulting data set, because it takes a long time to obtain enough experience to ask the right questions and to obtain reliable results when taking a medical history, unless a standard questionnaire is used. Moreover, there is a danger of a trainee entering wrong data into the medical record because of his inexperience.
Also a psychological aspect of the problem of retrieving medical data should be mentioned; one may wonder how the patient is being influenced, when he realizes that he is not questioned by an experienced doctor, but by a trainee. The effect might be that important answers are not given in full, or that the patient hesitates to transfer some valuable information related to his (sometimes highly individual) complaint to somebody he does not consider to be fully competent. In other words, during the acquisition of medical data, there are also non-quantifiable components that are related to the confidence a patient has in the doctor.
Skillfully trained medical interviewers may possibly retrieve more reliable data. In The Netherlands however, these interviewers are sparsely used in medical care. Further, here too the problem may arise of the lack of trust on behalf of the patient.

It can be concluded that the source of medical data and the way in which medical data are transferred from patient to doctor is of a higher importance than the way in which the data are physically entered in the computer, let alone how they are internally stored. So the question is, why not let the patient himself or herself enter his or her medical data in the computer? This question was the starting point for our research, described in this thesis.

RESEARCH GOALS

In the preceding paragraphs, we first mentioned the importance of the initial medical history for all further medical actions. Second, we discussed our expectations for the increasing use of computers for the interpretation of medical data. Third, we showed problems that may arise when acquiring patient data. We concluded that a possible solution may be the automation of history taking, in which the patient himself (or herself) plays a prominent role. For that reason, we wanted to investigate the consequences of a procedure in which the patient himself enters his medical data into a computer. This research is described in the following chapters. We shall first of all give an introduction to the chapters in this thesis.

All results, presented in chapters 1 to 6, are litteral transcriptions of earlier publications in different journals, as indicated in footnotes at the heading of the respective chapters.

- First we developed a system that enables an inexperienced user (i.e., a patient) to answer questions asked by an "intelligent" computer-based questionnaire. By "intelligent", it is to be understood that the system is able to determine the sequence of questions to ask on the basis of previous answers given by the patient in the course of the interview. Because medical data gathering had to take place in the framework of a research project, it was necessary that the system could easily be changed. The system for automated history taking is described in *Chapter 1.* In the *Appendix* the complete list of questions of the automated questionnaire is given.

The computer-based questionnaire was administered to 99 patients. Each item was presented in the form of a multiple choice question. By pressing one of several function keys, the patient could indicate his answer. His choice appeared immediately as full text on the screen for verification by the patient. The patient was allowed to answer all questions at his own pace, without being checked by someone else. In this way, he could reconsider all questions and answers, he could go back to earlier questions and correct his answers, or he could omit certain questions by indicating that he did not want to give any answer at all. At the end of a session, all answers were immediately printed and given to the patient for verification. The patient was allowed to keep this copy for himself.

Patients who answered this questionnaire were visiting the outpatient clinic for internal medicine for the first time. They were asked beforehand whether they were willing to participate in this research project and, for that reason, came to the hospital one hour before their scheduled visit with the internist. For all patients after the automated interview the conventional history was taken by a medical trainee and the internist. They had no prior knowledge about the contents of the computer-based interview.

The following problem areas were investigated in our study:

- As part of our research, we wanted to investigate some ergonomic aspects of the system. We investigated how questions should be presented to the patient and how patients might have problems using the system. This part of our study is presented in *Chapter 2.* The *Appendix* presents a description of the patient population.

- We were interested in the reactions and opinions of the patients regarding the automated system for history taking. *Chapter 3* describes this part of our study.
- Because we wanted to compare the answers from the computerised interview with those of the conventional, written answers of the oral interview, we investigated the nature and frequency of complaints in both types of interviews. To that end, the history data elicited by physicians were transcribed to the computer-based format. In *Chapter 4* a summary is presented of the comparisons between the different types of histories, whereas the *Appendix* to this chapter presents a full list of all the comparisons.
- In order to determine if there were differences in the semantic content of the two types of interviews, we offered a subset of all histories to three internists and asked them to write down the diagnostic hypotheses that they generated on the basis of the data. Comparisons of these diagnostic hypotheses, including intra- and inter-observer variabilities, are given in *Chapter 5.*
- A further point in our research concerned the clinical usefulness of the different types of medical histories. We asked physicians questions about the usefulness, completeness, and other aspects of the different histories. This survey is also described in *Chapter 5.*
- We were also interested in the relationship between the diagnostic hypotheses made at the time of the initial visit and the final diagnoses. The latter were made by the internists on the basis of the complete medical records, after the patients had been discharged from the hospital. Together with a summary of the entire study, this part of our research is presented in *Chapter 6.*

At the end of the six chapters, we conclude with a general discussion of the results obtained in our study.

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Chapter 1 - System description

First we developed a system that enables an inexperienced user (i.e., a patient) to answer questions asked by an "intelligent" computer-based questionnaire. By "intelligent", it is to be understood that the system is able to determine the sequence of questions to ask on the basis of previous answers given by the patient in the course of the interview. Because medical data gathering had to take place in the framework of a research project, it was necessary that the system could easily be changed. The system for automated history taking is described in *Chapter 1*. In the *Appendix* the complete list of questions of the automated questionnaire is given.

AIDA for the automation of the patient history

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Computer Methods and Programs in Biomedicine 25;1987:297-304.

Abstract

This article describes the application of a fourth-generation programming package (AIDA) for the construction of an interactive system for history-taking. It is shown that this system has been made very flexible and user-friendly, and that patients can easily answer all questions themselves. Parts of the system, that are supported by AIDA, are an interactive terminal with special, illuminated function keys, a screen driver for the generation and maintenance of 28 different screens, extensive help texts (with 260 help messages), and a report generator. The screens contain altogether 402 questions, through which 434 different answers can be given on 179 different items. The system has been evaluated extensively.

Fourth-generation programming; Medical record; Automated history taking

1. Introduction

Computers have nowadays been accepted in medicine: we see them applied in as widely varying areas as hospital administration, patient monitoring and the support of primary care. After the avalanche of computers for the support of management and administration, we have seen the introduction for the support of patient care, the nursing process and, most recently, for the assistance of the diagnostic and therapeutic process (e.g. expert systems). Relatively few attempts have been made to introduce computers at the level of the patients themselves. Though several successful systems have been reported in the literature (e.g. [1]-[4]), only very recently have the cheap micro-processors of today made it possible to bring the computer really near to the patient and to develop powerful and interactive programs for the acquisition of the patient history (e.g. [5]).

The construction of such systems should be very flexible and adaptable to changing requirements, that may vary from physician to physician, or from department to department. Flexibility of systems, however, hardly ever goes together with efficient programs. Only the fourth-generation programming languages that have been introduced offer the possibilities constructing such flexible systems while maintaining efficiency in the face of dynamically changing requirements.

In our department we have constructed an automated patient history-taking system with the help of the fourth-generation package AIDA. AIDA consists of a toolkit of different modules that take care of interactive input, screen generation, database construction, report generation, queries, etc. [6].

The patient reactions to the system that we have constructed with the help of AIDA have been described in earlier reports [7,8]; as have the reactions of the physicians and a comparison with the written medical record [9,10].

In this article we will describe the performance of the system. A research project has been executed in cooperation with the outpatient clinic of medicine of our hospital. In this project we used the questionnaire described in this article. The various questions that have been implemented into the computerized patient history-taking system are based on standard questions that are asked during routine history-taking in the Department of Medicine.

First of all we will describe the questionnaire itself and the way it was generated with the help of AIDA. We will also describe how the terminal was used by the patients, and the various screens that were generated to be offered to them; the different types of questions that have been implemented into the system; the way the patients could interact with the system by the use of an adapted terminal, together with the layout of the keyboard and the different screens that were offered to the patients; and a

Code	Type	Question	Options for answering
A	Frequency	Do you ever have complaint X?	never/once/seldom/ sometimes/regularly/ often/always
B	Intensity	How much trouble causes complaint X?	none/little/moderate/ much
C	Duration	How long does complaint X last?	<30 min/0.5-1 h/1-3 h/ 3-6h/6-12 h/0.5-1 day/ >1 day
D	History	Since when do you have complaint X?	<1 week/<1 month/ 1-6 months/ <1 year/1-2 years/ >2 years
K	Complaints	What kinds of (other) complaints do you have?	choice from list
L	Left/right	Where do you have your complaint?	left side/right side
N	Counting	How many/much?	use numeric keypad
P	Location	At what locations do you have the complaint?	choice from list
Z	Disease	What diseases do you have?	choice from list

K,L,P and Z questions may be answered with multiple answers. Escape answers exist for all questions (Don't understand/Don't know/No answer).

Table 1. Overview of the different types of questions per category (A, B, etc.) with brief indications of the standard types of options (see text for further explanation).

description of the computer-generated report.
Since the main reason for constructing this automated questionnaire was medical research, it had to be designed in such a way that it was easy to change the contents of the questionnaire, the sequence of questions, and the different internal decisions and branches built into the system. Without the use of a toolkit like AIDA this goal would not have been as easily realized.

2. Computerized questionnaire

We have constructed our questionnaire in such a way that the patients could have as many options as possible for answering the different questions. Various types of questions have been used to obtain information

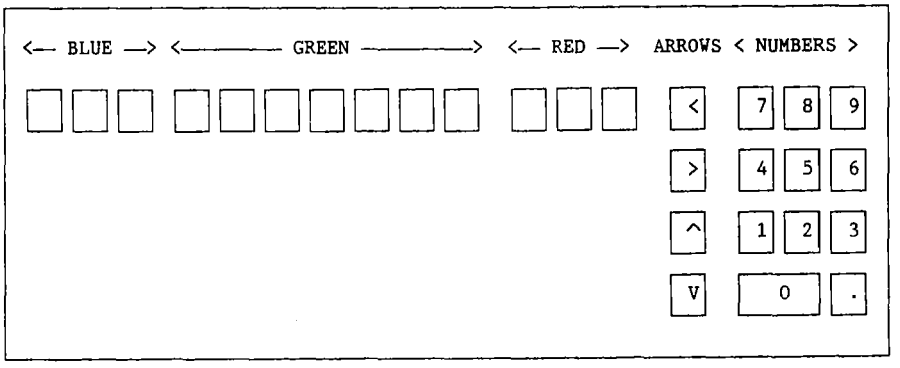

Fig. 1. Schematic layout of the function keys and the illumination that is switched on by system subroutines defined by AIDA. The repeat functions of the keys were switched off for inexperienced patients.

about the patient's complaints. Only if a patient's response is, to a certain degree, positive about a complaint does the system proceed in asking further questions related to this complaint. The various types of questions are related to different aspects of a complaint: its frequency, intensity, duration, and history.

As is shown in Table 1, each type of question has its specific answers. This could be realized by an extension to AIDA that enables the patient to answer a question by simply pressing one single key (a function key) without having to touch the return key; AIDA enables the user to define for each key a specific function. The different possibilities for answering the frequency and intensity of a complaint are displayed on an illuminated strip above the row of function keys (see Fig. 1).

Answers which are related to other questions may be entered using the numeric pad of the keyboard. One row of special function keys plus the numeric keys are the only keys that are to be used by the, often inexperienced, patient.

For each complaint, the patient has first to indicate the frequency of the complaint by pressing one of the function keys varying from 'never' to 'always', and only the strip above the specific function keys is then illuminated by a *green* colour. Next, the intensity of the complaint (running from

'no' or 'little' to 'much trouble') can be indicated by pressing specific keys that are illuminated by a *blue* colour.
Subsequently, a question is asked about the duration of the complaint for which the *numeric* keypad is used. The answering options vary from 'shorter than half an hour' till 'longer than one day'. The history of the complaint is revealed by asking since when the patient has had the complaint with answers running from 'for one week' to 'longer than two years ago'.
In all cases patients may press the so-called 'escape' answers with one of the following meanings: 'I don't understand', 'I don't know', 'No answer'. These last options are visible on a *red* illuminated strip above the function keys.
The above-mentioned four standard types of questions are used for all kinds of complaints and symptoms (in the sequel of this article we call complaints or symptoms 'items'). Other types of questions that are asked concern, for instance, accompanying complaints, the location of the complaint etc. For some questions the patient may choose more than one option to specify the answer. Again, for all questions the escape answers may also be used.

2.1. Interactive terminal

As mentioned above, one row of keys is used for functions that are illuminated by different colours (blue, green and red, for intensity, frequency, and escape answers respectively). To obtain a user-friendly interaction we used AIDA to optimize the ergonomic aspects of the interaction between computer and patient.
The ergonomy of the keyboard is highly improved by using the illumination above the function keys. At certain questions only those keys are illuminated which the patient is supposed to use to make a choice. This illumination is controlled by a command embedded in the help text of each question. AIDA enables implementation of all kinds of executable commands or of even entire programs, which may be called for distinct purposes. In this case, a command is given for each question, to illuminate a certain combination of lamps above the function keys. Dependent on the answers given by the patient, these lamps are switched on and off. In this manner the attention of the patient is drawn to certain keys in a natural way and he does not need to search for the location of the function keys. When, however, a key with a non-valid answering code is pressed, a 'beep' is heard and the same question can be answered again. The sound of this beep was made rather soft to lower the irritating effect of this audible feedback.

2.2. Screen layout

The computerized questionnaire is built from 28 screens. A screen may be regarded as a page of the questionnaire used to ask about (combinations of) certain complaints. All screens have been constructed in an identical way and are divided into two parts. A new screen is initially composed of the entries of the items on which questions are going to be asked, in order to provide a quick overview of all questions to the patient. Depending on the answers given by the patient, new questions may appear in the same screen and answers may be changed dynamically or erased.
For each item several questions may be asked. Most items are initially presented to the patient by asking type A questions (see Table 1). Further questions appear according to the answers given. The branching logic necessary for this dynamic questioning can easily be constructed with the help of AIDA. The next, type B question, emerges if the answer of the patient is 'sometimes' or a higher frequency. For each type A question it is possible to define another threshold. The answer to each question is checked by a subroutine within AIDA. When a certain combination of A and B questions is followed by other questions (e.g. type C, D, or K; see Table 1), it is possible to program a threshold, dependent on the values of both the A and B questions.
Questions of the K, L, P and Z types may result in more than one answer. After each valid answer the same question is repeated for a possible further reaction of the patient. If a patient does not want to give any further answers, he presses the escape key for 'No answer'. In all cases it is possible for the patient to go back to earlier answers and to change or reject them. If a non-valid answer is given by the patient and he does not indicate that he wishes to proceed by giving other answers or correcting the invalid answer, only valid answers are scored.
During the generation of the questionnaire, only one general type of question A, B, etc., was programmed in AIDA, whereas all specific questions were generated by implementing the contents of related texts (questions, answering options, help texts) into the different general question types.
At the end of each screen a question appears with three answering options: 0: go on to the next screen, 1: edit the same screen, 2: stop answering this questionnaire. If the answer 1 is given, the cursor moves back to the first question. The patient may use the arrow keys to pass questions that have been answered before and accepted by the patient and the system. If a frequency answer that was, for instance, earlier indicated as 'often' is changed to 'never', the further questions belonging to this answer are skipped and the screen is re-written without the more detailed questions. If the option 0 or 2 is pressed, all data are stored. After answer 2 the patient

is asked whether he really wants to stop the computerized interview or still wants to proceed.

2.3. Help functions

The so-called help messages are available for all questions of all types. After pressing one of the keys of the red type (the escape answer with the meaning 'I don't understand') help messages appear, giving information about the question and the way it can be answered. Help messages are extra parameters attached to the screens with the help of a subroutine, implemented in AIDA, which checks every answer. In our computerized history-taking system 260 such help messages have been programmed and attached to the various screens. Help messages appear automatically when a key belonging to a non-valid answer is pressed, for instance when a green key is pressed instead of a blue one. As soon as the patient gives an answer which is accepted by the system and is considered to be plausible, the help message disappears.

2.4. Storage of patient answers

The data of each patient are stored under one unique identification number. Each time a new screen is called, a check is performed by AIDA to see whether any data on the patient already exists in the database. If no data are found the initial screen is displayed without the previous answers; if data have been given previously, they are displayed on the screen and the cursor is positioned directly after the last question that was answered. The patient may then decide to edit data (option 1) or to leave the screen (0 or 2). Several situations may lead to screens that are already filled. It is in certain cases possible that a specific screen is offered more than once, dependent on previous answers or selected locations where a patient has indicated to have pain (as will be illustrated below). A message appears indicating that the screen has already been answered and that it is possible to skip the screen. This method of displaying already existing data, is at the same time a check on the integrity of the database: it is possible that some data are present, while other data have not yet been given. It is also advantageous for checking purposes by the patient.

3. Example of screen interaction

Before a patient starts answering the questionnaire, he may exercise with the help of a screen asking about non-medical questions such as television watching. In this way the patient gets accustomed to the use of the terminal.

Section	Screen	Problems with:
Main complaint	A,B,C,D	
General disorders and disturbances	Mouth and throat	Eating, swallowing
	Stomach and belly	Stomach, belly, nausea
	Urinary system	Urinating
	Gynecological system	Same, for female patients
	Lower airways	Respiration
	Limbs	Movements
	General	Social life, weight, feeling ill/feeble, nervous, metabolism, blood pressure, fever
	Exercise	Physical exercise
	Sleep	Sleeping
	Head	Seeing, hearing, dizziness
Locations	Head	Head, back of head
	Upper airways	Ear, nose, forehead
	Mouth and throat	Mouth, throat, neck
	Lower airways	Chest, upper back
	Exercise	Chest, upper back
	Limbs	Hip, leg, arm
	Back	Middle back
	Bowels	Anal region
	Urinogenital system	Abdomen
	Stomach and belly	Stomach and belly, lower back
Diseases		
Medical consumption		
Daily life		

Table 2. Different sections of types of screens, generated with the help of AIDA.
From the different screens about complaints, the system branches to other screens, depending on thresholds that were defined with the help of AIDA. The corresponding screens are sorted and selected according to the indicated problems and locations.

In Table 2 we have given a summary of all screens that are offered to the patient.
The system always starts with four screens asking about the main complaint, the presence of disorders and the presence of disturbances of general nature. The order of the next screens is determined on the basis of answers given to the first four screens. This selection of further screens is made on the basis of the answers of the frequency of corresponding disorders. In Table 2 the relations are also presented between the complaints and the screens dealing with disorders and disturbances. For instance, if a patient indicates that he often has problems with swallowing, a screen is called that deals with the mouth and throat; if breathing is indicated (e.g. 'regularly') another screen asks about lower airways.
Although the sequence of screens is determined by the complaints indicated by the patient, he is eventually confronted with all remaining screens.
In Fig. 2 we have given an example of a screen for the item 'Lower air passages'. Before answering, the cursor is located behind the first entry (coughing). The full question, together with the indication of the function keys that may be used for answering, is displayed in the lower part of the screen. Question entries are displayed on the screen in half-video (half light intensity). Other signs and answers are shown in full video. Fields to be answered are indicated by dotted lines. When an answer is entered by pressing a function key, it is displayed in full behind the item, and the cursor moves to the next question. The complete new question then appears in the lower part of the screen.
For a patient it is sufficient to concentrate on the lower part of the screen only, which is most near to the function keys. The upper part can be used to obtain an overview of all entries with the given answers. In the figure we have given a version of 'Lower air passages' in English (of course, in practice all questions are phrased in Dutch).

4. Physical location of complaints

After the first four screens, a screen is shown in which the patient may indicate the location of his physical complaints.
By using the cursor the patient is allowed to indicate this location in a schematic diagram of the human body in front and rear view (see Fig. 3). In this stylized picture the cursor can be moved to the location where the patient feels pain or is uncomfortable. The system then asks further questions about the type of complaint. Questions about frequency, intensity, duration and the history of the complaint are also asked. In total, there are 96 different (sub)locations which the patient may indicate. For each of the indicated locations he may select one or more of the following

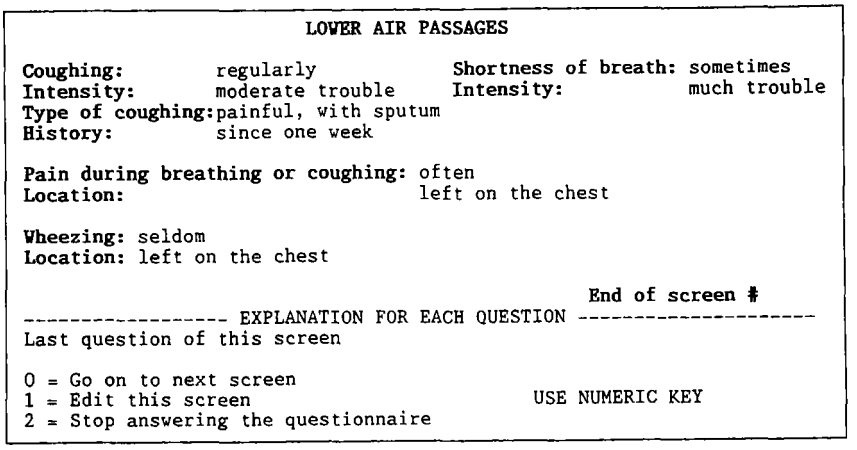

Fig. 2. Example of a screen on 'Lower air passages', after completion by the patient. After pressing one of the function keys, the answer appears as full text in the upper part of the screen (after the colon).

complaints: pain, pain radiation, inflammation, skin disease, loss of blood, sweating, complaint of joints, tingling, or other complaint.
The screen for the physical location of the complaints is in fact built up from three different screens. The first screen contains the stylized figure; the other two sub-screens contain questions about complaints. Dependent on the indicated location, one of the two sub-screens appears in the lower part of the screen where the schematic figure is also shown. Each point of this figure is one parameter in this screen. A sub-screen only appears as a function of the given answers. If one of the escape keys is pressed, the cursor moves back to the schematic figure. After finishing the questions on a certain location, a screen is called that is related to the tracts connected to the location that the patient has indicated. If this causes a screen to be called twice, a message announces that the corresponding screen has already been answered. It is then possible to update or change this screen or to skip it. In Table 2 we have also summarized the different screens that may be called depending on the locations selected by the patient.

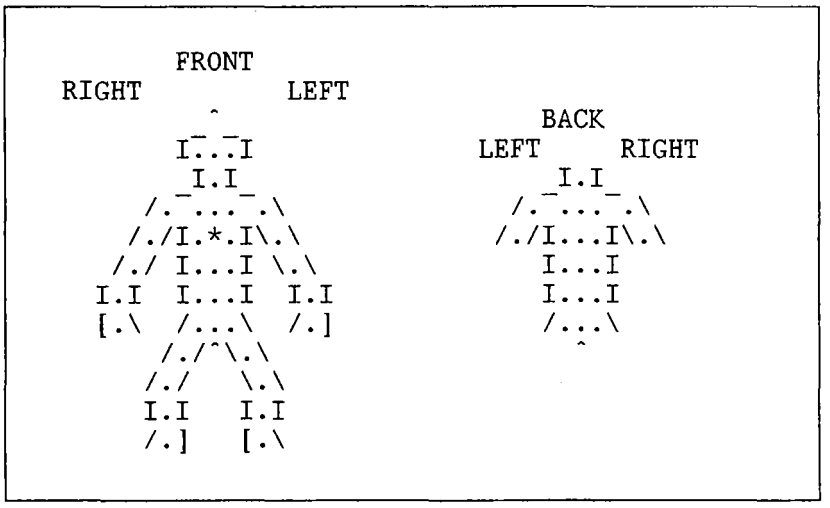

Fig. 3. Schematic diagram of the front- and backside of the human body, on which the patient may indicate where he feels pain or discomfort. From these indications on physical complaints, tract screens may be called for further details.

The questionnaire contains 28 screens with 179 items on which questions are asked, with 402 questions and 434 possibilities to give answers. Adding to this number the total number of locations that the patient may indicate and on which questions might be asked, the total number of questions reaches 768. 260 help messages have been programmed for the tract screens to provide information if the patient presses, for example, the escape key: 'I don't understand'.

5. Printed report

When the patient has finished giving answers, a printed report is generated by the system. This report generation is also supported by AIDA. The system supports the generation of output screens to review the information given by the patient. These output screens can be used in different formats: they appear either in the same order used when the patient answered the questionnaire, or in a standard, pre-defined order. In the summary version, the items that are answered with 'never', 'seldom', 'once', 'no answer', 'I don't know' and 'I don't understand' are not printed. First, the answers about the main complaint are printed. They are ordered in a rather

narrative way by connecting the different answers. The answers on the questions about general complaints and disorders are sorted as a function of magnitude of frequency. Answers with a high frequency are printed first, to be followed by the lower frequency answers. Next, the locations are reported at which the patient indicated that he felt pain or discomfort, followed by output based on the tract screens. The latter have a somewhat different order to that of the input. The next section of the report is about diseases present in the past. This section first starts with the present diseases, which are followed by diseases in the last two years, and then still earlier diseases. It also contains parts about drugs used by the patient, surgery, and diseases of parents, brothers, sisters, or other members of the family. The last part of the printed report contains information about daily habits such as food consumption, smoking etc.
If a questionnaire has been completely answered by somebody whith many complaints, this may result in a full report of approximately five pages. A summary report of a more or less 'standard' patient has a length of about two pages. In Fig. 4 we have given an example of a translated report from an average patient to give an idea about the contents of a report.

6. Discussion

The use of the fourth-generation programming package AIDA has proven to be extremely useful at all levels of the development and maintenance of the system for computerized patient history-taking reported in this article. Screens can be generated in an interactive way, modified and maintained; plausibility tests and help text implementations are supported by modules of AIDA.
Furthermore, AIDA supports the evaluation of the performance of the system when used by patients, by measuring, counting, timing etc. AIDA also supports the definition and use of special function keys and the generation of reports. The system appears to be user-friendly and adaptable to changing insights how to set up interactive history-taking. The ergonomy of the system was highly validated by the patients who used the system. After the pilot phase a minimum number of errors emerged.

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Fig. 4. Example of a final printed report, after computerized history-taking. See text for further details.

COMPACT MEDICAL REPORT

Patient: (name) Date:
Birth date:

REASON FOR VISIT
The patient visits the outpatient clinic because of health problems.
His complaints do exist longer than 2 years and are regularly present.
The patient is moderately worried about his health and sees as possible cause: working conditions.
His complaints cause: moderate troubles.
Received help from: General Practitioner.

Patient has trouble with:
Stomach and bowels -: often
Breathing — — — -: regularly
Exercise — — — — : regularly

Patient is troubled by:
Nervousness -: regularly
Fatigueness -: regularly
Dizziness — -: sometimes

PHYSICAL LOCATION OF COMPLAINT

At throat:
- pain
- swelling

frequency: often
intensity: much trouble
duration : 1-3 hrs
onset : since 1 week

At right elbow
- pain
- joint complaint

frequency: regularly
intensity: moderate trouble
duration : 6-12 hrs
onset : since 1-6 months

AIR PASSAGES

HOARSENESS: sometimes
onset: 1/2-1 yrs
WHEEZING: often
intensity: much trouble
onset: since 3-6 months

PHLEGM: regularly
type: brown/thin

COUGHING: regularly
intensity: much trouble
type: coughing fits in
PAIN BREATHING/COUGHING:
sometimes
location: in the back/chest
SHORTNESS OF BREATH: often
intensity: much trouble
onset: since 1/2-1 year

GENERAL

ALLERGIC: always
allergic for: cats
intensity: much trouble

CHILLY: often

PAIN OR SHORTNESS OF BREATH

During **CLIMBING** of stairs: regularly trouble: pain in chest
During **WALKING**: sometimes trouble: shortness of breath
PALPITATIONS: regularly
COMPLAINT: occasionally fast heartbeat

LIMBS

pain in **CALVES**: sometimes after long walk
thick **ANKLES**: often in the evening

NIGHTLY COMPLAINTS
nightly **URINATING**: always twice per night
nightly **AWAKENING**: always with shortness of breath
gets better by: sitting upright
sleeps on 3 pillows

APPETITE
APPETITE: good
WEIGHT: lost 2 kilograms
COMPLAINT: pain in stomach
cannot stand fat food

STOMACH AND BELLY
RUMBLING: sometimes
WINDINESS: sometimes
SOFT STOOLS: regularly
LIGHT STOOLS: sometimes
DEFECATION: once a day

PAIN IN STOMACH AND BELLY:
intensity: much trouble
duration: 1/2-1 hr
onset: longer than 2 yrs ago

URINARY TRACT
URINATING PROBLEMS:
sometimes dripping

CLEAR URINE: always
RED URINE: once

HEAD
HEADACHE: sometimes
intensity: little trouble

VISION: one eye low vision
SPECTACLES: for reading

LIMBS
TREMBLING: sometimes
intensity: little trouble
DEAD FEELING: regularly
intensity: moderate trouble
MOVEMENTS: sometimes
intensity: moderate trouble

BACK
BACKPAIN: sometimes
intensity: little trouble

SKIN
ITCHING: sometimes
ECZEMA: regularly
intensity: moderate trouble

BLUE STAINS: regularly

DISEASES AND COMPLAINTS

PRESENT	LAST TWO YEARS	LONGER THAN TWO YEARS AGO
o stress	o pneumonia	o poorness of blood
o coughing		

PRESENT DRUGS
o for stress

HOSPITALIZED FOR	OPERATED ON
o tonsils	o tonsils
o appendix	o appendix

DISEASES IN FAMILY

PARENTS	BROTHERS AND SISTERS	FAMILY
o hypertension	o cardiac disease	o cardiac disease
o gallstones	o congenital defect	o stroke
o rheumatism		o thyroid disease
		o cancer

MEDICAL CONSUMPTION
VISITS TO GENERAL PRACTITIONER: about once every half year
VISITS TO SPECIALIST: less than once a year
PARAMEDICAL HELP: from physiotherapist
X-RAY: 2 to 5 years ago

CONSUMPTION
ALCOHOL: wine
1 glass per day
SMOKING: cigars
1-5 per day
started: 30-40 yrs ago
not smoked: since 10-20 yrs

DIET: regularly
little salt
COFFEE: 5 cups per day
LIQUOR: sometimes

OTHER INFORMATION
VISIT TO TROPICAL AREAS: 1-2 yrs ago
WORKING CONDITIONS: office work
tedious work
AGE FATHER: 60-70 yrs
AGE MOTHER: 50-60 yrs
DECEASED RELATIVES: mother
sister

Chapter 2 - Ergonomic aspects

As part of our research, we wanted to investigate some ergonomic aspects of the system. We investigated how questions should be presented to the patient and how patients might have problems using the system. This part of our study is presented in *Chapter 2.* The *Appendix* presents a description of the patient population.

Automation of the patient history - evaluation of ergonomic aspects

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International Journal of Bio-Medical Computing 21;1987:287-298

Abstract

In this study it was investigated in quantitative terms how patient reactions were on automated history-taking. The study is part of a comprehensive project, in which also physicians participated in the validation of such computerized medical records. In total 99 patients, visiting the outpatient clinic of Internal Medicine for the first time, took part in this in-depth study, in which they could express themselves via an interactive and modified terminal and keyboard. The questionnaire that was used in the system contains 28 different screens. Patient complaints are entered together with data on frequency, severity, onset, and duration. The patient may indicate his physical complaints on a stylized picture of the human body. Of the 99 patients, 67 answered the full questionnaire, and another 16 the main part. On the average, 66 min were needed. Younger patients do complete the history in a significantly shorter time than older patients, resulting in relatively more completed histories for the younger group. Quick patients answered on the average 3.5 questions per minute, the slow patients only 2.5. This was strongly correlated with patient familiarization, that has also been investigated: patients who had a quick familiarization were able to finish within 50 min. Patients who needed no help at all in using the system had even answering rates of 3.9 /min.

Keywords: Computerized history; Internal medicine; Ergonomy; Evaluation

Introduction

The availability of computers has greatly influenced medical practice. With the help of data base facilities, for instance, a physician can store and retrieve data for patient care or for medical research. In this way patient data can be made available at wish at any place and at any moment. Computers are not only useful for the physician: they can also be used by patients for medical history-taking, with the help of a computerized questionnaire. Answering a questionnaire, however, takes time, and the use of a terminal usually prohibits that patients answer questionnaires at home, as is quite well possible with paper-based questionnaires.
One of the earliest questionnaires was the Cornell Medical Index (Brodman *et al.*, 1949). This paper-and-pencil questionnaire was filled out by the patient, usually in the physician's waiting room. Similar questionnaires made use of punched cards in order to make computer processing possible. The patient-answers were usually restricted to 'yes', 'no' or 'perhaps'. The patient had to answer about a hundred questions. With the help of the computer, a report could be printed, highlighting positive and uncertain responses. For the physician a concise report is desirable. Therefore in the program rules have to be present to determine important symptoms. The physician may have doubts about the adequacy of these rules and therefore be obliged to read a rather elaborate report.
A difficulty with these types of questionnaires was that they hardly could contain any branching logic. Positive and uncertain questions could not be elaborated upon. This task had to be performed later on by the physician. Consequently, the physician might spend as much time in reading the full printed report as it would have taken him to ask the patient directly. Also many positive answers could be interpreted with difficulty, without seeing the patient.
The first questionnaire with branching logic was introduced by Slack *et al.* (1966). In this case, additional questions could be asked, following certain responses. For example the duration, intensity and frequency of a certain positive finding (a complaint) could be further explored. Usually, common sets of clarifying questions were used. Slack and Van Cura (1968) also studied the acceptability of computer interrogation and concluded that it is reliable and well accepted by patients. Warner *et al.* (1972) developed a sequential Bayesian approach to history-taking. In this case a set of questions is always asked. After certain positive responses, further questions are asked and disease probabilities calculated according to Bayes' rule. The most likely diagnoses are then selected. Other questions are selected to distinguish between the two most likely diagnoses. Grossman *et al.* (1971) reported about a computer interrogation system at Massachusetts General Hospital in Boston. They compared the histories

obtained by the computer with those obtained by the physicians in second interviews, and found a high degree of agreement. Patients accepted the interview well. The physicians felt that too many data, not relevant to the actual patient management were collected, and that significant positive findings had to be rechecked in order to be sure that the patient understood the question. Also Lucas *et al.* (1976) concluded that computer interrogation was about as reliable as a physician, and that patients reacted positively on computerized questionnaires and in some cases did even prefer it.

The study reported here was initiated in order to investigate the benefits of computerized questioning both for the physician and the patient, based on the same patient population. Although several approaches were reported in the literature, as mentioned above, it was felt that a more comprehensive study, directed towards the diagnosis could be obtained by means of interactive computerized history-taking and subsequent interpretation by physicians. The purpose of our study was to investigate the relationship between complaints expressed by the patient and diagnostic hypotheses formulated by the physician. Also the diagnostic hypotheses stated on the basis of the written medical record were compared with those derived from the printed patient report. A further goal was to find out, whether the patients obtained a better insight in their own health status, by answering the automated questionnaire, and could express their complaints in a better way. Some results from our comprehensive study were reported earlier (Quaak *et al.*, 1986; 1987). In this article we will confine ourselves to the description of the way the patients interacted with the system. The system was designed in such a way that the patients could interact with it as freely as possible. To that end attention was paid to the use of coloured function keys, illumination of the keys of the keyboard, a user-friendly screen layout, multiple-choice answering possibilities, extensive help-functions, besides plausibility checks and branching logic. Evaluation was done of the times needed to answer the different parts of the questionnaire and the reasons why certain patients were not able to answer all questions of the history. More specifically we investigated, wherever possible in quantitative terms, the following aspects of computerized history-taking: (i) the influence of ergonomic aspects on patient performance and opinions, (ii) measurements related to responses of patients, and (iii) familiarization of patients as a function of age and sex.

Patients and methods

The patients, participating in our research project, visited the outpatient clinic of the Dept. of Medicine for the first time. The usual procedure at the clinic is, that these patients are first examined by a medical student

(trainee), after which a resident or an internist checks his results.
After a pilot study it was decided to let the patient perform the answering of the questionnaire before the oral history taking. Thereafter the patient would follow the routine procedure as described above. In total 99 patients answered the computerized questionnaire. The way the system was constructed by fourth-generation software has been presented elsewhere (Quaak *et al.*, 1987).

The terminal
For the computer interrogation, a standard computer terminal was modified to make it easy to use by the patients. The patient only had to use the upper row of keys, modified to function keys. The keys were divided into three groups: Blue, Green and Red, and were identified as such by computer-controlled illumination of the corresponding keys, to enable easy answering of questions about severity, frequency, and escape answers respectively. The escape answers were: "no answer", "I don't know" and "I don't understand". The numeric keypad was used for entering numeric codes concerning the duration of a complaint, its history etc. A further adaptation of the terminal was the removal of the return key and of the repeat function of the keys, in order to prevent the continuous generation of the code of the corresponding key when it was pressed too long.

The questionnaire
The questionnaire consists of 28 screens. All screens are split into two parts. The upper part contains a number of mnemonics (short names for more extensive questions), each followed by an answer field. In the lower part the full text of the question that has to be answered, is displayed (see Fig. 1a). After pressing a key, the corresponding full answer is presented in the answer field (Fig. 1b).
In order to acquaint the patient with the operation of the terminal, he is first confronted with an example, i.e. a non-medical screen to get used to the system. With the help of this screen the various question types are explained, together with the way to answer these questions or, if necessary, how to change an answer. After this short exercise, the computerized history-taking is started.
The first screen asks several aspects of the main complaint, its frequency, severity, etc. In the second and third screen questions are asked about the presence of general disorders (problems with eating, stomach or bowels, etc.). The fourth screen asks for general disturbances like being troubled by fatigueness, dizziness etc. In these four screens information about 33 items is asked. The fifth screen contains a stylized picture of the front- and backside of the human body. With the help of this screen the patient can indicate the location of his complaints. For each location the patient may

```
              (a)LOWER AIR PASSAGES

Coughing: .......... Shortness of breath ........

Pain during breathing or coughing: ........
Wheezing: .......

                                End of screen: ........
-----------EXPLANATION FOR EACH QUESTION---------

    Do you ever cough?
                                      GREEN or RED key
```

```
              (b)LOWER AIR PASSAGES

Coughing:regularly  Shortness of breath:sometimes
Intensity:moderate  Intensity: much trouble
Type of coughing: painful, with sputum
History: since one week

Pain during breathing or coughing: often
Location: left on the chest

Wheezing: seldom
Location: left on the chest

                               End of screen #
-----------EXPLANATION FOR EACH QUESTION---------

   Last question of this screen
0 = Go on to next screen
1 = Edit this screen          USE NUMERIC KEY
2 = Stop answering the questionnaire
```

Fig. 1. Example of screen for Lower Air Passages, before (a) and after (b) answering by the patient. The full question appears in the lower part of the screen, with an indication of the expected answers, although at the same time the illumination at the function keys also makes clear out of which answers the patient should make a choice. The full answer appears in the upper half of the screen.

select one or more of the following complaints: pain, pain radiation, inflammation, skin disease, loss of blood, swelling, joint complaint, tingling, or any other complaint. Next, the frequency, severity etc. of such physical indications can be given. The patient is also asked whether he wants to answer more questions about the complaint. If so, the corresponding tract-screen is displayed. The next sixteen screens ask questions about tracts, and a total of 95 items are involved. The order in which these screens are

EXAMPLE OF PART OF PRINTED PATIENT HISTORY

```
Patient: XXXXXX                              Date: 20 March 1985
Birth date: XXXXXX

                        REASON OF VISIT
Patient visited the outpatient clinic because of
problems wih his health.
The compaints existed longer than two years and are
                                        regularly present.
The patient is rather worried about his problems and
sees as possible causes of his complaints:
                                        working conditions
The patient received help from his family physician.

Patient has trouble with:          Patient is troubled by:
Stomach and bowels -: often        Nervousness -: regularly
Breathing ----------: regularly    Fatigueness -: regularly
Exercise -----------: regularly    Dizziness ---: sometimes
Sleeping -----------: sometimes

                    LOCATION OF COMPLAINTS
At throat:                         Frequency: often
   - pain                          Intensity: much trouble
   - swelling                      Duration : 1-3 hours
                                   Onset: since one week

At right elbow:                    Frequency: regularly
   - pain                          Intensity: moderate
   - joint complaint               Duration : 6-12 hours
   - swelling                      Onset: since 1-6 months

                        AIR PASSAGES
HOARSENESS:              sometimes  COUGHING:        regularly
onset:           since 1/2-1 year  intensity:  much trouble
WHEEZING:                   often  type:      in the morning
intensity:          much trouble   PAIN BREATHING/COUGHING:
onset:           since 3-6 months                  sometimes
PHLEGM:                  regularly  location:     in the back
type:             brown and thin                 on the chest
SHORTNESS OF BREATH:        often
intensity:          much trouble
onset:           since 1/2-1 year

                           GENERAL
Allergic:                  always  Chilly:              often
allergies for:               cats
                    much trouble
```

Fig. 2. Example of part of a simple printed report, after completion by the patient of the interactive history- taking. Only answers with a higher frequency than 'sometimes' are printed. Longer reports are also possible, if desired.

presented is determined by the answers given to the first four screens. Screens, that were already presented before, when answering the fifth screen, are now omitted. The next five screens contain questions about the past medical history; one contains questions about the medical consumption; a last screen contains miscellaneous questions about working

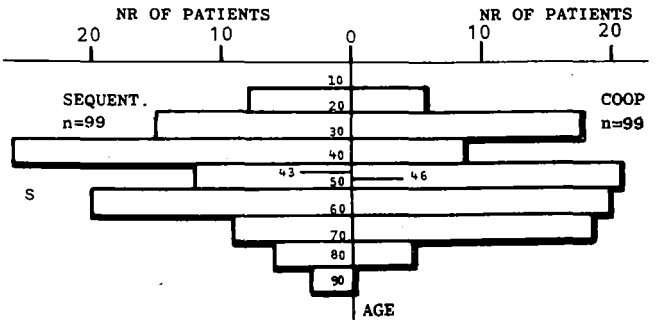

Fig. 3. Age distributions of patients who participated in the project (right side) and a sequential group of patients (left) visiting the outpatient clinic.

conditions, visits to tropical countries, etc. In total 179 items may be asked by 402 questions, while the patient has a choice out of maximally 434 answers. The branching logic of the program has been constructed in such a way that after each frequency question, dependent on the answer given, additional questions may be asked about the severity of the problem. After the interrogation the patients answers are printed and given to the patient for review and comments. Figure 2 gives an example of a condensed report.

Selection procedure

The patients were not completely at random selected: they were recruited by telephone and had to live in Amsterdam or in one of its suburbs. Only those patients were contacted, that had appointments early in the morning. The computerized questionnaire was either answered that same morning, starting an hour before the appointment, or, incidentally, the day before. The patients, that were asked for their cooperation (about 300), were not always able to participate, but only very few did refuse to cooperate. In total, 99 patients participated in our study. In the second part of the study, the reasons for not cooperating were determined. Of 95 patients, that were asked in that part, 51 agreed to participate. The patients that were not willing to cooperate usually had either other appointments, or considered themselves too old or too ill. Only seven patients declined without stating a reason.

In Fig. 3 the age distribution of the research population of 99 patients is compared with the age distribution of a random group of 99 consecutive patients that also visited the clinic for the first time. It can be concluded that these age distributions are not significantly different. Also the sex distributions of both groups are similar, indicating that the patients participating in the study do not show a large selection bias concerning these aspects.

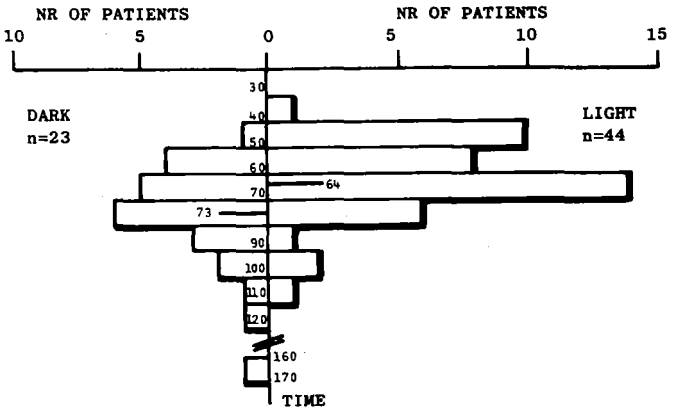

Fig. 4. The time the patients needed to answer the full questionnaire, depicted for the DARK and LIGHT groups. The former group needed on the average 73, and the latter 64 min.

Subdivision of the population

The patients were subdivided into three groups on the basis of having the questionnaire completed or not. Group A: 67 patients, who completed the whole questionnaire; Group B: 16 patients, who answered the main part of the questionnaire but not the part concerning the past medical history; Group C: 16 patients, who even did not complete the main part of the questionnaire, but gave answers about main complaints.

During the research period, the effect was studied of the illumination of the keys of the terminal. There were 30 patients who answered the questionnaire using a terminal without this illumination (the DARK group) as compared to 69 patients who used the illuminated keyboard (LIGHT group). Since the illumination was added to the keyboard in order to make the use of the terminal easier, it was also studied whether this equipment indeed reduced the time needed for completion. For both subgroups, the effect of the different ergonomic approaches were evaluated, not only by measurements of response times, but also by observation of the behavior of the patients and their familiarization to the system.

Results

Time measurements

As was stated earlier, the questionnaire was split into two parts: a part containing questions about the patients' complaints (the main part), and a part with questions about past diseases and medical consumption. All patients started with the main part. Usually the patients had only limited time available (about one hour) for working with the terminal, because of

their subsequent appointment with the medical trainee for oral history-taking. Patients will have varying numbers of complaints; the dependency on this number has been investigated by computing the time needed per given answer.

As specified above, 67 patients completed the full questionnaire (group A). In Fig. 4 a histogram of the total time, needed by the patients of this group to complete the questionnaire, is displayed. On the average, 66 min were needed. There was a slight, but no significant difference between the DARK and LIGHT groups (73 and 64 min, respectively). In the A-group, the younger patients completed the history in a shorter time than the older patients. This difference is significant when different age groups are compared (< 40 years, between 40 and 60 years, and > 60 years). In the A-group 48% of the patients < 40 years completed the questionnaire within one hour, as compared to 15% of the age group between 40 and 60 years, and 8% for the oldest patients.

Not only does the time needed to complete the questionnaire depend on age, but this is also the case for the percentage of patients who completed the questionnaire: 82% of the youngest group, 63% of the middle group, and 56% of the oldest group finished completely the computerized history-taking. Since the patients were usually obliged to stop answering questions after 90 minutes, both observed dependencies on age are correlated. When we make a correction for the extra screen they have to answer, women are neither slower nor faster than men in answering the questionnaire.

The same conclusion was reached for the group of patients who completed the main part of the questionnaire (groups A plus B, in total 83 patients). The time needed for completion of the main part of the questionnaire depends on age in a significant way. Again, the percentage of patients who completed the main part of the questionnaire, decreased with age. The reason, why a patient stopped prematurely, was also recorded. Usually the reason was lack of time (24 patients); in total only 8 patients decided voluntarily to stop. The patients of group C stopped after 51 minutes on the average, two-thirds of them because of lack of time.

Of the 16 patients who stopped before completing the main part, six wanted to stop voluntarily. These six patients stopped, on the average, after 55 min, and completed about 14 screens. Since some of the patients were forced to stop because of external reasons, it is interesting to compare the answering rates of the different groups. It appears that the answering rate correlates well with the grade of completion. The patients who finished the whole questionnaire answered on the average 3.5 questions/min; those who finished only the main part had a rate of 3.2 questions/min. This answering rate was also found for patients who had to stop because of lack of time. The patients who decided to stop had a much lower mean answering rate: 2.5 answers/min.

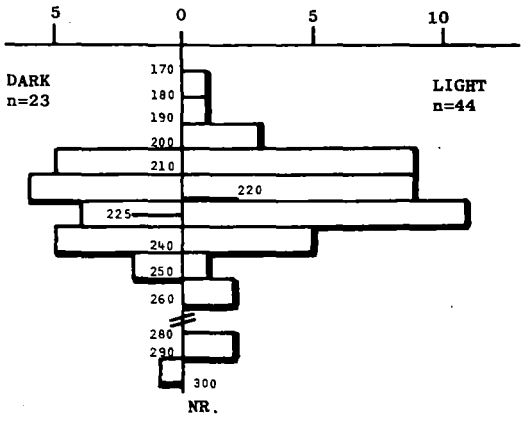

Fig. 5. The number of patients for the LIGHT and DARK groups who gave a certain amount of answers in completing the entire questionnaire. There are no differences for both groups (means 220 and 225 answers respectively, overall mean is 222 answers).

In Fig. 5 the distribution of the number of answers given by the patients is presented. As can be seen, on the average 222 answers were given by those patients who completed the entire questionnaire, with no difference between the DARK and LIGHT groups (225 vs. 220 answers). It appeared that in group A, there was no age-dependency: the older patients provided on the average the same number of answers (and had for that reason a similar number of complaints) as the younger groups. This unexpected outcome may be partly due to selection, although the age distribution of the research group was similar to the age distribution of a group of consecutive patients. Another selection mechanism is the fact, that this absence of a relationship was found for group A, in which a higher mean answering rate was found than in the other groups. Therefore, within the time constraints of the study, only those older patients will have completed the entire questionnaire, when having a relatively smaller number of complaints.

Patient familiarization

The principal investigator familiarized the patients with the computer terminal. The patients were watched to ensure that they fully understood the method of operation. The speed of familiarization was recorded by the investigator. Four classes of patients were discerned: N, patients showing no familiarization at all, i.e., the patients had continuously problems with the use of the terminal: S, patients showing a slow speed of familiarization, for whom only the first few screens offered problems; R, patients who

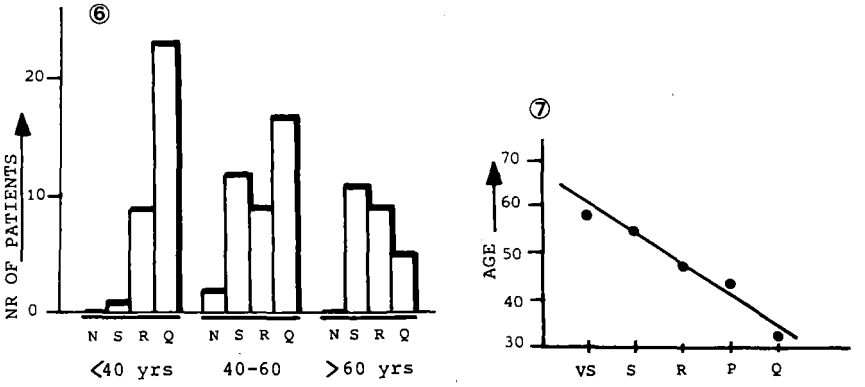

Fig. 6 Number of patients in three age groups (<40, between 40 and 60, and >60 years), who had no (N), (very) slow (S), reasonably quick (R), and quick (Q) familiarization with the use of the interactive system for history-taking.

Fig. 7 The mean age of patients as a function of speed of familiarization with the system: very slow (VS), slow (S), reasonably quick (R), prompt (P), and quick (Q).

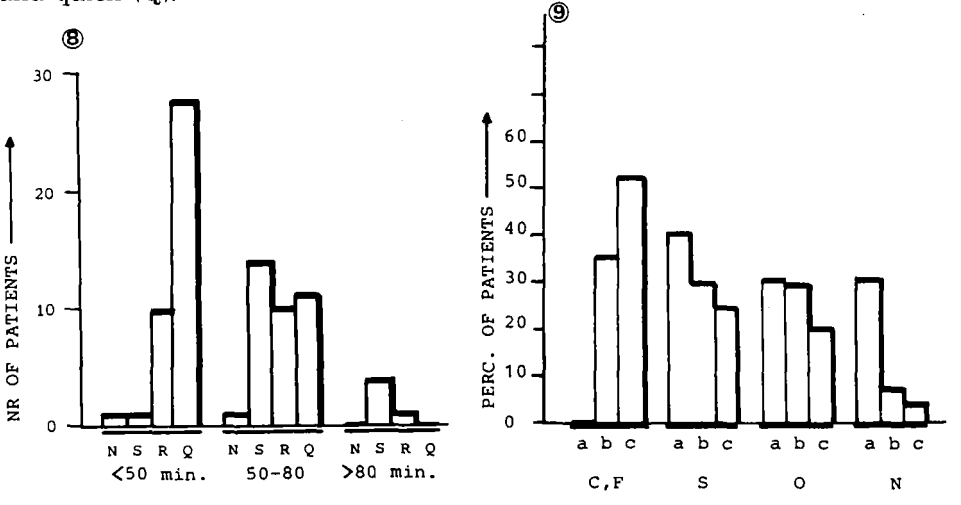

Fig. 8 The number of patients in the categories of Fig. 6, who completed the questionnaire within 50, in between 50 and 80, and after 80 min.

Fig. 9. Percentages of patients in age categories <40, between 40 and 60, and >60 years who needed continuously (C) or frequently (F), sometimes (S), only once (O), or no (N) assistance. (a) Patients younger than 40 years, (b) patients in between 40 and 60 years, (c) patients older than 60 years.

showed a reasonable speed of familiarization, i.e. after the first exercise screen, the patient had only minor problems with the next screen; Q, patients who familiarize quickly; after the first exercise screen the patients had no problems at all, using the system.
In Fig. 6 the speed of familiarization is expressed as a function of age class; in Fig. 7 the mean age is computed for groups of patients who were very slow, slow, reasonably quickly, had prompt reactions, and who had very quick reactions. There is a very strong relationship with age, as appears from the figures. Of course, the degree of familiarization is determined whether the patients needed much time for the total interview, as can be seen from Fig. 8. The reasonably- or very quick patients were able to finish the interview within 50 min. Slow patients needed over 60 min, and some even over 80 min. Because of the relationship with age, apparent from Fig. 7, it can be understood why older patients needed more time. The patient was given assistance whenever it was needed. In Fig. 9 the frequency of assistance is presented (in percentages). In 29% of 82 patients (the patients who completed at least the main part), frequent assistance had to be given. Patients who decided to stop needed on the average more assistance. Patients needing no help had an answering rate of 3.9 answers/min; patients who needed assistance for each screen had a rate of only 2.5 answers/min.

Conclusions and discussion

First of all we offer the main conclusions from this study. Patients needed on the average 54 min to answer the main part of the questionnaire; the time needed to complete the entire questionnaire was 66 min. This includes the time needed for familiarization with the system. During this time, on the average 222 answers were given, although the speed by which the patients answered the questionnaire was correlated with age; there was no relationship with sex. The questionnaire permits specific questions to be asked, in response to more general questions; branching logic takes care of further in-depth questioning. There was always the possibility to choose from multiple answers and in this way the history-taking was very user-friendly.
It could be observed, that older patients were considerably slower in getting familiarized with the terminal than younger ones. Problems were observed in getting acquainted with the layout of the screens: some patients were not able to distinguish the different parts of the screens. The number of such problems appeared te be correlated with age and sex; especially young patients (below 40 years) had little or no problems in using the terminal. However, the screen on which the patients could indicate the location of their physical complaints appeared to be too difficult to use for

many patients. There is an indication, that the illumination of the special function keys resulted in a faster familiarization than without its use. About 70% of the patients could complete the full questionnaire, and more than 80% could complete the main part of it, although only a limited time (in the order of one h) was available. Only 10% of the patients did not want to continue answering after a little less than 1 h.

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Chapter 3 - Patient appreciations

We were interested in the reactions and opinions of the patients regarding the automated system for history taking. *Chapter 3* describes this part of the study.
In the Appendix the paper questionnaire is given.

Patient appreciations of computerized medical interviews

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Abstract.

In a research project on the automation of patient histories, 99 patients in internal medicine were questioned about their opinions on computerized medical records, after having answered an automated questionnaire. Patients were very positive on being able to express their medical complaints and the large majority found it useful (94%); 68% could express all or most of their complaints, but some of their physical complaints could not be entered (47% women against 25% men). Of the male patients 74% found the range of answers from which to choose sufficient, against 52% of the women. The printed report was positively rated, with a higher appreciation by men.

Keywords: Internal medicine: Medical record; Patient appreciation; Automated medical history.

1. Introduction

In the last decades several systems have been developed for the automation of (parts of) the patient interview [1,2]. Some early systems were based on a paper questionnaire that was sent to the patient's home, that had to be filled in and sent back to the physician; whereafter it was keypunched, entered into a computer and printed in a standardized form [3]. In some instances also mark-sense readable forms were developed. These forms were intended to be used before the actual patient interview was done by a physician. Such projects were started because it was felt, that the time allotted to the oral interview was rather short, and that important complaints might be easily overlooked or the interview concentrates too much on one complaint. This finding was also the reason why the so-called Problem Oriented Record (POR) was developed [4].

During the last few years coding and keypunching have been circumvented and, because computers became cheaper and personal computers appeared on the market, systems became friendlier for the non-professional user. In several projects paper forms were replaced by interactive terminals where the patient is able to enter his own answers into the computer [5]. Some of such systems even have special keyboards that are constructed in such a way that typewriting by the patient can be avoided as much as possible and errors can be prevented and corrected.

Still, there are many different ways to construct software for interactive history taking. It can be done by just following menus containing questions and a series of answers, from which the patient should choose some answer, say, one out of five different possibilities. The order of the questions may be varied in different ways: a patient either has to reply to each question that has been presented by the system, or 'intelligence' has been built into the system so that the patient is asked in depth only about those categories for which he apparently has some complaints. Other ways of entering data might be a friendly interactive system, for instance the use of touch-screens, or the use of special function keys; voice input has not as yet been realized for taking patient interviews.

In this article we want to report on a research project that we carried out in cooperation with the Department of Internal Medicine of our hospital. Patients were asked to answer questions about their complaints, while sitting behind a computer terminal. The keyboard had been modified in such a way that even non-experienced patients could use it after a very short introductory period. In this report we will discuss the results of a questionnaire given to 50 patients who participated in the study concerning their opinions on computerized history taking. A full description of this system is given elsewhere [6]. In figure 1 we have given a picture of the type of terminal that the patients used during the computerized interview.

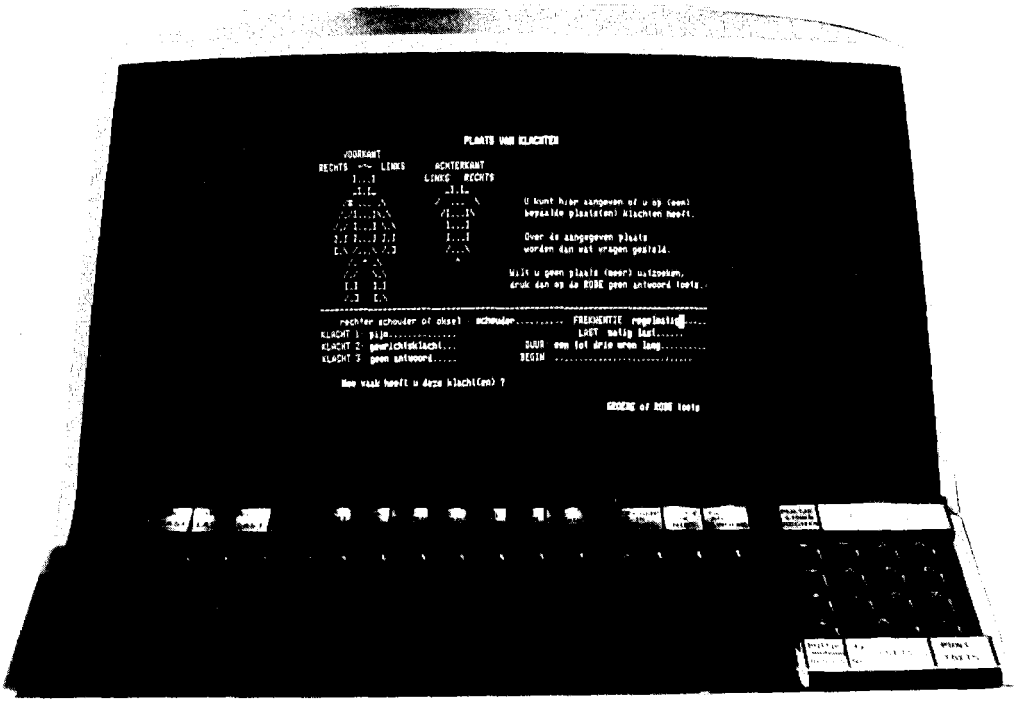

Figure 1. Display terminal, used for computer-assisted history taking. The patient presses keys that are indicated by lights in different colours.

As soon as the medical interview was completed a report was generated on a nearby printer and given to the patient for inspection, who was allowed to keep it and/or modify it.

2. Patients and methods

In our study we requested 99 patients with their first appointments at the out-patient clinic for Internal Medicine to arrive about one hour earlier than their actual appointment. Only those patients who had an appointment between 10.00 and 11.00 a.m. were asked to participate; the few that declined the invitation did so because they had a lack of time. Since the patients were requested to come one hour before the actual oral patient interview, some of them could not complete the computerized interview in full, although almost all of them completed the main part. For most of the 50 patients who participated in this part of the project there was still enough time to ask their opinions on the computerized interview that they had completed.
The male/female ratio of the group of 50 was exactly the same as in the

total group: 38% women (19) and 62% men (31). The questionnaire about the opinion of the patients was only asked in the last phase of the project. Only 10 patients (of the 50) were not able to complete the entire computerized medical questionnaire.
Also, the mean ages of patients participating in the opinion questionnaire were the same as in the total group: 48 years for the men and 44 years for the women. In the group of patients, who answered the opinion questionnaire we counted 3.5 answers per minute during the computerized history taking, whereas in another group of 20 patients who were not able to answer the opinion questionnaire because of lack of time, 3.2 answers per minute were given during the computerized interview. Apparently the patients who expressed their opinions were handier in using the terminal. This also might have influenced their opinions about the use of a computerized interview in a positive way.
Answering the opinion questionnaire took about three to five minutes and was done during the time that the computerized medical interview was printed. Since the patients did not answer the questionnaire anonymously, this might possibly have had influence on the results.
In the opinion questionnaire (OQ) eight questions were asked about the computerized patient interview (PR) and the report. In the first question several appreciations could be indicated with 'yes' or 'no'; two questions were asked about expressing patient complaints and one question about a possible change in insight in one's own complaints. Another question asked the opinion about the different possibilities that were offered to express one's complaints. The last three questions concerned the printed report produced while the patients answered the first questions, and that could also be checked by the patient. After this review of the report, the patients could answer these last three questions: one about the appreciation of the report, another about the expected use of the report by the patient himself and one about its expected value for the physician, whom the patient was supposed to see after the computerized history taking.
In the following paragraphs we shall discuss these questions one by one and look at the answers given by the patients.

3. Results

In this section we shall review all patients' opinions (OQ1 - OQ8) about the computerized patient interview.

3.1. OQ1: Opinion about the computerized interview

The first question concerned the opinion of the patient about the use of the terminal itself for answering medical questions. Seven 'appreciations' could

Patient appreciations

Answers	Yes	No	Missing
Useful	92	2	6
Easy	84	8	8
Interesting	84	6	10
Lengthy	10	74	16
Annoying	4	76	20
Difficult	4	72	24
Unnecessary	2	72	26

Table 1. Opinions of the patients (OQ1) on the use of a computerized history. Patients expressed their opinions as 'yes' or 'no' to the questions.

be expressed by marking each of them by 'yes' or 'no', although it was not necessary to indicate all appreciations. For that reason some items obtained less indications than other ones. All 50 patients did give at least one appreciation.

In the group of 50 patients, 40 answered the complete computerized interview, six patients almost completed the interview and another four completed only the main part of it.

In table 1 we have summarized the answers of the patients with respect to the first question about appreciation.

As can be seen, 92% considered the PR useful and 2% did not; 6% of the answers were missing in this category; 84% found it easy, 8% not easy, although 72% found it not difficult, whereas 4% answered 'yes' to this question; 6% of the patients found the PR uninteresting and 10% found it lengthy.

'Annoying' was the opinion of only 4% of the patients and 72% found it not unnecessary. The finding that some of the questions, although falling in the same category, were answered slightly differently, could be due to the fact that some questions had a more or less negative sounding and were for that reason less frequently answered. It can be concluded that there is generally more agreement with positive items (84-92%) than disagreement with negative items (72-76%).

Summarizing, the patients seem to be rather positive: more than 72% gave a positive answer. Especially the item 'useful' is answered in 94% of the cases, 92% positively. Apparently, patients have few doubts about the use of a computerized patient interview, but hesitate in giving a negative reply. The 10 patients who did not fully complete the computerized interview, were slightly more negative: 30% of them answered that they found the

PR lengthy, and 20% of them indicated that they found the interview annoying.
We also examined the age distributions of the different opinions, and we found that in the patients younger than 40 years (17 patients) 10% of the answers were not given and 3% were negative. For the age-group 40-60 years (20 patients) these percentages were 24% and 6% respectively, and for the age-group older than 60 years (13 patients) these percentages were 10% and 7%. We see that there is only a slight tendency to give more negative answers with increasing age. The replies were mainly positive.
If we look at the sex differences (19 men and 31 women) we find that significantly more women have the opinion that the computerized patient interview is lengthy (16% against 0%). Less women, however, answer that they find the interview 'difficult' (67% as compared to 78%) and more women answer yes for 'easy' (87% against 78%). The appreciations for 'annoying', 'unnecessary' and 'useful' are equal for men and women. Men give more positive answers for 'interesting' than women (94% against 77%).

3.2 OQ2: Expressing complaints

The next question in the OQ was intended to obtain an impression on how the patients felt that they were able to express themselves regarding their complaints. The question was formulated as follows:

Were you able to express your complaints by the computerized questionnaire?

Here again, there were several possibilities for the patients in choosing answers. In table 2 we have summed up the answers of all 50 patients and have also given separately the results for the group of 40 patients who answered the patient interview completely, and for the 10 who only answered the main part. About 70% could express most or all of their complaints, 26% only part of their complaints and 2% could not express their complaints at all. The same distributions of answers are found for the group of 40 and 10 patients.

The main reason that the majority of patients (68%) could express all or most of their complaints, might be the result of how we have structured the computerized interview: first of all the patient is asked about his/her main complaints, and even patients who had to stop answering before finishing the questionnaire had already expressed most of their complaints. For the group of 40 patients who completed the total computerized interview, we investigated whether their opinions were related to the number of

Answers	50 patients	40 of 50 patients	10 of 50 patients
All complaints	20	16	4
Most complaints	48	38	10
Part of complaints	26	20	6
None of complaints	2	2	0
Don't know	0	0	0
No answer	2	2	0
Other	2	2	0
Don't understand	0	0	0

Table 2. Opinions of patients (OQ2) whether they felt they could express their complaints by a computerized interview. The group of 40 answered the full computer questionnaire, the group of the 10 the main and most important part of it.

questions that they answered during the computerized interview. In the group of patients, who said that they could express all or most of their complaints, on the average 220 answers were given during the computerized history taking; this was exactly the same for the group of patients who said that they could only partly express themselves with respect to their complaints; for the few patients who said that they could not at all express their complaints (three patients) the average number of answers was 200. Because of the small number of patients in the last group, we of course cannot conclude that there is a correlation between the number of answers during the PR and the opinions given in the second question of the OQ.

We also investigated the sex differences with respect to this question in the OQ. There appears to be a significant difference between the two groups: 79% of the 19 men said they could express most or all of their main complaints, whereas this was the case only for 62% of the 31 women; 10% of the men and 35% of the women could express themselves partly; and 10% of the men and 3% of the women could not express themselves at all regarding their main complaints.

In the age-group of patients between 40-60 years these differences are even more prominent: all/most vs partly for men is 32%/5%, and for women 10%/29%. In the discussion in the end of this article, we will give further comment on this finding.

Answers expressable	50 pat.	40 of 50 patients	10 of 50 patients
Yes All complaints	11	11	0
No Some physical compl.	18	15	3
Some psychol. compl.	5	4	1
Some social compl.	0	0	0
Some other complaints	4	3	1
Most important compl.	11	7	4
Some less important complaint	1	0	1
Don't know	1	1	0
No answer	4	3	1
Don't understand	0	0	0
Missing	2	0	2

Table 3. Opinions of the patients (OQ3) whether they could express all complaints or had difficulties in expressing some of their complaints.

3.3 OQ3: Unexpressed complaints

A further question in the OQ was about complaints that could *not* be expressed during the computerized interview. This question, however, did not directly follow the question on the possibility to express complaints, but was preceded by the question on the range of answers (see below). The question asked here was as follows:

Which complaints could not be expressed in this questionnaire?

The answers on this question are presented in table 3. Because patients could indicate more than one item we have presented the number of answers instead of percentages. In table 3 we have also given the total number of answers for the groups of 40 and 10 patients who answered the PR completely or the main part, respectively. We see that of the 50 patients only 11 could express all their complaints and another 11 could not express their most important complaints. The category with the highest percentage for which the patients could not express themselves was physical complaints (18), whereas some of the patients indicated that they also had problems with psychological and other complaints. Only two patients did not answer this question.
It is remarkable that as many as 22% of the patients indicated that their

most important complaints could not be expressed by the computerized interview. It is also interesting that no one indicated that he/she could not express his/her complaints dealing with social problems. In the computerized interview itself, there was only one rather global question dealing with this category:

Do you have social problems?

Of all patients, 28% answered this question with 'sometimes', 'regularly' or 'often'. So, although there apparently were complaints, no one felt the need to give more details.
If we relate the answers to this question with the answers given on the first question - the appreciation of the questionnaire - we see the following: patients who could not express some physical complaints gave 106 positive answers and eight negative answers, whereas patients who could express all their complaints gave 70 positive opinions and no negative answers.
If we look at the sex differences then it appears that 25% of the men against 20% of the women indicated that they could express all complaints, whereas 47% of the women indicated that they could not express some physical complaints, against 25% of the men. It also appeared that 12% of the women could not express some psychological complaints, against 5% of the men. In the age-group of 40-60 years, 19% of the women indicated that they could not express some physical complaints against 5% of the men. In combination with the results on the second question, it could be concluded that, especially in the age-group 40-60 years, the women could not express part of their complaints that fell especially in the category physical complaints.
We also investigated whether the total number of answers given in the computerized interview differed amongst the different categories in this question of the OQ. This certainly was not the case, because the mean of the total number of answers given during the PR for the patients who said that they could express 'all complaints', 'no physical complaints', 'no psychological complaints', and 'no important complaints' were 215, 218, 227, and 214 respectively.

3.4. OQ4: Change of insight in own complaints

The next question that was asked was the following:

Did you change your opinion regarding your own complaints while answering the questionnaire?

The different answers that could be given are listed in table 4 together with the total number of patients' answers. It can be seen that of all patients 39

Change in insight	50 pat.	40 of 50 patients	10 of 50 patients
Increased	5	4	1
Not changed	39	32	7
Changed	1	1	0
Decreased	1	1	0
Don't know	1	1	0
No answer	1	0	1
Other	1	1	0
Don't understand	0	0	0
Missing	1	0	1

Table 4. Opinions of patients (OQ4) whether they felt they had changed their insight in their own health/disease status after the computerized interview.

answered that their opinion had not changed at all, for five patients the insight increased, for one patient it even decreased, one patient indicated that it had changed without giving a direction and three others didn't know or gave no answer (one patient did not answer this question).
The reason for asking this question was the assumption that it might be possible that the insight of the patient in his/her own complaints might have changed during the interview, because the patient had expressed himself in an orderly manner. Dove [7] calls this the 'psychotropic' effect of a questionnaire. It might also happen that, afterwards, when the patient reviews his answers on the printed report, he may look at his/her complaints in some other way than before. By asking this question we tried to obtain at least some idea about the use of such computerized interviews for patient self-care, that can only be stimulated when the patient himself has a clear picture of his own complaints.
There appeared to be no significant differences between men and women: 83% of the women and 74% of the men said that their insights remained unchanged. There also appeared to be no relationship with the age-categories.

3.5. OQ5: Range of answers in the computerized interview

Between questions OQ2 and OQ3 treated above, a question was asked about the range of possible answers that could be indicated in the computerized interview. The following question was asked:

Range of answers	50 patients	40 of 50 patients	10 of 50 patients
Too extensive	1	0	0
Sufficient	29	24	5
Insufficient	0	0	0
Good	9	9	0
Too restricted	6	5	1
Don't know	3	2	1
No answer	0	0	0
Other	0	0	0
Don't understand	0	0	0
Missing	2	0	2

Table 5. Opinions of patients (OQ5) on the range of possible answers by which they could express themselves.

What is your opinion about the range of possibilities in the different questions?

In table 5 we have indicated the different categories from which the patient could choose and the total number of answers given. Two patients did not answer this question. Of all patients 38 (76%) found the range of answers good or sufficient, one patient said 'too extensive' and 6 said 'too restrictive'; three patients didn't know.
From the figures in table 5 it appears that there is no real difference between the two groups of patients who completed the entire questionnaire, or the main part of it, except maybe for the questions 'good' or 'too extensive'. But, because of the small number of patients in the second group, we cannot say that these differences are significant.

Of the men, 74% found the range of answers sufficient, whereas this was only the case in 52% for the women. On the other hand, 10% of the men and 24% of the women found the range of answers good. 'Too restricted' said 14% of the women, against 10% of the men.
As a preliminary conclusion it can be drawn from table 5 that most patients are satisfied with the range of possibilities offered to them in expressing themselves during a computerized interview.

Printed report	45 patients Yes	No	No answer	38 of 45 patients Yes	No	No answer	7 of 45 patients Yes	No	No answer
Useful	41	1	3	34	1	3	7	0	0
Orderly	35	1	9	30	1	7	5	0	2
Too long	3	26	16	1	24	13	2	2	3
Unnecessary	5	24	16	5	20	13	0	4	3
Unclear	2	27	16	2	23	13	0	4	3
Too short	1	28	16	1	24	13	0	4	3

Table 6. Opinion of patients on the usefulness of the printed report. Of the original group of 50, five had no time to inspect the report. In the category NA, no answer was provided.

3.6. OQ6: Appreciation of the printed report

During the time that the first four questions (OQ1, 2, 3 and 5; OQ4 was asked later) were answered, the report was printed for inspection by the patient. After the patient had reviewed the report, the patient answered three questions regarding the summary of his/her own answers. The first question that was asked was:

What is your opinion about the printed report?

In table 6 we have summarized the different options and the answers of the patients. Of the group of 40 patients (who completed the entire interview) and 10 patients (who completed the main part of it), two and three patients respectively were not able to review the report because of lack of time. Of the remaining 45 patients, 41 (91%) found the report 'useful', 35 (77%) found it 'well ordered', 26 (57%) 'not too long', 24 (53%) 'not unnecessary', 27 (60%) 'not unclear', and 28 (62%) 'not too short'. Of the group of patients who did not complete the full computerized interview there were only slight deviations in the categories useful, ordered and unclear. The majority of the opinions is rather positive about the computerized report. The group of patients who answered that the report was too long gave 2.5 answers per minute, which is significantly lower than the 3.8 answers per minute given for the group of patients who answered that the interview was not too long. Apparently, patients who need more time for the questionnaire don't like to spend more time inspecting the printed report.

With respect to the sex differences, men inclined to find the printed report more useful than women; they also liked the orderly way it was printed and they did not find it too long (63% against 54%). There is a striking difference between men and women with respect to the question whether they found the report unnecessary: 42% of the men said 'no', against 62% of the women. For the other questions there was no real difference between the two sex groups.

3.7. OQ7: Use of report by patient

The next question that was asked about the printed report was:

Do you think you will ever review this report again?

This question was answered by all 50 patients, even the five patients who did not really inspect the printed report in detail. The patient could choose out of the following answers:

no;
maybe;
probably yes;
certainly;
I don't know;
I don't understand;
no answer.

Because the answers between the group of 40 and 10 patients are not significantly different, of all patients 40% answered with 'certainly' and 26% 'probably yes', whereas 10% and 12% said 'maybe' or 'I don't know'. Only 6% said no. There were no differences between men and women, except for the answer to the categories 'certainly' and 'I don't know'. Of the men 52% said 'certainly', against 32% of the women; 5% of the men said 'I don't know', against 16% of the women. Apparently women are more uncertain about the expected use of the printed report than men.

3.8. OQ8: Value of report for the physician

In this question the patient was asked whether he expected that the printed report would be useful for the physician. The following question was asked:

Do you think it is important that the doctor will also review the printed report?

From all 50 patients, 48 answered this question. The patient could choose out of the following options:

not important;
maybe;
probably yes;
certainly;
I don't know;
I don't understand;
no answer.

No significant difference was found between the groups who completed or almost completed the computerized history taking. Of the total group 60% answered 'certainly' and 26% 'probably yes', which is, taken together, a positive response of almost 90%. The category 'maybe' was 6%. None of the patients had the opinion that it was not important; 4% of them said that they had no opinion and 4% did not answer. Looking at sex differences, even 94% of the men said 'certainly' or 'probably yes', against 80% of the women. Only 12% of the women were uncertain, had no opinion or did not answer.
Maybe the answers to this question were the most important ones of the entire opinion questionnaire. We will come back to this and the other results in the next section, where we shall discuss our findings.

4. Discussion

Of a total group of 99 patients who participated in our research project into the use of computerized patient questionnaires, 50 patients took part in giving answers about the usefulness of a computerized patient interview. These were the patients of a subgroup of 70 who used a terminal that was adapted and modified for computerized history taking. Because of lack of time, for 20 patients this opinion questionnaire could not be given. In the group we had 19 men with a mean age of 48 years and 31 women with a mean age of 44 years. The age and sex distributions were comparable to those of the total population of 99 patients. In comparison to the entire group of 99 patients, the group that also answered the opinion questionnaire had a slightly higher total number of answers in the computerized medical history.
The majority of patients were positive in their opinion about the questionnaire as a whole; 92% of the inquired patients had the opinion that the questionnaire was useful and 84% thought that the questionnaire was easy and interesting. About 75% of the patients had the opinion that the computerized interview was not too lengthy or annoying, 72% had the opinion that it was not too difficult and not unnecessary.
We found no significant differences in answers between the different sexes and the different age groups (<40, 40-60, >60).
About 70% of all patients answered that they could express most or all of

their complaints with the help of the computerized questionnaire. In the age group of 40-60 years this percentage was lower: 45%.
Patients who could express only part of their complaints were not significantly more negative about the computerized interview. When asked about which complaints they could not express, 36% answered that some physical complaints could not be indicated, 22% indicated that their most important complaints could not be expressed.
In response to the question whether the insight in their own health status or complaints was changed or not, 78% answered that their insight had not changed by answering the computerized questionnaire and 10% answered that it had indeed changed. A large majority (76%) of the patients had the opinion that the range of possibilities to give answers was sufficient to good, 12% said that there were too few possibilities for answering.
For some questions there is a marked difference between the opinions given by men and women. Significantly more women (16%) than men (0%) had the opinion that answering the questionnaire was a lengthy procedure. More women than men (35% versus 11%) indicated that they could only partly express their complaints, 47% of the women answered that they could not express some physical complaints against 25% of the men. Of the men 21% indicated that their insight into their complaints had changed, against 7% of the women. Of the men 84% indicated that the range of answers was sufficient or good against 66% of the women. The appreciation of the printed report was positively validated (useful) by 91% of the patients: 95% men and 88% women; 78% of the men and 57% of the women were positive about the expected usefulness of the printed report for themselves. Asking about the usefulness of the printed report for the physician, 94% of the men had the opinion that it was probably or certainly important for the doctor, against 80% of the women.
In our investigations we also confirmed several results already obtained by other investigators. On the basis of the positive opinions of the patients about the questionnaire, we are convinced that computerized history taking has a proper place for a certain category of patients, especially during their first encounter - not only in the outpatient clinic, but also in primary care.

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Chapter 4 - Quantitative comparisons

Because we wanted to compare the answers from the computerized interview with those of the conventional, written answers of the orally interview, we investigated the nature and frequency of complaints in both types of interviews. To that end, the history data elicited by physicians were transcribed to the computer-based format. In *Chapter 4* a summary is presented of the comparisons between the different types of of histories, whereas the *Appendix* to this chapter presents a full list of all the comparisons.

Computerization of the patient history - patient answers compared with medical records

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Summary

Computerized medical history taking, in which patients answer questions by using a terminal, is compared with the written medical record for a group of 99 patients in internal medicine. Patient complaints were analysed with respect to their frequency of occurrence for all important tracts, such as the respiratory, the gastro-intestinal and the urino-genital tracts. About 36% of over 3,200 patient answers were identical in the patient record and the written record, but a considerable percentage of complaints (56%), that were present in the patient record, were missing in the written record; the reverse was true for 4.5%. A computerized patient record appears to contain more extensive information about patient complaints, still to be interpreted by the experienced physician.

Key-Words: Medical record, Automated Patient History, Problem-oriented record, Internal Medicine

Computergerechte Anamnese - Patientenantworten im Vergleich mit Arztberichten

Eine computergerechte Anamnese, wobei die Patienten selbst Fragen unter Benutzung eines Bildschirms beantworten, wird verglichen mit dem niedergeschriebenen Artzbericht für eine Gruppe von 99 Patienten der inneren Medizin. Die Beschwerden der Patienten wurden analysiert auf ihre Vorkommenshäufigkeit in allen wichtigen Organsystemen wie den Luft-

wegen, dem Verdauungstrakt und dem Urogenitaltrakt. Etwa 36% von mehr als 3200 Patientenantworten waren mit dem niedergeschriebenen Bericht identisch; jedoch fehlte in den niedergeschriebenen Berichten ein erheblicher Prozentsatz von Beschwerden (56%), die in den Patientenantworten auftauchten. Das Umgekehrte war der Fall für 4,5%. Eine computergerechte Anamnese enthält offensichtlich ausführlichere Informationen über die Beschwerden der Patienten, die dann jedoch noch durch einen erfahrenen Arzt interpretiert werden müssen.

Schlüssel-Wörter: Artzbericht, computergerechte Anamnese, problemorientierte Niederschrift, innere Medizin

Introduction

In many countries of the Western world, computers have been introduced in hospitals to support management and planning. Such systems are commonly known as Hospital Information Systems (see, e.g., [6,9]). The first wave of Hospital Information Systems mainly dealt with the support of hospital management and the infrastructure of the hospital rather than the direct support of medical care. Only during the last five to ten years have we also seen computers being introduced for the storage and retrieval of patient data and the support of medical care at the departmental level [1] and even for the medical practitioner [12].
During the last few years, the introduction of computers for the support of medical care has been stimulated by the advent of personal computers; the introduction of small and cheap systems has not only impact on medicine on the level of the physician, but also on the level of the patient himself. Patients are becoming aware of the fact that they themselves as well as medicine are surrounded by modern technology including computers. This development is stimulated in the Western countries by governments who try to decrease the costs of hospital and medical care in general and to stimulate the so-called self or home care.
One of the means to make patients more aware of their own health status is computerized history taking. Several systems have been developed in the past for this purpose (e.g.,[2,7,8,11,12]). A condition in such cases is that the patient should at least obtain a copy of his own medical record. Such systems could then serve the patient as well as his physician: the patient, because he is able, at his own pace, to tell his story to a computer via a terminal, the physician, because he is able to quickly obtain a general impression of the patient's complaints and his overall health condition before oral history taking. Moreover, computer-supported interviewing could be more efficient and save time, especially for health check-ups and

screening. Further, computerized patient history taking can be of importance to "monitor" patients as a function of the years that they are treated, for instance in cases of diabetes, hypertension or chronic lung diseases. In the end, one could even think of (portable) terminals in the patient's home.

Such considerations were the reason for starting a research project to investigate whether patient answers, gathered by a computer, were intrinsically the same as such answers given to a physician taking a patient interview. Together with the Department of Internal Medicine, we studied the contents of 99 patient histories taken in the usual way and 99 computerized histories in which the same patients were sitting behind a terminal. The system that we developed has been described elsewhere [3]. In this article we will report on the comparison between the information contents of the computerized patient record (PR) and the written medical record (MR).

The *computerized* history taking was principally identical to the oral interview, because the former was based completely on the forms that are in use in our hospital and followed the same guidelines and instructions. After asking about main complaints, the history reviews the different tracts, as is usually done during the first patient encounter in the out-patient clinic. Thus, questions are asked with respect to general health, heart and circulation, respiration, the gastro-intestinal tract, etc. Only if a patient appears to answer positively with respect to certain complaints, the system asks further questions in that direction. Computerized patient interviews took about one hour on the average. The reaction of patients to such computerized history taking has been published elsewhere [5].

For the *written* medical record the interview of the same patients is first of all made by a medical student who takes such histories on a routine basis during his internship. If such a medical trainee makes the interviews, they are often more complete than when taken by an internist. All patient histories are reviewed by an internist. These written medical records were used for comparison with the computerized patient histories. This comparison is the main subject of this article.

Patients and methods

In our study, 99 patients were invited to participate in the project. Only very few of those approached to participate refused. They never refused for other reasons than just lack of time, because they were requested to come to the out-patient clinic at least one hour before the regular oral patient interview was planned. On the contrary, they were all most eager to participate. If a computer interview had to be disrupted, it was only because of the fact that the regular interview was about to start. All patients were

able to complete at least the main part of the computerized interview so that we could compare all records of the two types. Cooperation was obtained from 38 male patients with a mean age of 48 years and 61 women with a mean age of 45 years.

Interactive computerized interview

Since the system we used for taking the computerized interview has been extensively described elsewhere, we will name only the main characteristics. The central feature of the system is that it focusses around the complaints(problems) of the patients. If the patient has complaints or troubles, the system starts first of all asking questions about these categories. Questions do, for instance, regard the onset, duration and intensity of pains or troubles. The location, where the patient feels physical pain or uneasiness can be indicated on a schematic figure displayed on the terminal.
The question about the frequency of occurrence of complaints is, most of the time, asked in the following form:
"Do you ever have complaint ...".
The answers, among which the patient can make a choice, were in that case: never/once/seldom/sometimes/regularly/often/always.
Such answers are given on a special keyboard on which the patient only has to press a function key on which the meaning of the answer has been printed. Moreover, only those keys are illuminated from which the patient is supposed to make a choice. Besides the keys that were mentioned, the patient is always allowed to press keys for so-called "escape" answers:
"I don't understand", "I don't know", or "no answer".
The latter is done because a patient is never forced to give an answer at all. As soon as the patient has touched a key, the answer appears on the screen as full text, next to the question that was asked. In this way, he is always able to correct his answer.

Patient Record (PR) and Transcribed Record (TR)

In order to compare the information in the computerized patient record (PR) with the written medical record (MR), the data in the latter record were one by one transcribed into another, also computerized questionnaire (TR). Of course this was not done by the patient himself but the MR was transcribed as reliably as possible by a physician, different from the one who had conducted the oral patient interview. Only very seldom could the information in the written medical record not be transferred to a computerized form. Of course the answer "I don't understand" was never given in this case. In translating the written medical record data into a

computerized form, the lack of information about a certain item was interpreted as "I don't know".

In gathering medical information from the patient, we should be aware that, when using a computerized method without the presence of a physician, this could lead to a technical misunderstanding on the part of the patient. For that reason, a training session always preceeded the computerized medical history taking. In this training session, non-medical questions were asked about daily life, such as watching TV. In case, during the computerized interview, the patient did not know how to handle the system, he could always ask for assistance. It appeared, however, that after a few minutes most patients became very well used to the system.

It must be mentioned that, whereas the computer method has certain shortcomings, the usual history taking also has its limitations because all information offered to the doctor is "filtered" through the physician's brain (interpreted) before it is written down. Such interpretations may give rise to considerable errors [10]. Furthermore, the physician might just "forget" to ask about certain complaints or details.
In comparing data from the computerized patient interview (PR) and the transcribed medical record (TR), we restricted ourselves to a comparison of quantifiable or codable data. Of course, qualitative information could not easily be compared because of its subjective character. Nevertheless, we should be aware that especially such extra or qualitative information might be of great value for the physician when he generates diagnostic hypotheses. This qualitative comparison between the different types of records, i.e. the interpretation of the contents of the records by internists, is the subject of a report that has been published elsewhere [4].
In order to be able to compare the contents of the two different types of records, we brought some order into the similarities and dissimilarities in the answers given. For practical purposes, we only compared the "frequency-answers". For reasons of presentation the seven "frequency-answers" were arranged in four instead of seven groups:

negative	(never)	(-)
slightly positive	(once, seldom)	(+)
moderately positive	(sometimes, regularly)	(++)
strongly positive	(often and always)	(+++)

In order to make the comparison more comprehensible we clustered some categories. In case patient's answers both to the written and the computerized patient interview fell into the same category, we called them similar. If both types of records indicated the absence of certain complaints (both have "never" as frequency) they were coded as negative. If both

		Frequency of complaints (%)				
		-	+	++	+++	?
Nose bleeding	PR	72	17	7	2	2
	MR	3	2	1	0	94
Ear ache	PR	63	8	27	1	1
	MR	6	0	1	0	93
Hoarseness	PR	49	18	24	6	3
	MR	22	0	9	2	67
Ear ringing	PR	60	10	25	4	1
	MR	23	0	7	1	69
Deafness	PR	65	9	15	6	5
	MR	60	2	11	3	24
Wheezing	PR	62	7	24	1	6
	MR	68	10	9	1	12
Cold	PR	6	30	60	3	1
	MR	9	1	15	6	69
Coughing	PR	17	22	49	10	2
	MR	56	2	31	8	3
Pain when breath-	PR	67	10	21	1	1
ing or coughing	MR	45	2	3	0	50
Phlegm	PR	37	18	38	7	0
	MR	55	3	22	2	18
Shortness of	PR	39	18	33	9	1
breath	MR	74	3	18	2	3
Mean values %	PR	49	15	29	5	2
	MR	38	2	12	2	46

Table 1. Frequency of complaints in the respiratory tract for the computerized record (PR) and the written medical record (MR). Percentages are given for all 99 patients of how often complaints were absent (-), once or seldom present (+), sometimes or regularly occurring (++), and often or always present (+++). For instance for the item "coughing" in the PR, this question was answered with "never" in 17%, with "once" or "seldom" in 22%. In a few cases, patients did not answer this question ("?": 2%). The table is discussed in detail in the text.

types of records had data in adjacent categories, we called the differences small (SD); if the differences were larger, for instance "regular" as compared to "once" or "always" to "sometimes", we called them large (LD).

Quantitative comparisons

By the methods indicated here we analysed the 99 medical records of both types. In the following paragraph we will give the results of our comparisons for the different types of complaints, expressed in tables.

Results

We counted the occurrence of complaints in the two types of records (MR/TR and PR) for all tracts about which the patient was interviewed by the computer interview as well as by the medical trainee. We will now discuss these results, taking all tracts together, but first we will give detailed results on just one tract (respiration) to offer an example of how the entire comparison was made for all other tracts as well.

Respiration

The questions concerning the upper airways were answered by 93 patients and those concerning the lower airways by 92 patients. In *Table 1* we gave the percentages of times patients indicated they had a complaint in a certain area, as a function of the frequency of occurrence as defined in the preceding paragraph. We can for instance see from the table that over 50% of the patients indicated in the PRs having a cold, sometimes to regularly, or were coughing (60% and 49% resp.), whereas this was less frequently observed in the MR (15% and 31% resp.). For six of the eleven categories of questions, in up to 94% no information could be found in the written medical record except for the items coughing and shortness of breath that was almost always present in the MR as well.
Comparing the answers in the category "never", we see that, on the average, this answer was given during the computerized interview in 49%, whereas in the oral interview in only 38%. On the average, in the computerized interview the patients gave a slightly positive answer (+) in 15% of the cases whereas this was the case in only 2% in the medical interview. The same difference is seen in the category "moderately positive": 29% and 12% respectively.
In *Table 2* we expressed the similarities and differences for the categories we have shown in Table 1 and defined earlier. For the other medical tracts we will just give the sum of all similarities and differences, but again - as an example - for the respiratory tract we also give the details to show how we arrived at the total figures. We see from the sum that in 345 items there was a reasonable or even total similarity between the two types of records. Only in 19 cases was there a small (SD) and in 1 case a large difference (LD) between the two types of records. Apparently, in the written record the fact was missed that the patient had a complaint about deaf-ness, whereas the patient had indicated this complaint during the computerized interview.

Quantitative comparisons

	Identical compliants			Complaints given in PR		Complaints given in MR	
	Similar	Small diff.	Large diff.	Denied in MR	Not in MR	Denied in PR	Not in PR
Nose bleed.	5	-	-	1	86	1	-
Ear ache	5	-	-	2	86	-	-
Hoarseness	17	4	-	10	61	1	-
Ear ringing	17	2	-	7	64	2	1
Deafness	59	-	1	7	21	1	4
Wheezing	55	3	-	13	11	5	5
Cold	19	2	-	7	64	1	-
Coughing	46	1	-	38	3	2	2
Pain breathing /coughing	32	1	-	11	46	1	1
Phlegm	46	2	-	28	17	-	-
Shortness of breath	44	4	-	36	2	5	1
sum	345	19	1	160	461	19	14
(%)	34	1.9	0.1	15.7	45	1.9	1.4

Table 2. For the respiratory tract it is indicated how often the MR differed from the PR. Only frequency indications (from - to +++) were taken into account. The first column gives (dis)similarities for complaints that were indicated in the PR as well as in the MR. Differences are called *small* if the frequency indications fall in adjacent categories; if not, they are called *large*. The second column indicates how often a complaint, indicated by the patient in the PR, was either negated in the MR or just not mentioned. The third column gives similar figures but now for the MR.

Two interesting columns are the cases where the patient gave information during the computerized interview, whereas in some cases this was even positively denied or not mentioned in the written medical record. We see that for 160 items the computerized record mentioned the presence of a complaint, whereas this was denied in the medical record. Even for the items "coughing" and "shortness of breath", their presence was denied in 38 and 36 cases, respectively. We must remark, however, that of the total number of 160 denials only 4 were "strongly positive" (+++). In 461 cases the patient mentioned a complaint that was not mentioned at all in

the medical record. Of these 461 cases. only 10 items fell into the category "strongly positive".
The last two columns indicate complaints that were stated in the written medical record but were not given by the patient in the computerized questionnaire. For 19 items negative answers were given by the patient during the computerized interview. and 14 times no mention was made.
In summary. 34% of all frequency indications of respiratory symptoms were similar in the written and the computerized patient records. It was found in both types of records that only 1.9% fell in the category of small or large differences. A much larger percentage of the items. 45%. was not present in the written medical record: 15.7% of the patient complaints were negated in the written medical record. whereas the patients positively indicated that complaints were present in the computerized record.
For the other tracts we will only give the summary of similarly detailed tables as we presented for the respiratory tract.

Other tracts

In *Table 3* we show the total results that we presented in Tables 1 and 2 for the respiratory tract only. Table 3 summarizes the results of the complaints indicated in the computerized patient record (PR) and the written medical record (MR) for the following tracts: respiration, circulation, gastro-intestinal. stools. urinary. nervous system, general plus skin, general disorders. and health disturbances.
When looking at the strongly (+++) and moderately positive (++) indications - that means complaints that were always. often. regularly and sometimes present -. it appears that the patient record gives twice as many indications as the written medical record (35 to 17). This difference is even much stronger for the complaints that are only once or seldom present (13 to 2). It seems as if a patient. when sitting behind a computer terminal, is more inclined to indicate that he has complaints. even if they are only very seldom present. We will leave further comments on this finding for the discussion at the end of this article. The differences between the computerized records and the written records in the category "never" are much smaller. The largest differences are found in the category where answers were lacking: 45% to 4%.
On the basis of the frequencies as presented. there is no reason to say that these systematic differences are more prominent in one tract than in another: on the contrary. differences appear to be rather systematic. To make these differences and the fact that they are systematic more visible. we have expressed these percentages in a scattergram (see Figure 1).
If the differences in strongly positive frequencies are an indication for the fact that in the written medical record several important complaints are

		Frequency of complaints (%)				
		-	+	++	+++	?
Respiration	PR	49	15	29	5	2
	MR	38	2	12	2	46
Circulation	PR	52	11	27	9	2
	MR	45	1	18	4	32
Gastro-intest.	PR	48	16	27	7	2
	MR	28	1	9	4	58
Stools	PR	42	14	30	8	7
	MR	48	2	12	4	35
Urinary	PR	69	8	10	1	12
	MR	40	2	4	1	52
Nervous syst.	PR	42	13	30	9	6
	MR	25	1	15	4	54
General & skin	PR	52	12	23	8	5
	MR	24	1	7	3	66
Gen.disorders	PR	49	9	28	10	4
	MR	42	3	21	4	30
Health disturb.	PR	29	16	37	18	0
	MR	37	2	21	7	33
Mean	PR	48	13	27	8	4
	MR	36	2	13	4	45

Table 3. Frequencies of complaints for all tracts. The figures are identical to the mean values, as presented in Table 1 for the respiratory tract only.

missing, we see that this is the case through the entire range of tracts. We will restrict ourselves to discussing the category "strongly positive", i.e. often and always, where we found the following results for the different tracts:

In the circulatory tract the main differences were caused by the fact that during the computerized interview patients indicated as having pain or shortness of breath while mounting a staircase and walking which was, in several instances, not remarked during oral history taking. The main differences in the gastro-intestinal tract are caused by the fact that patients complained about belching or rumbling that was not mentioned during the regular medical interview. In the questions about stools, differences were seen in complaints about windiness and soft or thin stools: complaints about haemorrhoids were also made by the patients and not re-

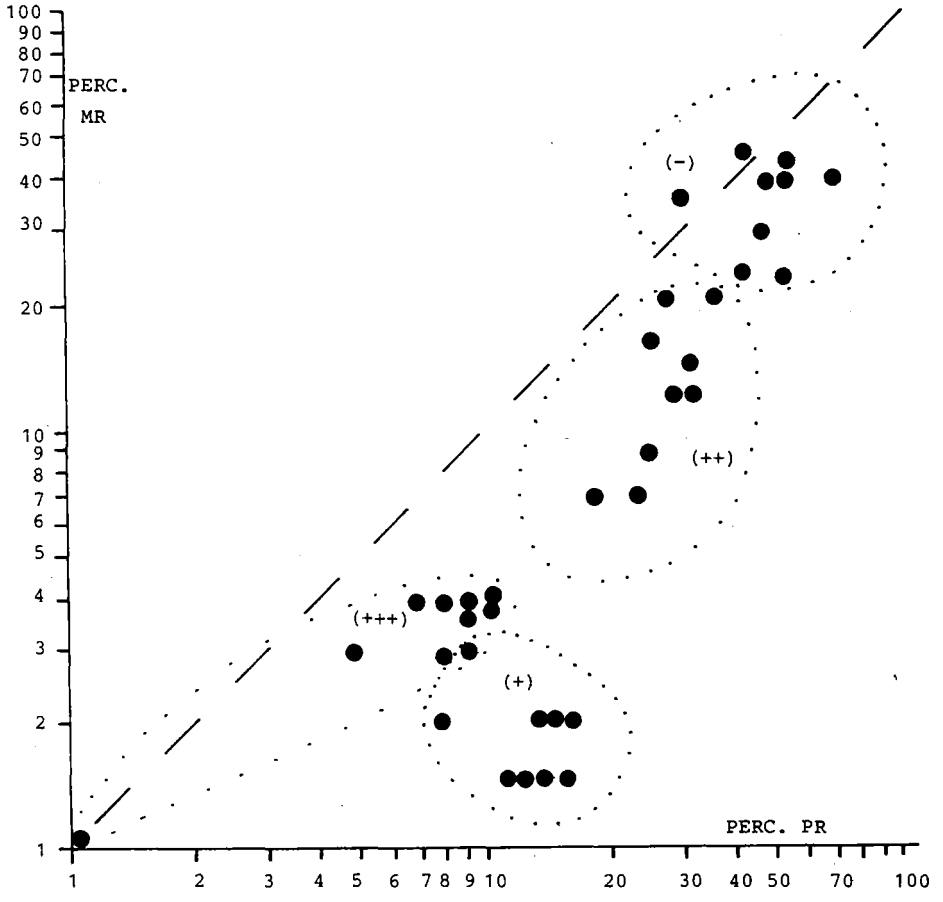

Figure 1. Graphical presentation of the percentages in the 5 columns of Table 3. Horizontally we have indicated the percentages in the PR, vertically in the MR (abscissa and ordinate have a logarithmic scale to amplify the effect in the small percentages). If all frequencies were identical, they would all fall on the dashed line. The different categories appear te be clustered, but all of them fall at one side of the line, which confirms our finding that the PR is "richer" in indications of complaints.

marked during oral history taking. In the urinary tract, there were no real differences in the complaints with high frequencies. In the nervous tract, tract, patients complained about back pain and feeling cold which was not stated in the medical record. In the category "general questions and skin" patients complained about feeling chilly and shivering or sweating, also not mentioned during history taking. We want to remark that even large dif-

	Identical complaints			Complaints given in PR		Complaints given in MR	
	Similar	Small diff.	Large diff.	Denied in MR	Not in MR	Denied in PR	Not in PR
Respiration	34.0	1.9	0.1	15.7	45.0	1.9	1.4
Circulation	49.3	3.0	0.9	12.5	31.0	2.7	0.6
Gastro-int.	26.8	1.7	0.3	13.3	56.0	1.7	0.2
Stools	41.6	3.3	0.5	17.9	31.5	1.5	3.7
Urinary tract	43.2	0.4	0.0	6.2	43.9	3.2	3.1
Nervous syst.	27.9	2.7	0.5	14.1	50.3	3.4	1.1
General skin	21.6	0.9	0.4	7.8	64.0	2.0	3.3
Gen.disord.	44.2	3.9	1.2	14.5	27.1	7.1	2.0
Health dist.	38.4	5.0	0.3	20.9	33.3	2.1	0.0
Mean	36.3	2.6	0.5	13.7	42.4	2.8	1.7
		39.4		56.1		4.5	

Table 4. Differences in the occurence of frequencies in the PR and the MR. All legends are identical to Table 2, but here are the summaries given for all different tracts. In about 40% identical complaints were mentioned in both the PR and the MR, although differences in occurence existed. In about 56% complaints were indicated in the PR, but not "seen" or denied in the MR; the reverse is true for 4.5% for the MR, not indicated by the patients in the PR.

ferences between the computerized record and the regular oral interview do not necessarily have an impact on the final diagnosis because they will have to be interpreted by an experienced physician in their context.
In the same way as we looked at similarities and differences in the respiratory tract, we show in *Table 4* the summaries of all other tracts; on the bottom line of this table we give the mean percentages of all tracts taken together.
We see that in 36% of all complaints indicated the information in the two types of records was identical. Differences in the complaints stated existed in 2.6% for small and in 0.5% for large differences. In 42% indications were given in the computerized patient record that were not found at all in the written medical record. In about 14%, positive information by the patient was denied in the written medical record. The reverse was true in 2.8% (present in the medical record but denied in the computerized record).

	never	once	seldom	sometimes	regularly	often	always
PR	4158	110	971	1784	590	486	261
MR	3225	94	65	729	506	292	32
PR/MR	1.3	1.2	14.9	2.4	1.2	1.7	8.2
PR-MR	933	16	906	1055	84	194	229

Table 5. Absolute numbers on how often complaints were indicated by patients in the PR or observed in the MR, for all frequencies of occurrence, from "never" to "always". In order to see the discrepancies between the two types of records the absolute difference is given as well as the ratio PR/MR. They are relatively highest for "seldom" and "always", absolutely for "never", "seldom", and "sometimes". Differences in adjacent categories are called small (see also Tables 2 and 4).

and 1,7% (not present in the computerized patient record but present in the written medical record)
In summary: if we assumed that the written medical record was the ultimate truth, it would mean that 56% of the information in the PR would be "false" positive and 4.5% is "false" negative, but - because the reverse could also be true - we will come back to this issue in the discussion.
One of the reasons for the large discrepancy with respect to the indications given in the computerized patient record, which were not present in the written medical record, could be the fact that the patient, when sitting behind a terminal, is inclined to give positive answers. This assumption is indeed supported when we inspect *Table 5*, where we presented the total number of indications in the categories "never", "once", "seldom", etc. for the computerized patient record and the written medical record.
Indeed, the absolute differences are highest in the categories "never", "seldom" and "sometimes", but when looking at relative differences, especially the categories "seldom" and "always" show the highest differences. From the figures it appears that, although a large proportion of the indications in the computerized record fall into the categories "never", "seldom" and "sometimes", percentually many strongly positive indications in the category "always" were found in the computerized record but were not mentioned in the written record.

Discussion

If we compare the answers given in the written medical record with those in the computerized record, it is striking that patients gave twice as many positive answers sitting behind a computer terminal than during the oral interview. Objectively speaking, it means that the written medical record contains only half the information present in a computerized interview. At the same time, it must be stated that positive indications are very often on the borderline of presence or absence, while falling into the categories "seldom" and "sometimes". We have to take into account that the patient, when answering the computerized questionnaire, was never pressed to give an answer, could quietly think as long as he wished and took about a full hour to answer all questions, whereas during the oral interview there always was the psychological effect of sitting in a room with an "expert", i.e. the trainee or internist on whom the patient might feel dependent and who had less time to complete the interview.

The percentage of similar indications was 36% (Table 4); the negative statements formed about 60% (1,900 out of 3,225 answers) of these similarities. The majority (52%) (169 out of 324) of all strongly positive indications in the written medical record was also answered positively by the patient sitting behind the terminal, but only a minority of the strongly positive computerized answers of the patients (23%, 169 out of 747) was answered positively on the basis of the written record information.

It is doubtful whether the differences in the categories "never", "seldom" or "sometimes" do give rise to diagnostic hypotheses when such indications are offered to a physician. More serious are the differences in the categories "often" and "always". This happened about 460 times in this group of 99 patients, which means about 4.5 times per patient. If such complaints are serious, it is reasonable to screen patients during their first encounter by a computerized interview, before they see the physician. The diagnostic consequences of the different types of records have been the subject of a separate investigation. The results of this investigation have been published elsewhere [4].

The authors have a strong feeling that certain categories of patients with serious complaints, attending the out-patient clinic for the first time, should be given the possibility to use a computer terminal to offer their complete profile of complaints to the internist before the oral history is taken. And although this has not been proven by our study, it might also be wise to do the same for patients who have recurrent problems and who frequently visit their family practitioner. By screening such patients yearly (e.g. the patient with chronic respiratory disease or recurrent cardiac complaints) a trend in their general condition could be detected. With the advent of cheap personal computers and the high and still rising costs of

health care this could be efficient as well for the physician as the patient. At the same time the patient could be made more aware of his own health status.

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Chapter 5 - Appraisal by internists

In order to determine if there were differences in the semantic contents of the two types of interviews, we offered a subset of all histories to three internists and asked them to write down the diagnostic hypotheses that they generated on the basis of the data. Comparisons of these diagnostic hypotheses, including intra and interobserver variabilities, are given in *Chapter 5*.
A further point in our research concerned the clinical usefulness of the different types of medical histories. We asked physicians about the usefulness, completeness, and other aspects of the different histories. This survey is also described in *Chapter 5*.

Appraisal of computerized medical histories: comparisons between computerized and conventional records

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Summary

Automated patient histories in internal medicine have been compared with written medical records by investigating the diagnostic statements that were generated for both types of records by three internists. Also the intra- and interobserver variability was evaluated. In addition, the opinion of the internists about the usability of the different records was investigated. To have a fair comparison, the written record was transcribed to a computerized form and also offered to the internists. Each internist evaluated in total 72 records (from 18 patients) and altogether 529 diagnostic hypotheses were generated. The intraobserver agreement was for the written record 55%, for the automated history 46% and for the transcribed record 38%. Interobserver agreement was 23.5%, the agreement between the automated patient history and the written record was 24%, between the former and the transcribed record it was 36%.

Introduction

During the last decade several systems have been developed for the storage of medical data. Most systems contain sections for, e.g., the storage of laboratory data [1], the documentation of drugs given to the patient [2] and the storage of quantitated or coded data [3]. Especially in the clinic such systems are commonly seen to support the usual clinical procedures and the conditional retrieval of data, or are used for planning and management [4]. In academic environments such data bases are also used for medical research [5,6]. The construction of a computerized medical record appears to be a rather complicated problem.

How such medical data bases should be constructed has been the particular subject of many studies of which Weed's Problem Oriented Medical Record (POR) is one of the most prominent [7]. Not only in clinical environments, also in out-patient or ambulatory care systems have been developed for the storage of data and the support of the clinician or the general practitioner. The system COSTAR (Computer Stored Ambulatory Record) is one of the earliest examples in this area [8]. Nowadays there are also several small systems available for the support of the general practitioner in storing medical data [9,10].

In most instances it is the physician or his direct assistant (trainee) who enters the medical data into the computer. This is done either during the patient interview or later on from notes taken during the interview or from the written medical record itself. It is understandable that such data entered by the physician were influenced by his own interpretation of the patient's complaints. In the approach of the Problem Oriented Medical Record [7] one tries to take measures against a too early interpretation of the medical data by documenting as accurately as possible all complaints of the patient.

A very different approach is to ask the patient himself to enter his data into a computer. Several successful systems are reported in the literature [11-22]. Most systems are primarily meant as a support to the collection of data. It was also the experience of the researchers involved, that a computerized patient interview never replaces the direct doctor/patient contact. A computerized patient questionnaire only comprises those parts that can be formalized, whereas a patient/physician dialog also contains many other informal aspects such as individual experiences and emotions. Nevertheless, an advantage of a direct entering of medical data by the patient himself might be the completeness and the avoidance of a too early interpretation by the physician. At the same time, however, it must be remarked that it may happen that the patient himself does not fully understand the questions asked him by the computer, which could in the end result in misinterpretations and wrong answers.

In this research project, we used a computerized patient questionnaire system, introduced in the Department of Internal Medicine. The system we used has been described earlier [22]. In this part of our research project we asked ourselves the question whether diagnostic hypotheses based on a computerized patient questionnaire or record (PR) would be identical to those based on a conventional written medical record. To that end 99 patients, admitted to the outpatient clinic for Internal Medicine, were invited to take part in this project. They were requested to enter their complaints and other relevant medical data themselves into a computer, and afterwards they had a standard interview with a physician. This written medical record (MR) was used thereafter by an independent physician to fill in a second computerized questionnaire as if the patient himself were sitting behind the keyboard. This latter computerized medical record was made as complete as possible, solely on the basis of a transcription of the written medical record.
On the basis of these two now computerized medical records, that we shall call in the remainder of this article the patient record (PR) and the transcribed record (TR), three internists were asked to formulate their diagnostic hypotheses. The internists also received the original written medical record that formed the basis for the transcribed record. PRs, MRs and TRs were offered in a random order, to be described below.
In this article we will describe the different reactions of the internists on the three types of medical records. The latter was based on a questionnaire that was offered to the internists each time that they reviewed a record. The answers by the patients themselves are the subject of an other report [23].

Material and methods

Of the group of 99 patients who participated in our study on the comparison of the computerized patient questionnaire with the conventional record, the first 18 were selected for a study on the interpretation of data in the medical record (PR, TR and MR). The group consisted of 5 men with a mean age of 42 years and 13 women with a mean age of 41 years. These patients needed on the average 74 min to answer the computerized questionnaire. The women gave on the average 226 answers, the men 212; 11 women and 4 men answered the questionnaire completely, 3 only answered the main part of it.

Questionnaire

The questionnaire was based on the routine patient history taking, commonly used in the Dept. of Internal Medicine, and contained general

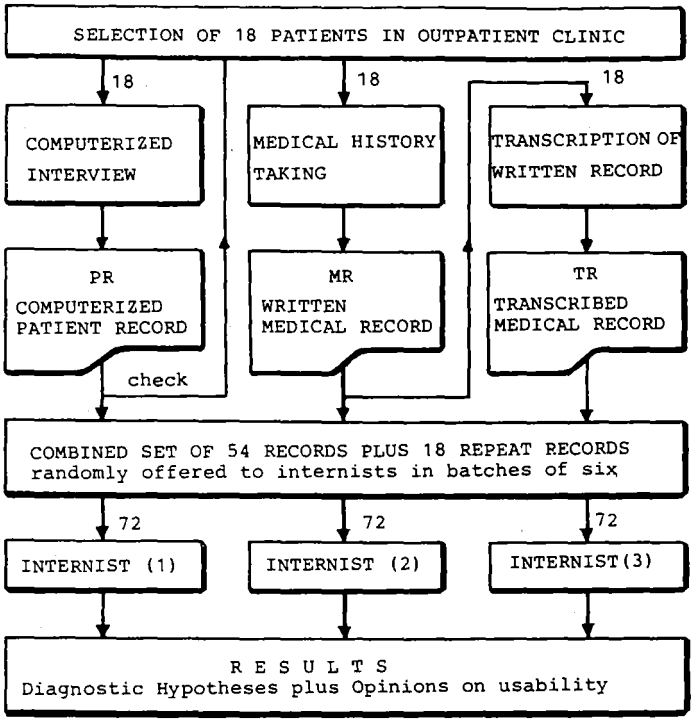

Fig 1. Schematic diagram of how the study was done. Patients were requested to answer a computerized interview that resulted in a computer-printed patient record (PR), which was checked by the patient. Afterwards the usual oral interview took place, resulting in a written medical record (MR), which formed the basis for a computerized transcribed record (TR). Of 18 patients all three reports were offered to three internists plus 18 repeat records resulting in 72 records per internist. For each report diagnostic hypotheses were generated and opinions were given with respect to the usability.

questions with respect to the health of the patient and his/her complaints. Routine questions were also asked with respect to respiration, circulation, the upper gastrointestinal tract, stools and genito urinary tract, the nervous system, skin and general disorders. Regarding complaints or symptoms, the patient could choose between answers such as: never, once, seldom, sometimes, regularly, often, or always.
Dependening on the answers given, more specific questions could be asked. Each question could also be answered with: "I don't understand," "I don't know," or "I don't want to give an answer." The keyboard that was used in this study was adapted to these types of answers, in such a way that the

patient could use so-called function keys related to the different answers. If a certain answer was given by pressing a key, then the answer was displayed in full on the screen of the terminal. A description of all question types and answers in the total group of 99 patients has been published elsewhere [22, 23]. In this report we want to restrict ourselves not to the contents of the patient answers, but to the appraisal of the different records by the internists.

Types of records

Of each patient three different medical records were presented to three internists. In summary these records are the following (see also Fig. 1):
1. Patient record (PR). A report generated on the basis of the answers of the patients to the automated questionnaire. The patient himself checked this computerized report. This report contained in an orderly manner all information that was entered by the patient into the system.
2. Written medical record (MR). The written medical record was made during history taking and formed the basis for the transcribed record, to be mentioned below. This written medical record was generated by a medical student and checked by an internist. In the last year of their medical study, these students make these interviews routinely in the out-patient clinic of internal medicine.
3. Transcribed record (TR). The transcribed record was generated by an independent physician on the basis of the information in the written medical record, by using the same computerized questionnaire as was used by the patient (see Fig. 1). On the basis of these data a similar report was generated by the computer, as was done from the direct patient answers. So, from the outside, no difference could be made between the two types of computerized reports.
All reports were made anonymously, but to each report the sex and the age of the patient were added.
Although the PR and TR forms could from the outside not be discerned by the internists, whether they stemmed directly from patients or were a transcription of the written medical record, of course the copy of the written medical record was clearly distinguishable. It is understandable that this could not be avoided and it might have influenced the opinion of the internists on the usability of the written record.

Interpretation

The various forms, i.e., the output of the computerized patient interview (PR), the computerized physician interview (TR) and the MR, were presented to three internists of the Department of Internal Medicine of our

Academic Hospital. None of the internists had seen the data of the patients before. They were requested to interpret the medical data presented to them and to write down diagnostic hypotheses. The appraisal by the internists of the usability of the different records to generate diagnostic hypotheses are the main subject of this article. We also give results on the inter and intraobserver variations regarding the diagnostic hypotheses.
All reports, i.e., for each patient three, were presented to the internists in groups of six. Each group contained two forms of each type, but all reports in a group were from different patients. The 54 reports were offered to the internists in a random order. After the nine groups of six forms were presented, three groups were presented again to see whether there also existed an intraobserver variation. The internists, however, were not aware of the fact that they had already seen these records. These three repeat groups contained the same combinations of reports as presented the first time. So, in total the internists had to review 54 plus 18 reports. The internists received one batch of six reports per week.
For each report, the internists had to review the medical data and to answer a questionnaire, asking their opinions not only about the diagnostic hypotheses, but also on other aspects of the report, that we shall discuss below. The time needed to interpret a group of six reports was about 1 hr. This time was reduced only slightly after the internists got used to this procedure.

Results and Opinions of Internists

Each internist was requested to answer a questionnaire for each record that was presented to him. On this questionnaire only four main questions (Q1-Q4) were asked. In the following we shall review these questions and give the opinions of the internists on the different records offered to them. Their answers are ordered with respect to the type of record that was offered to them.

Q1: "To what extent is the record usable for general patient care ?"

The options from which the physician could make a choice were: not usable/hardly usable/partly usable/well usable/perfectly usable/no answer. In Table 1 the statistics are given for the three different types of records, per internist, and for all three types of reports.
Taken together, the internists judged that the written medical record could be well (39%) or perfectly (15%) used, against 19% and 9% for the patient record. For the transcribed record these figures are 13% and 9% respectively. The internists judged that the written medical records are not or hardly usable in 8%, the patient record not in 13% and the transcribed record not in 26%.

	Internist											
	(1)			(2)			(3)			All		
Usable	MR	TR	PR	MR	TR	PR	MR	TR	PR	MR	TR	PR
Perfectly	6	5	5	2	0	0	0	0	0	8	5	5
Yes	4	3	6	10	2	3	7	2	1	21	7	10
Partly	5	4	2	5	7	8	9	10	17	19	21	27
Hardly	1	0	0	0	3	5	1	3	0	2	6	5
Not	0	0	0	1	5	2	1	3	0	2	8	2
No answer	2	6	5	0	1	0	0	0	0	2	7	5

Table 1. Usability of the three types of medical records (written medical record (MR), transcribed record (TR), and patient record (PR)), as indicated by each internist and by the group.

From these results we see that the internists, taken together, validated the written medical record considerably higher than both types of computerized reports. Opinions between internists differ greatly, as is seen from the interobserver variation in Table 1. From this table it is seen that internist (1) estimated the usability much higher for all types of reports, while internists (2) and (3) were on the pessimistic side and hardly ever gave the answer that the records were well or perfectly usable.
It was also investigated whether the appreciation of the usability changed as a function of time, e.g., because the internists got acquainted with the printed reports. No significant shift in the profile of opinions, however, could be detected. We also investigated in how many cases two of three internists had the same opinion with respect to the usability of the reports. For the MR this appeared to be only in 9 out of 18 cases; for the PR in 8 and for the TR in 10 cases. So, we see that there is no significant difference in agreement or disagreement between the internists with respect to the type of report that is offered to them; in fact they do agree in about 50% of the cases.
The intraobserver variation with respect to the usability of the reports was estimated on the basis of offering again three groups of 6 reports twice. In 8 of the 18 reports internist (1) had the same opinion twice; for internists (2) and (3) this was the case in 11 and 13 reports, respectively. Although it seems that internist (3) is the most stable one, we must take into account that this physician tended to give mainly the answer "partly usable". Internist (1) tended to cover the entire range of possible answers, as is seen from Table 1. Taking the three internists together they had for the six written medical records in 13 of 18 cases twice the same answer; this was for the patient record 8 and for the transcribed record 11.

History	Internist (1) MR	TR	PR	(2) MR	TR	PR	(3) MR	TR	PR	All MR	TR	PR
Main compl.	11	8	4	4	0	1	13	6	3	28	14	8
Tracts m.c.	7	9	10	12	1	3	5	4	6	24	14	19
Tracts o.c.	6	6	11	14	6	9	3	5	5	23	17	25
Routine q.	7	9	15	11	3	5	1	1	5	19	13	25
Gen. inf.	6	7	6	0	0	4	0	2	3	6	9	13
None	3	0	0	0	7	1	1	6	0	4	13	1
Unknown*	1	0	0	1	1	0	0	0	0	2	1	0

* This last category is used when they did not know to give an answer. The maximum number that could be reached in all cases is 18.

Table 2. Opinions of internists as to how often they considered the records to contain information about main complaints, tracts related to the main complaint, tracts related to other complaints, routine tract data, general data, or no information at all.

In summary it can be concluded that the internists tended to validate the written medical record higher with respect to usability for general patient care than the other types of reports; but there is a large inter and intraobserver variation.

Q2: "For what parts of the medical history does the record offer usable medical information ?"

The internists could make a choice out of the following options, although the answers were not exclusive so that more than one answer could be given: Main complaint/tractus data connected to main complaint/tractus data connected to other complaints/routine tractus data/general information/none/no answer.

In Table 2 we have given the figures per internist and per type of medical record for all options. It can be seen that internist (1) obtained, in his opinion, a rather clear view of all relevant medical data in all types of reports, whereas internists (2) and (3) were less optimistic, which is in agreement with the findings in Table 1. Again, we see that on the average the written medical record is judged to contain more relevant medical information than the other reports.

When the data from the written medical record are transcribed to a computerized form, the information about the main complaint seems to be partly filtered out. We will discuss this finding below. It is striking that in

	Internist											
	(1)			(2)			(3)			All		
Usable	MR	TR	PR	MR	TR	PR	MR	TR	PR	MR	TR	PR
Not	3	2	0	0	8	4	1	5	0	4	15	4
Before hist.	14	15	18	14	9	13	4	7	7	32	31	38
During hist.	13	15	16	12	2	3	15	8	10	40	25	29
After hist.	6	5	12	4	1	3	0	1	0	10	7	15
Later on	1	1	5	1	0	0	0	0	0	2	1	5
Other	0	0	0	0	0	0	0	0	0	0	0	0
No answer	0	0	0	1	1	0	0	0	2	1	1	2

Table 3. Opinions of internists at what stage of medical care the different types of records had their appropriate place.

the opinion of internists (2) and (3), the transcribed medical record is judged not to be usable at all in 7 and 6 cases respectively. We investigated whether the opinions of the three internists changed in time, but this was not the case. Overall, the internists indicated that the main complaint was best represented in the MR, i.e., in 28 out of 54 cases. In the PR the tractus data connected to other complaints and the routine tractus data are both best represented in 25 out of 54 cases. In the TR the data connected to other complaints were best represented (17 of 54).
The intraobserver variation is here much more difficult to evaluate than in the first question, because more than one answer could have been given. For that reason, it is rather difficult to discover a shift in the appreciation between the first and the second review of the 18 reports that were offered twice. Nevertheless, we have found that in about half of the cases, all types of reports taken together, the opinions of the internists shifted. For the written medical record they gave identical answers in 2 x 27 of a total of 81 (67%), for the patient record in 2 x 14 of 73 (38%) and for the transcribed record in 2 x 7 out of 50 (28%) hypotheses. The differences are striking and will be discussed below.

Q3: "In what stage of patient care could the records possibly be used ?"

The different answers that the internists could give were as follows:
Not usable/before-/during-/after history taking/later on, during patient care/ other/no answer.
In Table 3 the different opinions are again represented per internist and per type of record. Here also, more than one answer could be given for each question. As can be seen from Table 3 the written medical record was

	Internist											
	(1)			(2)			(3)			All		
Certainty	MR	TR	PR	MR	TR	PR	MR	TR	PR	MR	TR	PR
Certain	13	18	34	23	22	36	9	7	7	45	47	77
Probable	19	20	27	33	22	25	17	18	28	69	60	80
Possible	13	18	8	14	8	13	30	21	26	57	47	47
Total	45	56	69	70	52	74	56	46	61	171	154	204
Sum		170			196			163			529	

Note. In total the internists generated 529 hypotheses for the three types of records for the 18 patients, i.e., about 3.3 diagnostic hypotheses per record per internist.
Table 4. Degrees of certainty (certain, probable, possible) in which diagnostic hypotheses were generated.

preferred above the other types of reporting to be used during history taking, which is of course understandable. It also appears that again internist (1) is more optimistic with respect to computerized reports, than the other two internists. Overall, in four cases the written medical records are judged to be not usable at all. This same number is given for the patient record, although by one physician only, and in 15 cases the transcribed medical record is judged to be of no use. For the patient records the highest preference (38 of 54 cases) was given that they would be of use before the history taking by the physician. For the written medical record and the transcribed record these numbers were 32 and 31. The MR was considered to be best usable during history taking (40 of 54) in comparison with the PR (29 from 54) and the TR (25 from 54). The total validation of the patient record and the written medical record was about the same, whereas the transcribed record had significantly less indications that it would be of use before, during or after history taking. Overall, there is a slight preference of using the patient answers before and after history taking as compared to the written medical record. Also for this question no shift in judgment was found as a function of time and adaptation.
With respect to the intraobserver variation, internist (1) appeared to be slightly more stable than the other two, whereas the stability for the written medical record and the patient record is about the same and for the transcribed record slightly lower.

Q4: Degree of certainty by which internists formulate diagnostic hypotheses

We also investigated the degree of certainty by which the internists formulated their diagnostic hypotheses; they were requested to indicate these degrees by means of the categories: certain/probable/possible (or maybe). We will give the statistics about the number of hypotheses and their different degrees of certainty for the different types of reports as well as for the different internists. This has been summarized in Table 4.
As can be seen from Table 4, for the patient report significantly more diagnostic hypotheses (204) are generated than for the other types of reports (for MR, 171; for TR, 154). The total number of hypotheses generated by internist (2) is about 15 to 20% higher than for internist (3), 196 as compared to 163.
Although the three internists mutually differ significantly with respect to the so-called "certain" diagnostic hypotheses it is surprising to see that the level of certainty for the patient record is about 40% higher than for the two other types. The same applies, although in a lesser degree, for the probable diagnoses. Even for internist (3), who appeared to be the pessimistic one amongst all three, the number of probable diagnoses is far higher for the patient record (61) than for the transcribed record (46).It can be seen that on the average 3.3 diagnostic hypotheses were generated per record and per internist. Also here it was investigated whether there was an adaptation of the function of time, which appeared not to be the case.

Agreement between diagnostic hypotheses

Per internist we have counted the number of identical diagnostic hypotheses between the written medical record and the patient record, the written medical record and the transcribed record, and the transcribed record and the patient record. It has also been counted in how many cases the diagnostic hypotheses were identical in all three types of reports together. A diagnostic hypothesis was counted as identical if it was literally the same or when the hypothesis had the same synonyms. Examples are, for instance, "irritable bowel syndrome" and "spastic colon syndrome," or "stomach suffering" and "gastritis."
The results of this analysis have been depicted as VENN-diagrams in Fig. 2. In this figure it can be seen for each of the three internists in how many cases of the diagnostic hypotheses there was an overlap between the different types of reports. It is striking to see that the overlap between the MR and the TR (33%) is slightly lower than between the PR and the TR (36%), although one should expect that the agreement would be the highest between MR and TR, because the latter is a computerized version of the

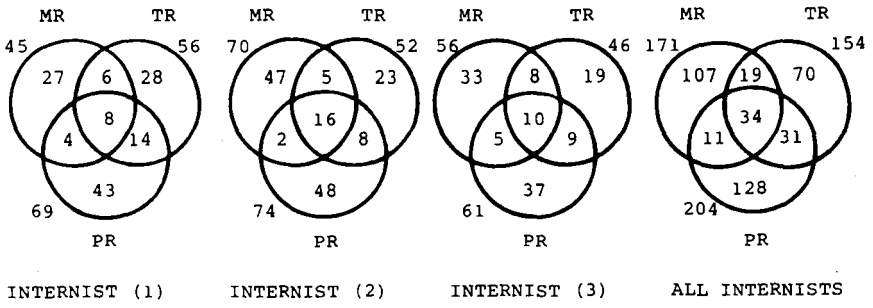

Fig 2. Venn diagrams of agreements in diagnostic hypotheses for the three types of records. The diagrams are given for each internist and for the group of three.

former. The lowest agreement was between the MR and PR, and was only 24%. Although the differences between the three internists are not significant, it seems to be that the second internist is the most stable, when comparing the hypotheses from all types of reports together.
When looking at the intraobserver variation (see Table 5) we can see that for all three internists the percentage of identical diagnostic hypotheses is highest for the written medical record (mean 55%), followed by the patient record (mean 46%). Again, the transcribed record is lower (38%). The internists do not show large mutual differences, although the first internist appears to be less stable than the other two.
The last comparison that we have made with respect to diagnostic hypotheses is how often the different internists gave identical diagnostic statements when compared to each other. This has been expressed in Table 6 as percentages of the total amount of diagnostic hypotheses given. This was the case for only 23.5 of all 320 hypotheses.
It is confirmed again, that for the written medical records the differences between the internists are slightly lower than for the other records. If we mutually compare the diagnostic hypotheses of the internists taking together the three groups of two internists then the agreement for the medical record, the transcribed record and the patient record appears to be 26, 22 and 23%, respectively. It can also be seen that the agreement between internists (2) and (3) is the highest, 30% as compared to 20 and 21% for the other two comparisons.

Discussion

From the results described above we have seen that the three internists had the opinion that in 54% of the MR the information is good or excellent, in comparison to 28% for the PR and 22% for the TR. It is clear that

Appraisal by internists

Reviewed	Internist (1) MR	(1) TR	(1) PR	(2) MR	(2) TR	(2) PR	(3) MR	(3) TR	(3) PR	All MR	All TR	All PR
Total	34	31	38	45	36	29	37	33	37	116	100	104
Identical	16	10	14	28	14	14	20	14	20	64	38	48
(%)	47	32	37	62	39	48	54	42	54	55	38	46
Overall Identical (%)		39			51			50			47	

Note. About 47% of all diagnostic hypotheses were identical.
Table 5. Intraobserver variations in 18 records (6 of each type), that were offered twice to the internists.

the internists valued the written medical record more highly than the computerized reports, which applies both to the PR and the TR. As mentioned earlier, this could have been influenced by the fact that, of course, they knew from the type of report offered to them, which one was of the conventional type and which one was generated by the computer - although from the outside they could not distinguish between the transcribed and the patient records.
If we were to assume that the information contents in the transcribed record is roughly the same as in the written medical record - because the former was transcribed from the latter - it could be the way of presentation that has influenced the opinion of the internists regarding the usability of the different reports. Yet, there remains a significant difference between the patient record and the transcribed record. This difference also remained stable as a function of time: no adaptation was seen regarding the different types of computerized records, which is caused by the fact that the review of such records in this study only formed a tiny part of the entire amount of medical records the internists usually see routinely.
Besides the effect of the different appearance of the types of records, there might also be another reason why the written medical record was considered to be more usable than the computerized one. This is mainly caused by the fact that the written medical record gives a more complete picture of the main complaints and the related tract data of the patient. The patient record and the transcribed record often missed information about these main complaints, whereas the patient record gives a better view with respect to the routine tract information. This is in agreement with the opinion of the internists that they thought the computerized record has its proper place *before* the oral history taking, whereas the proper place of the written medical record is *during* the history taking by

Appraisal by internists

Internists	Percentage MR	TR	PR	Mean
1 - 2	26	19	15	20
2 - 3	31	30	28	30
1 - 3	21	16	25	21
Mean	26	22	23	23.5

Note. Of the 320 diagnostic hypotheses that were generated (see Table 5), only 23.5% was identical if groups of two internists were mutually compared.

Table 6. Interobserver variation regarding diagnostic hypotheses, for the 18 records that were offered twice.

the physician. A computerized record, whether generated by the physician or the patient himself, contains a more formalized description of the patient history, whereas a written record may express informal and individualized aspects as well.

We have seen that the computerized PR was the most rich in generating diagnostic hypotheses. Also striking is the conclusion that the certainty level of the hypotheses based on the PR was much higher (77%) as compared to the written medical record (45%) (see Table 4). The lowest amount of hypotheses and a low certainty level was seen for the transcribed record. But although the certainty level was high, we must take into account that the intraobserver variation is very large, because considerable differences were seen when the different forms were offered a second time. The diagnostic hypotheses that were raised the first time had only a very small relationship with the hypotheses generated by another internist (overall agreement 23.5%) (see Table 6). There was also a low correlation between the hypotheses generated in the different types of records: only 36% agreement was found between hypotheses based on the TR and the PR. The lowest agreement was found between MR and the PR (24%). The interobserver agreement was also very low: at most 26% for diagnostic hypotheses based on the MR, whereas this was even lower for hypotheses based on the PR (23%) (see Table 6).

In conclusion it must be said that our study confirms that there is a very large intra and interobserver variation, when internists are requested to formulate diagnostic hypotheses based on written medical records or computerized medical records. Because diagnostic hypotheses based on a computerized patient interview give rise to at least the same if not a higher amount of diagnostic hypotheses, such a computerized interview may help

(a) to reach a more complete profile of patient complaints with respect to routine tracts, (b) direct the attention of the physician to information that he could have missed if he had only taken the interview orally, and (c) offer help to structure the routine patient history-taking during the first encounter of the patient in the outpatient clinic for internal medicine. For that reason it might be appropriate to ask certain patients to answer questions in a computerized interview during their first encounter.

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Chapter 6 - Diagnostic evaluation

We were also interested in the relationship between the diagnostic hypotheses made at the time of the initial visit and the final diagnoses. The latter were made by the internists on the basis of the complete medical records, after the patients had been discharged from the hospital. Together with a summary of the entire study, this part of our research is presented in *Chapter 6*.

Comparisons between written and computerised patient histories

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British Medical Journal 18th July, 295, 184-190.

Abstract

Patient histories were obtained from 99 patients in three different ways: by a computerised patient interview (patient record), by the usual written interview (medical record), and by the the transcribed record, which was a computerised version of the medical record. Patient complaints, diagnostic hypotheses, observer and record variations, and patients' and doctors' opinions were analysed for each record, and records were compared with the final diagnosis.

About 40% of the data in the patient record were not present in the medical record. Two thirds of the patients said that they could express all or most of their complaints in the patient record. The doctors found that the medical record expressed the main complaints better (52%) than the patient record (15%) but that diagnostic hypotheses were more certain in the patient record (38%) than that in the medical one (26%). The number of diagnostic hypotheses in the patient record was about 20% higher than in the medical record. Intraobserver agreement (51%) was better than interobserver agreement (32%), while the interrecord agreement varied from 25% (between the medical and patient records) to 35% (between the transcribed and patient records). One third of final diagnoses were seen in the medical record, with 29% and 22% for the transcribed and patient records, respectively. Interobserver agreement in the final diagnosis was 35%.

The results of the study suggest that computerised history taking is suitable for certain patients in addition to, and not as a substitute for, the oral interview with a doctor.

Introduction

Diagnosis is the core of medicine; no medical decision can be made reliably without sufficient, though not necessarily complete, data interpreted by knowledgeable doctors. The most important stage in the decision scheme is the first one: the encounter between the patient and a doctor, be he a general practitioner or specialist. When medical data acquired at this stage are unreliable or deficient there is a risk of a wrong decision being made and the patient being improperly treated or referred to the wrong specialist. Taking a reliable history is the crux of all further medical actions, as was recognised by Weed when he devised the problem oriented record [1]. Since computers made their first appearance in medicine attempts have been made to augment history taking by studies in which patient performance and acceptance were investigated [2-4]. Before interactive equipment became available many techniques were used to acquire data, with or without the help of a doctor or nurse, such as coding sheets [5], mark sense forms, punched cards, sortable pictures or cards, audio and video tapes, etc. Later, interaction between computer and patient became possible with the use of typewriter terminals and visual display units [6,7]. Also special terminals were developed with adapted keyboards and for displaying graphical information [8]. Such systems should be highly interactive, have an ergonomic design, and contain a built in "intelligence".
Personal computers are now familiar in doctors' offices and some patients' homes and a new generation of doctors is being educated for the coming information age [9]. More people expect doctors to use computers for practice organisation and storing patient data, and several systems have been designed to store medical records, laboratory data, diagnostic codes, and medical histories [10].
No large studies have investigated the impact of a computerised patient history on diagnosis and treatment. Most systems emphasise the efficiency of history taking, and researchers have investigated the reactions of patients and doctors to them [11,12]. Because of the growing impact of computers on medicine the personal computer raises the possibility of automated history taking, with the medical record becoming increasingly computerised. This may lead to medical protocols and audit being based on patient data stored in computers, allowing computer assisted medical decision making using information stored in detailed data bases.
These considerations led us to investigate some aspects of computerised patient histories not hitherto reported. We evaluated how far both written and computerised medical records contained identical patient data for the same patient population; how patients reacted to automated interactive history taking; whether the diagnostic hypotheses, made on the basis of the different types of medical records, were comparable and how they

related to the final diagnosis with its implications for further medical care; what interobserver and intraobserver variations occurred with these types of medical records; and how doctors reacted to the different types of medical histories.

Patients and methods

The study was carried out in the department of medicine at this hospital. Some 300 patients were asked to participate in the project, and 99 agreed. Those who refused did so because of lack of time or other obligations. All patients referred by their general practitioner had a morning outpatient appointment and were asked to come one hour earlier to participate in the project. There were 38 men and 61 women, whose mean ages were 48 and 45, respectively. There were no significant age differences between the men and women ($t=0.88$, $p=0.38$).

Interactive system

We have developed an interactive system to take the computerised patient history [13], in which the main characteristics fulfil the requirements established by earlier investigators [14]. The system consists of a display terminal and an adapted keyboard with only function keys, which is very easy to use. The terminal is connected to a small computer, which runs a program generated by fourth generation software [15]. All questions are simply formulated, and when a patient does not understand the question he may press a key to convey this. Answers are selected from a multiple choice menu with up to seven possibilities instead of just yes, no, or don't know. As soon as a key is touched the answer appears as full text on the screen so that the patient may change it, reject it, or even go back to earlier questions. Description of complaints is supported by a schematic picture of the human body, on which the patient may indicate sites of pain or discomfort.

This system consists of over 400 questions relating to 179 different items. Two hundred and sixty "help messages" were built in to help the patient when he does not understand the question. Each history taking is preceded by a brief exercise in which the patient is asked about daily habits, such as watching television, to familiarise him with the method. The system starts by asking about the patient's main complaints, which he may indicate in the picture. It then moves on to questions on related organ systems, which are screened, and in depth questioning follows only if a patient has indicated that he has complaints. When the patient has finished, or wishes to stop, a printed report is immediately generated for him to review, change, or reject. The patient receives a copy of this report.

The study consisted of three different stages.

Stage 1: acquisition of medical records

All patients participated in the computerised history taking before being interviewed by the doctor. The computerised history taking ended in the printed report, called the patient record, and the interview with the doctor in the written medical record. This interview was taken by a medical student in the last stage of clinical training and afterwards verified by a resident. Both the computerised and the written interview followed the same guidelines and were based on the list of medical history questions routinely used in the department for patients on their first visit to the outpatient department. The computerised history was not available during the oral interview. Directly after the computerised interview the patients answered a short written questionnaire, giving opinions on this method of history taking.

As our aim was to compare the usual, written medical record with the computerised patient record a third medical record was generated by transcription of the medical record, following the same system as the patient had used, by an independent physician. This was called the transcribed record. Except for some non-quantifiable or uncodable items this record should have contained the same information as the medical record.

This phase of the project provided three types of medical records from 99 patients. A subgroup of 50 patients, drawn from and with similar age and sex distributions as the original group of 99, gave their opinion on computer supported history taking. This completed the first stage of our project, in which we compared the prevalence of complaints reported by patients both within and among the different types of records.

In order to compare the medical data in the different types of records in stage 1 we have restricted ourselves to a comparison of the quantifiable or codable data alone. It is much more difficult to compare qualitative data and impressions, let alone the results of non-verbal communication, although we are aware of the diagnostic importance of such information for the doctor. The computer compared the information contained in the so called frequency answers to certain types of questions. These answers were given by the patients in a range from "never" to "always". We clustered these categories of answers in four groups: negative (never; -), slightly positive (once and seldom; +), moderately positive (sometimes and regularly; ++), and strongly positive (often and always; +++). Depending on the frequency of a complaint, further in depth questions were asked. For such answers we identified absent, small, and large differences in the given answers for the different types of records.

Stage 2: diagnostic hypotheses

In the second stage of the project the three types of records from a sample of 18 patients were examined in weekly batches of six by three doctors, who had not seen the patients before. All records were made unidentifiable. For six of these patients all the records were examined a second time much later without the doctors' knowledge. Each doctor was given 72 records and asked to rate their usability and indicate diagnostic hypotheses. These diagnostic hypotheses and the doctors' opinions were analysed.

Stage 3: variability

In the third stage the interobserver and intraobserver and interrecord and intrarecord comparisons and a comparison of final diagnoses were analysed. We looked for differences in diagnostic hypotheses between the types of records and for discrepancies between and within doctors. The three doctors were offered the complete written medical records of the same 18 patients one and a half years after their first visit to the clinic. These records were analysed for intraobserver and interobserver variations.
Statistical methods - We used the following statistical methods to test the validity of our hypotheses: Student's t test to compare the means of two groups with respect to some continuous feature; Pearson's product-moment correlation to investigate the linear relation between two continuous features; the $x2$ test to investigate the relation between two features measured with a nominal scale; and Cochran's Q test for the investigation of several nominally scaled features simultaneously. A significance level of alpha=0.0 was chosen for all tests, and continuous features were log transformed where appropriate.

Results

Stage 1: acquisition of medical records

Frequencies of patient complaints

For each organ system we analysed the number of times that patients indicated a complaint in the written medical record and the computerised patient record in detail. The medical record was first transcribed to allow an automated analysis and comparison of the data. Here we summarise the statistics of the results for the different organ systems.
Figure 1 shows the percentage of times that a complaint was indicated as slightly (+), moderately (++) or strongly (+++) positive and the percentage of times that data were deficient. This is drawn for the respiratory, the circulatory, and the gastrointestinal organ system; stools; the genitouri-

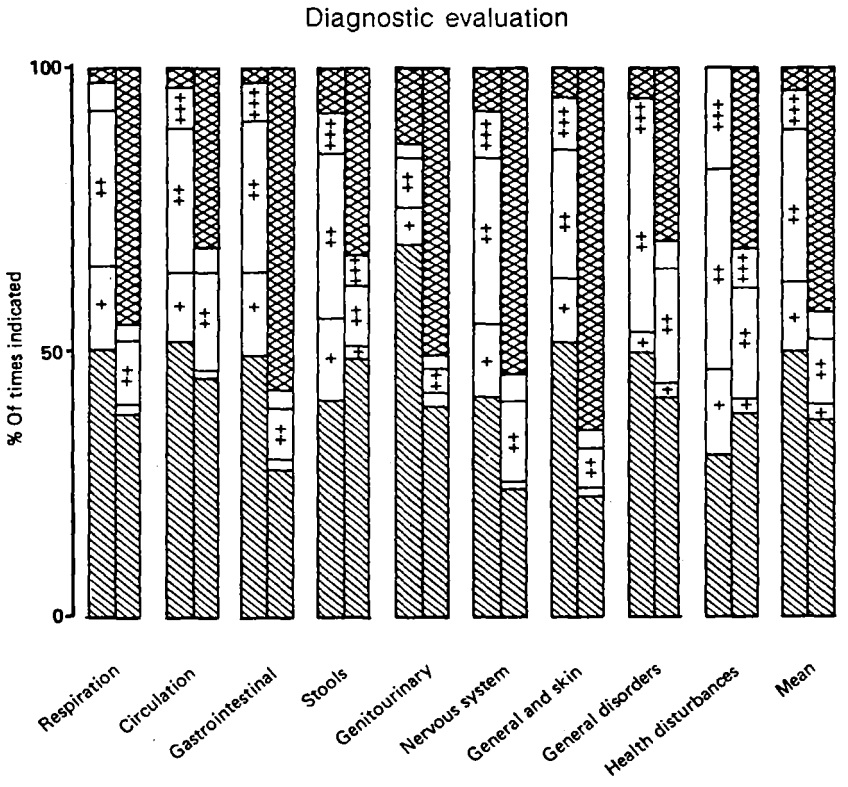

Figure 1. Frequencies of patients' complaints for the different organ systems in the written medical record after transcription (right hand column of each pair) and the computerised record (left hand column of each pair). Percentage of complaints denied by patient ▨ and complaints for which no answer was given (or asked for) ▩ are shown; + = symptoms indicated once or seldom, ++ = those indicated sometimes or regularly, and +++ = those indicated often or always.

nary organ system; the nervous system; general complaints and skin; various other disorders; and health disturbances.

Many of the data (45%) were deficient in the (transcribed) written medical record but only 4% in the patient record. On average, 48% of all complaints were positively included in the patient record, compared with 19% in the medical record. The remainder, 36% for the medical record and 48% for the patient record, were negatively indicated. Of the strongly positive registrations, 8% were indicated by the patient in the patient record and 4% in the written record. Table I shows how often complaints were not present or positively indicated in the two types of records for all 99 patients. In absolute numbers the differences were largest for the moderately positive (sometimes and regularly) indications.

	Diagnostic evaluation				
	Never (-)	Seldom or once (+)	Sometimes or regularly (++)	Often or always (+++)	Unknown (0)
Patient record	4158	1081	2374	747	367
Medical record	3225	159	1223	324	3765

Table I. Number of complaints reported in patient and medical records by frequency.

Differences between records

Figures 2-5 show the differences between the two types of records for all organ systems. A complaint indicated with the same frequency in both records was called similar. Complaints indicated in both records but with different frequency were also coded similar but with small or large differences. A difference was called small if, for instance, the patient record showed ++ and the medical record +++, and a large difference was

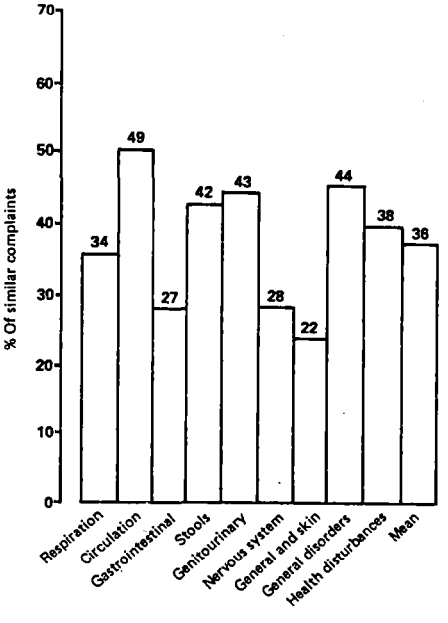

Figure 2. Complaints classified as similar in medical and patient records for all organ systems.

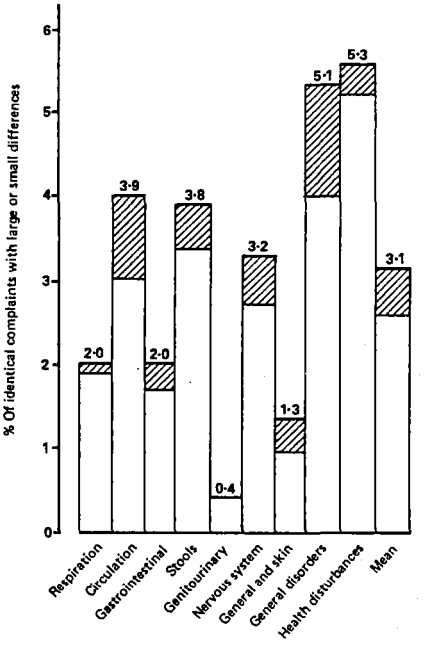

Figure 3. Complaints classified as identical in medical and patient records but with small □ or large ▨ differences.

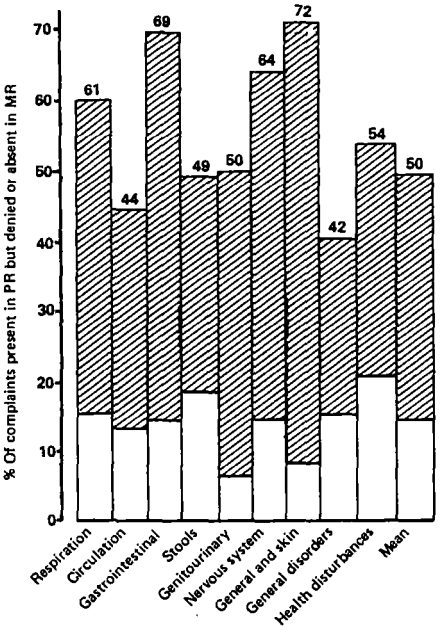

Figure 4. Complaints present in patient record (PR) but absent ▨ or denied □ in medical record (MR).

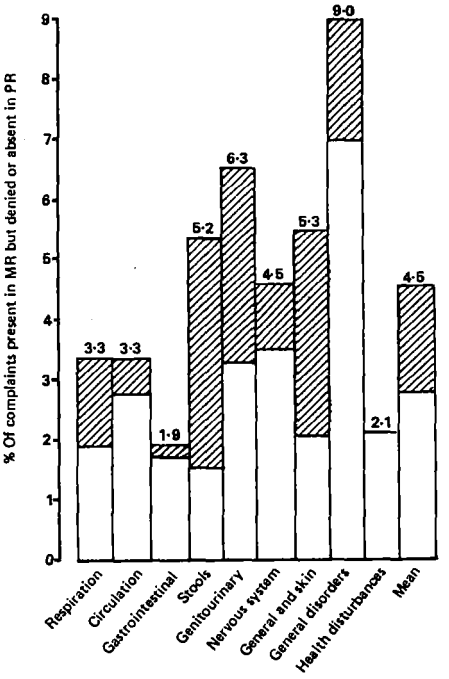

Figure 5. Complaints present in medical record (MR) but absent ▨ or denied □ in patient record (PR).

present between + and +++. On average, 36% of all complaints were similar, 2.6% having small and 0.5% large differences. Figure 4 shows that of 50% of the complaints indicated in the patient record, on average 14% were negated in the medical record and 36% absent. The reverse - complaints present in the medical record but not in the patient record - was true for 2.8% (negated) and 1.7% (absent) (figure 5).

Figures 2-5 show the scatter of percentages between different organ systems. On the basis of these frequencies, no differences were more prominent in one organ system than in another. Because "strongly positive" differences seem to be more serious we will discuss some of these. In the "circulation" section patients indicated having shortness of breath on exercise several times but not during the oral interview. Patients also complained of belching or rumbling and of back pain in the computerised interview but not during oral history taking. Such differences did not seem to be very serious or frequent, but many more observations were omitted in the medical record than in the patient record.

Diagnostic evaluation

Question	Answers	Reply	
Do you think the computerised interview was (Tick as many as you like)	Useful	Yes:	92
	Easy	Yes:	84
	Interesting	Yes:	84
	Lengthy	No:	74
	Annoying	No:	74
	Difficult	No:	72
	Unnecessary	No:	72
Were you able to express your complaints by the interview ?	All complaints		20
	Most complaints		48
	Partly		26
	None		2
	No answer/other		4
Could all complaints be expressed by the interview ? (Tick as many as you like)	All		22
	Some physical not		36
	Some psychological not		10
	Some other not		4
	Most important not		22
	No answer/other		16
Did you change your opinion regarding your own complaints while answering the interview ?	Insight increased		10
	Not changed		78
	Changed		2
	No answer/other		10
What is your opinion about the range of answers in the different questions ?	Too extensive		2
	Sufficient		58
	Good		18
	Too restricted		12
	No answer/other		10
What is your opinion about the printed report ? (Tick as many as you like)	Useful	Yes:	91
	Orderly	Yes:	78
	Too long	No:	58
	Unnecessary	No:	58
	Unclear	No:	60
	Too short	No:	62

Table II. Patients' answers to questionnaire on computerised history taking. (Values are percentages of patients)

Patients' opinions

Fifty patients answered a questionnaire on the computerised interview. The ability of patients to indicate their complaints with the help of a computerised interview was investigated (table II). Twenty per cent said that they could indicate all, 48% most, and 26% some of their complaints. Thirty six per cent of the patients could not express some physical complaints; in 22% this was their most important complaint. Patients found this method of history taking: useful 92%, easy 84%, interesting 84%, not lengthy 74%, not annoying 74%, not too difficult 72%, and not unnecessary 72%; while 10% said that their insight into their own health had changed, 78% said that it had not altered and the others gave various answers. The choice of answers was considered to be good by 76%; too restricted by 12%; and too extensive by one patient. Most (91%) found the printed report useful, 78% orderly, 58% not too long, and 62% not too short. We could find no relation between patients' opinions and age or sex (all $p>0.05$). Further details about patients' opinions can be found in a separate report [16].

Patients' performance

An average of 66 minutes were needed to complete the interview. Younger patients completed the history in a significantly shorter time (within 60 minutes) than older patients. We found a significant ($p<0.001$) correlation of -0.52 between age and the number of questions answered each minute. The fast patients answered 3.5 questions a minute, the slow patients 2.5. On average, a completed history contained 222 answers. We found no sex differences in the average time needed for completing the history (*t* test, $p=0.70$).

Stage 2: diagnostic hypotheses

For a subpopulation of 18 patients all three types of records were examined by three doctors to investigate the diagnostic information contained in them. Besides these 54 records the same doctors also interpreted six repeat records of each type, making a total of 72. There was no outward difference between the transcribed record and the patient record. From the 54 records the three doctors generated a total of 522 diagnostic hypotheses: 167 from the medical records, 156 from the transcribed records, and 199 from the patient records (see fig 6). The first doctor generated 167 diagnoses in all, the second 193, and the third 162. On average, 3.3 diagnostic hypotheses were generated for each record, with 20% more for the patient records and 10% less for the transcribed records.
We also asked the doctors to characterise each diagnostic hypothesis as

Diagnostic evaluation	Medical record	Transcribed record	Patient record
Certain	25	30	38
Probable	38	36	40
Possible	37	34	22

Table III. Probability of diagnostic hypotheses reached by three doctors using three types of record. (Values are percentages)

certain, probable, or possible. Table III shows that in the certain category the patient record was much more prominent (38%) than the medical record (25%) or the transcribed record (30%). We found significant differences in these certainty profiles among the different record types ($x2=11.7$, $p=0.002$) and even more prominent differences among the three doctors ($x2=50.2$, $p<0.001$).

Doctors' opinions

The doctors were asked about the medical usability of the records and whether they thought that the records gave sufficient importance to the main complaints or contained no relevant diagnostic information. Table IV summarises the doctors' opinions (more than one answer was possible for each record). They found information about the main complaint in the medical record in 52% of the 54 records, in the transcribed record in 26%, and in the patient record in only 15%. As table IV shows, the transcribed record was considered to have least usability for all other indications, whereas the patient record was considered to be very important for organ systems related to other complaints and routine questions (both 46%).

Usability (more than one answer possible)	Medical record	Transcribed record	Patient record
For main complaint	52	26	15
For organ systems related to main complaint	44	27	35
For organ systems related to other complaints	43	31	46
For routine questions	35	24	46
For general information	11	17	24
No use/unknown	11	27	2

Table IV. Usability of three types of record for diagnosis. (Values are percentages)

	Diagnostic evaluation		
Usability	Medical record	Transcribed record	Patient record
Perfect, good	54	22	28
Partly	35	39	50
Hardly, not	7	26	13
No answer	4	13	9

Table V. Usability of three types of record for patient care. (Values are percentages)

Table V amplifies these findings, showing whether the records were good or perfectly, partly, hardly, or not usable for patient care. These impressions, however, are qualitative rather than quantitative. For this question the answers were mutually exclusive. In 54% of the cases the medical record was considered to be good (39%) or perfectly usable (15%). For the patient record the figures were only 19% and 9%, respectively, and half of the patient records were considered to be partly usable. The transcribed record was considered to be not or hardly usable in 26% of cases.

Stage 3: variability

We investigated interobserver and intraobserver variation for the doctors and for the different types of records. For the 18 patients, each with three types of records, and the three doctors 522 diagnostic hypotheses were generated. In only 17% of all of the diagnostic hypotheses was there full agreement among the doctors for all three types of records. Figure 6 shows this as a Venn diagram. Agreement between the medical and transcribed records was 32%, between the medical and patient records 25%, and between the transcribed and patient records 35%. The agreement between the first and second doctors regarding the diagnostic hypotheses was 28%, between the first and third 30%, and between the second and third 39%. We also investigated the diagnostic profiles- that is, the number of times the doctors recorded diagnostic hypotheses for the different organ systems. In this respect there were no differences between the doctors ($x2=19.8$, $p=0.14$) but significant differences between record types ($x2=30.5$, $p=0.007$) and sexes ($x2=34.5$, $p<0.001$).
For six patients the three records were offered twice, resulting in 150 extra diagnostic hypotheses from 18 records and three doctors: 2.8 diagnostic hypotheses for each record. For these hypotheses we investigated the intraobserver and intrarecord variability. The intraobserver agreement varied for the three doctors from 40% to 61% and the intrarecord agreement from 50% to 52%. The overall intrarecord and intraobserver agreement was therefore 51%.

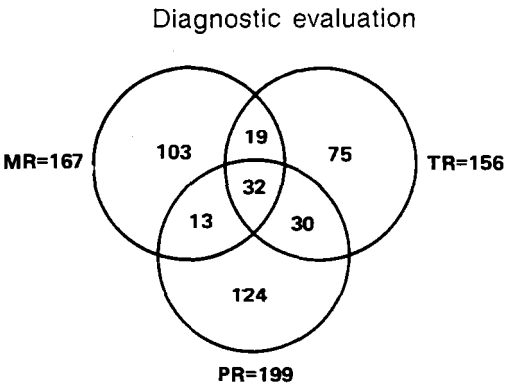

Figure 6. Venn diagram of discrepancies in diagnostic hypotheses reached by three doctors between the medical record (MR), the patient record (PR), and the transcribed record (TR). Of the 522 hypotheses, only 90 (3 x 30) were identical for all three doctors and 96 (3 x 32) for all three types of record.

Comparisons with final diagnosis

We compared the diagnostic hypotheses with the final diagnoses, which were made by the same three doctors about one and a half years after the patients completed their treatment. The doctors were offered the complete written records (called the definite medical records) of the patients, but without the discharge diagnosis or any computerised report. On the basis of these documents they were asked again to make a final diagnosis. These diagnoses were compared with the hypotheses in the original records, and table VI shows the results. On average, the doctors made 2.5 diagnostic statements for each complete written record. The interobserver agreement was 35% (in the earlier records it was 32%). Of all the final diagnoses, 33% were already seen in the medical record, 29% in the transcribed record, and 22% in the patient record. As can be seen from table VI there were significant differences between these percentages ($p<0.01$, Cochran test with $Q=27.7$), but the outcome of this test was primarily influenced by the second doctor, and to a lesser degree by the third doctor. Overall, the doctors scored individually 26%, 29%, and 29%.

Discussion

Written and computerised history taking were based on the same intake questionnaire used in the department of medicine. Because we found large discrepancies between results from the written medical record and the computerised patient record in all three stages of our study we will comment on these findings. Firstly, we summarise and discuss the main differences from the three stages.

	Diagnostic evaluation			
Doctor	Medical record	Transcribed record	Patient record	Mean
1	25	28	25	26
2	36	30	21	29
3	39	29	19	29
Mean	33	29	22	

Table VI. Agreements between diagnostic hypotheses in three types of record and final diagnosis for three doctors. (Values are percentages)

Stage 1

In stage 1 it seemed that on average, for all patient data, 12% more negative answers were given in the patient records than in the medical ones and that about 40% of data present in the patient records were not observed in the medical records. This finding is supported by several other studies [3]. In the category of complaints that were always or often present patients gave twice as many indications in the patient records as in the medical ones. The same was true for indications in the categories sometimes or regularly. For borderline answers (seldom, once) the discrepancies were even larger. In cases where patients indicated a complaint in both records discrepancies were minor: large differences in 0.5%, small ones in 2.6%, and fully similar indications in 36%. A large percentage was denied or not present in the medical record but indicated in the patient record: 14% and 36%, respectively. The reverse - present in the medical record but denied or not given in the patient record - was true in 2.8% and 1.7% of cases, respectively. While 68% of the patients said that they could give most of their complaints in the patient record, 22% said they could not mention their main complaint.

The lack of data in the medical record seemed to be spread equally over all the organ systems included in the history. We should, however, be careful not to conclude too hastily that data present in the patient record were indeed missing from the medical ones. With most computerised interview systems the patient is stimulated to give more answers because more information is requested so that some redundancy of data seems inevitable. With our system, however, some "intelligence" has been built into the branching logic, and questions are asked in more depth only if the patient has indicated some complaints. Our study confirms other findings that patients seem to be very positive about computerised history taking [3,7,11,12].

Stage 2

The findings in stage 2 concur with those in stage 1. The doctors, however, thought that main complaints were much better expressed in the medical record (52%) than in the patient record (15%) and that there was also more information about the organ systems related to the main complaint in the medical record: 44% compared with 35%. Other organ systems and routine questions, however, were considered to be better represented in the patient record (46% and 46%, respectively, whereas for the medical record the figures were 43% and 35%). This is further supported by the opinions on usability: the medical record was considered to be good or perfectly usable for patient care in 54% of cases and the patient record in 28%; the medical record was described as partly usable in 35%, and the patient record in 50%. The transcribed record was valued below the other records, probably because of the filtering process of the transcription, which meant that non-factual and non-quantifiable data could not be documented.
In general, the patient record was considered to contain hard facts and to be more complete and reliable. Interestingly, diagnostic hypotheses for the patient record were labelled as certain or probable in 78% of cases, while for the medical record this was only 63%. The absolute number of diagnostic hypotheses generated for the 18 patients for the patient record was about 20% higher than for the medical one, reflecting the larger amount of data in the patient record.

Stage 3

Stage 3 showed large discrepancies between the doctors, irrespective of the type of record. The average agreement between two doctors was only 32%, while the mean intraobserver agreement was 51%, highest for the medical record (61%) and lowest for the transcribed record (36%). The interrecord agreement varied from 25% (between the medical and patient records) to 35% (between the transcribed and patient records). These interobserver and intraobserver and interrecord variabilities shed more light on the usability of the different types of records.
We have shown that 33% of the final diagnoses were reflected in the initial diagnostic hypotheses derived from the medical record. For the transcribed and patient records this was even less: 29% and 22%, respectively. Because the medical and transcribed records seemed to agree more with the definite medical record than the patient record it could not have been merely the printed format that caused this difference. The medical record seems to contain better semantic information, whereas the patient record contains more factual data, not necessarily leading to diagnostically relevant conclusions. We should be aware, however, that this is not a final

conclusion because on the basis of these and similar findings we should improve computer assisted history taking, which is only in its infancy. Furthermore, it should be realised, as has been shown by Hampton *et al* [17], that for medical outpatients the clinical examination rarely adds to the history diagnostically. Our study confirmed this, and we were able to extend this finding to the three types of record.

Role of computers

The fact that the doctors did not find the same diagnostic information in the patient or transcribed records as in the medical record could be attributed to several reasons. Firstly, all of the doctors are used to written records. The batch of six records that they received each week contained four computerised records (two patient and two transcribed records). As the doctors saw many more written records during the week they could not be expected to adapt to this uncommon presentation of patient history data. Moreover, we should not exclude the fact that many doctors are still slightly prejudiced against computerised patient histories. The most important reason, however, is the fact that computerised records contain only the formal, factual aspects of a history. Qualitative and non-verbal information, let alone personal notes, are not contained in such structured records, nor are they written in natural language.
The large discrepancy between the doctors, even though they were all from the same department, deserves comment and might have several explanations. The diagnostic statements that were requested from the doctors were based on the written or printed records alone; the doctors did not see the patients themselves. Nevertheless, the doctors felt significantly more certain about hypotheses drawn from the patient record, perhaps because it contained more data, as shown in stage 1 and supported by stage 2.

Conclusions

From these findings several conclusions may be drawn.
Firstly, computerised patient histories are more complete than written medical records. This does not necessarily lead to more diagnostically important conclusions. Our study, however, shows that there were more than twice as many strongly positive complaints in the computerised patient record than in the written medical record. This is supported by the fact that 68% of all patients said that they could express all complaints; most (92%) were positive about computerised history taking.
Secondly, doctors generated about 20% more diagnostic hypotheses for the patient record than for the medical one, with an average of 3.3 hypotheses for each record. Though the doctors preferred the medical record to the

patient one (54% *v* 28% when asked about usability), they were much more certain about diagnostic hypotheses in the patient record (38%) than in the medical one (25%).

Thirdly, interobserver agreement in interpreting medical records seems - rather surprisingly - to be independent of the type of record and was as low as 32%; even for the final medical record it was only 35%. Intraobserver agreement also seems independent of the record type (51%). This is clearly an area of concern, and further research is needed. Widespread acceptance of computerised history taking cannot be hoped for if such large variabilities persist.

Fourthly, 33% of the diagnostic hypotheses from the written medical record concurred with the final diagnosis, while for the computerised patient record the figure was only 22%. This is only partly due to the formal character and the structure of a computerised record, as was made clear by the comparison with the transcribed record. The main cause probably lies in the smaller amount of semantic information contained in computerised records, and thus the interpretation of both written and computerised medical records needs improvement.

Finally, our study suggests that computerised history taking is suitable for certain patients (first referral, chronic diseases, and follow up), preceding rather than replacing the oral interview in order not to miss any relevant data for further diagnosis and treatment.

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Main conclusions and discussion

In this chapter we will summarize the principal findings of our study. In doing so, we shall follow the order of topics in the previous chapters of this thesis. We shall then discuss the results of our study.

Principal findings

1. *The automated system for history taking*

In the first part of our study, we investigated the usefulness of an automated system for history taking. In developing this system, the use of the fourth-generation programming package AIDA proved to be most useful at all levels of development and maintenance. Screens could be generated in an interactive way, modified, and maintained; plausibility checks and help-text implementations were supported by modules of AIDA. Furthermore, it was easily possible to monitor and evaluate the performance of the patients who used the final system, by counting the different answers and timing the answers. AIDA also supported the definition and use of special function keys and aided in the generation of reports. The interviewing system appeared to be user-friendly and permitted us to modify the system rapidly in the course of our study. We developed two versions of the system: one for the pilot phase, after which the emerging errors were resolved, which resulted in a second version for the main phase of our investigations.

2. *Ergonomic aspects*

On average, 82 patients needed 54 minutes to answer the main part of the questionnaire; the mean time, 67 patients needed to complete the entire questionnaire, was 66 minutes. These figures included the time required for familiarization with the system. During this total time, 222 answers were given on average. The speed by which the patients answered the questions was correlated with age (-0.52, $p<0.001$); there was no correlation with the sex of the patient. The questionnaire permitted specific questions to be asked in response to more general questions; branching logic took care of further in-depth questioning. There was always the possibility to choose from multiple answers. It was observed that older patients were considerably slower in getting familiarized with the system than younger ones. Some patients had problems getting acquainted with the layout of the screens; some patients were not able to distinguish among the different parts of the screens. The number of such problems appeared to be correlated with age and sex; young patients in particular (below age 40) had little or no problems in using the terminal. However, the screen on which the patients could indicate the location of their physical complaints ap-

peared to be difficult to use for many patients. There was an indication that the use of the special function keys, especially their illumination, resulted in a faster familiarization than there was without illuminated indications. About 70% of the patients completed the full questionnaire, and more than 80% completed the main part of it, although only a limited time (in the order of one hour) was available. Ten percent of the patients indicated they wanted to stop answering questions after about one hour.

3. *Patient appreciations*

Of the 99 patients who participated in our study, 50 took part in an evaluation of the usefulness of the system. The majority of the patients were positive about the computer-based interview as a whole: 92% had the opinion that the questionnaire was useful and 84% found it easy and interesting. About 75% had the opinion that the interview was not too lengthy or annoying; 72% indicated that it was not too difficult or unnecessary. We found no difference in attitudes among age groups and between sexes. About 70% of all patients stated that they could express most or all of their complaints with the help of the computerized questionnaire. In the age group of 40 - 60 years, this percentage was lower (45%).
Patients who could enter only part of their history were not significantly more critical of the computerized questionnaire. The majority of the patients found the range of possibilities for registering answers as *sufficient* or *good*. There was a remarkable difference between the opinions given by men and women only for the questions about the length of the questionnaire, the question about a changed insight and the questions about the possibility to express complaints and the amount of answer options. The printed report, which was generated directly after the interview, was rated positively.

4. *Quantitative comparisons of complaints*

In comparing the answers given in the written history with those in the computerized record, it was striking that patients gave twice as many positive answers sitting themselves behind a computer terminal than during the oral interview. It must be stated, however, that such differences often were not significant. The frequency of identical responses in both types of interviews was 36%, of which almost 2/3 were negative answers. Of all strongly positive answers, 52% were identical in the written and the computerised record. On the average, each patient indicated a complaint by answering a question with "often" or "always", when there was no indication of this answer in the written medical record, 4.5 times. For 42% of the registered answers in the computerized record, no corresponding information could be found in the written medical record.

5. *Appraisal by internists*

For a subpopulation of 18 patients all three types of records were examined by three internists. They were requested to give their opinion about the usefulness of the different types of patient histories and to generate diagnostic hypotheses on basis of the histories. The internists had the opinion that the information content of the written medical history was good or excellent in 54%. Only 28% of the computerized records were considered good or excellent. The doctors thought that main complaints were better expressed in the medical record (52% of the records) than in the computerised questionnaire (15%). On basis of the computerised questionnaire more diagnostic hypotheses (204) were generated than on basis of the written record (171). The internists were asked to classify the generated hypotheses in one of three certainty levels: certain, probable or possible. A significant difference was found for the indicated certainty per record type ($p=0.002$): 38% of the diagnostic hypotheses based on the computerised questionnaire were classified as certain against 25% of the diagnoses based on the written record.

6. *Overall comparisons*

To complete our study, we compared all diagnostic hypotheses of the three doctors with each other to obtain intra- and inter-observer variabilities. We found large discrepancies between the doctors, irrespective of the type of record. The average agreement between two doctors was only 32%, while the average intra-observer agreement was 51%. The inter-record agreement varied from 25% to 35%. We also compared the diagnostic hypotheses, generated on the basis of the patient histories, with the final diagnoses, made from the complete medical record after sending the patient back to the GP. 33% of the final diagnoses were reflected in the diagnostic hypotheses derived from the written medical history. For the computerized history 22% of the final diagnoses were hypothesized on the basis of the patients answers.

Discussion of main results

attitudes of patients

In our study we found very positive attitudes of the patients toward using an automated questionnaire, as have other investigators [1]. For that reason, we may conclude that there are few revoking arguments from the side of the patients against the use of automated history-taking systems.

ergonomic aspects

Older patients might need some assistance in using a computerized system for history-taking. Younger patients had less problems in using the system than older patients. These results agree with recent research from Slack who also found a relation with the education level of the patients [2]. This phenomenon may further change as the use of computers becomes more common place.

formalized interaction

The style of interaction between the system and the patient is highly formalized, which has both advantages and disadvantages. The main restriction is that there is less mutual understanding between the patient and the computer-based interviewer. The system is able to collect medical *data* in a standardized way. When a knowledgeable physician interprets these data it becomes medical *information*. But also machines process data and (in the near future) expert systems are able to transform data into more or less medically relevant information. However one always has to be critical about the fact to what extent computers will (or should) ever take over this role of transformer of data into medical information and in that way take part in the relationship between a patient and his doctor.

role for automated patient history systems

With the help of automated history taking systems it is possible to collect many medical history data from a patient in a standardized way. The cooperating internists indicated that especially the so called routine information is usable in comparison with the medical history data gathered in the classic way. This favours the recommendation to use these methods in screening situations, during the first encounter of a patient in an outpatient clinic, or for the follow-up ("monitoring") of certain patients with chronic diseases (such as cardio-vascular or respiratory diseases) who pay regular visits to their doctor.

provocation of complaints

Questionnaire systems may also suggest complaints to patients, by their very nature of asking questions about possible symptoms. By asking questions, they may easily generate too many positive answers, as we have seen in our study. The patient may never have volunteered certain complaints spontaneously, some of which the patient may not have recognized as abnormal. When we compared the data gathered with help of the questionnaire with the medical record data, for 42% of the questioned items no data could be found in the medical record. One third of these questions about possible complaints was answered with "sometimes", "regularly", "often" or "always" by the patient with help of the computerized questionnaire. The doctor, having only a very limited amount of time available for his patient, may fail to inquire about certain patient symptoms. The importance of various complaints in suggesting a diagnosis will always be disputable: it may be of interest for a patient to present all his complaints in order for the physician to obtain a broad basis for the diagnosis. In medical practice, however, too many complaints may hide the most important ones (like noise obscuring a signal). Verification of all complaints may be too time-consuming and expensive.
Warner [3] and Haug [4] experimented with questionnaires asking questions guided by a Bayes' ruled system. But here we meet the problem of inadequate knowledge for a broad medical basis, together with the narrow approach of human experts who select too early diagnostic hypotheses. These methods may prove their validity in a restricted medical problem field. But on the other hand a complete questioning system when using computers may not be bad at all. For instance, one of the attractions of the so called alternative medicine is the elaborate inquiry about complaints.

written history more useful

We have found that the written patient history was considered more useful by the internists than the computerized record, primarily because the written record was considered to be more complete with respect to the main complaints. The physicians' attitudes might also reflect the fact that the doctors were more familiar with a written record than a computerized questionnaire. The internists believed that the computerized record has its proper place *before* the oral history-taking, whereas the place of the conventional record is *during* history-taking by the doctor. A written record, as mentioned before, may express informal and individualized aspects of the history besides formal findings, in natural language, instead of the standardized sentences of the computerized history. We also found that on the basis of the computerized report, diagnostic hypotheses were given

with more certainty than with the written record. This may imply that diagnoses based on computer generated reports are given with more strength than those based on handwritten records. This is an interesting aspect which certainly asks for further research. Has this phenomena to do with a tendency to trust printed information more than handwritten data, or were the internists not able to read all the handwritten data properly which gave them a feeling of uncertainty, or has it to do with the fact that the computerized record offered more data to generate diagnoses than the medical record? This phenomen influences for a great deal the use of computers in medicine, one has to be aware of this aspect in using computers in medicine. More research has to be done to check whether the certainty of a diagnosis is based on the information itself or on the way the information is presented. If so, it renders the use of an automated questionnaire more valuable: the information gathered in this way has a greater impact than informally gathered information. It is important like always, that one is sure of the fact that the gathered information has been validated.
Nevertheless, physicians prefered the written record, and they prefered especially the presentation of the main complaints in it. This preference may also have to do with the differences in experience with the two types of records. Because of the different nature of these records the comparison will always has his limits. In our comparison we mainly looked at the outcome: the diagnostic hypotheses, generated on basis of the input material: the records.

low correlation with final diagnosis

It is only partly reassuring that hypotheses generated from the written medical history had a slightly higher overlap with the final diagnoses than with the computerized history. As was shown, there appeared to be a very large diagnostic disagreement among internists, when referring to both types of records, both patient histories in isolation and complete medical records. This means that computerized history taking always has to be placed within certain restraints like the introduction of any other new technique.
At the same time, one should realize that studies such as this one are primarily meant only to provide a foundation for future research aiming at the improvement of the structure of the medical record. Because there is a low correlation among the internists based on the data in the written medical record, the latter should not be used as the "golden standard". As there are so many uncontrolled influences in medicine it will always be difficult to find a golden standard to verify the originally gathered data.

basic medical problems remain

Our study shows that, although today's computer technology is suited for the task of gathering patient history data and patients are willing to participate in automated history-taking. The principal limitations of computer-based patient interviewing are non-technical in nature and are related to basic medical issues: the relationship between patients and doctors and the methodology of how physicians acquire and interpret medical data. Data acquisition methods for written medical records need to be improved because present methods show many shortcomings regarding reliability and completeness [5]. Much more basic research will be required to solve these problems before computer-assisted history-taking should be introduced on a large scale.

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Final remarks

In the following I shall give some personal comments on the study and shall also look at the prospect of computer-assisted history taking.

The first contact between a patient and a doctor is always the initiative of the patient in asking for help. The encounter concerns a question asked by one human being to another, more knowledgeable person. For the transfer of information between these two people, speech, data communication techniques, and other data acquisition methods are being used.

1. *Transformation of data*

   An automated questionnaire is a method by which data can be obtained from the patient about his medical condition in a standardized way. The questionnaire concerns so-called "soft data", as contrary to "hard facts", like detected by medical examinations. However, by using a standardized and validated data acquisition method, the completeness and accuracy of the data are increased and the data become less soft.

2. *The doctor-patient relationship and responsibilities*

   It is understandable that during the process of information exchange a relationship grows, which is often characterized by mutual trust and confidence. This confidence is caused by the fact that the exchanged data have a very personal nature and are at times concerned with life or death. The primary issue is that an individual seeks a solution for his personal problems. Whether this help is given by an expert, is of secondary importance, as is the possible inequality in the mutual relationship.
   It is the patient's responsibility to present his health problems in such a way that the physician can obtain optimal insight into those problems. In a similar way, it is the responsibility of the physician to use methods that optimize data exchange. If, subsequently, these data-exchange techniques would offer the possibility to assist in the diagnosis, then both the patient and the doctor should be encouraged to use such methods. Of course, ethical aspects should also be considered in this respect.
   It is conceivable that, for certain medical applications, in the future computers will assist the physician in the generation of diagnostic hypotheses. Of course, in all cases the doctor is responsible for final decisions and the patient management, but in many instances he will base his diagnosis (partly) on computergenerated suggestions. For certain applications, physicians eventually will have enough confidence in the diagnostic support methods to use them in practice, of course

enough experience must have been obtained and a proper evaluation must have been performed. The more that data are processed by computers, the more that computers will also give support for data interpretation. Whether this interpretation is ethical, depends on the degree to which computer interpretations are better or worse than human interpretations.

3. *Data vs. information*

When using questionnaires, many data are generated that may not have direct medical significance. The medical significance of these data is determined by the translation of data into information. The translation of data into information depends on the context, in fact for each culture and for each knowledge field data will obtain different meanings, as they are influenced by all kinds of sociological, psychological, cultural, economical aspects. In short: people may ascribe a different meaning and significance to their complaints in different circumstances. The way that one expresses one's complaints may also lead to personal advantages or disadvantages.
From a purely medical point of view it might be of interest for the patient to document all his complaints and symptoms to obtain an understanding that is as complete as possible so that an optimal diagnosis may be reached on the basis of these data.

4. *Computerized questionnaires*

There is much more work to be done in the development of computerized history taking; the use of free text and natural language is not yet possible and perhaps never will be. Doctors are also not yet accustomed to use computerized questionnaires in their practice, although the method itself has its worth and could be part of proper medical management. Computer-based questionnaires should be introduced already during medical education.

5. *Use of written medical record in combination with computer-assisted history taking*

It has been shown that the information in the written medical record is often insufficient to suggest the final diagnosis to independent observers. Still, the medical record forms the basis for all medical actions. How could we possibly improve the information content of the written record? In our opinion history taking should be preceeded by an efficient computerized history with standardized questions. The (printed) questionnaire answers could form the basis for further in-depth questioning, so that a better documented and more complete picture is

generated about the patient's complaints. Using such a procedure, the computer-based questionnaires might even help to improve the efficiency of patient care.

6. *Areas for further research*

The following question seem suitable for further investigation of the usability of the medical record in combination with the use of computer-assisted history taking.

"Do automated questionnaires increase the effectiveness and efficiency of medical care and the way physicians deal with medical data for solving the problems of the patient?"

In this respect the following aspects, condensed in short phrases, may be further investigated:

DATA COLLECTION

- the recording of (all) patient complaints
- the generation of a list of real patient problems
- the use of questionnaires for preventive medicine

EFFECTIVENESS

- the detection of complaints and their underlying diseases
- the use of computerized history data for diagnosis and therapy
- the increase of the patient's responsibility for his own health, with regards to a possible effect on the healing process

EFFICIENCY

- the improvement of the efficiency of medical care in solving the medical problem of a patient
- the integration of questionnaires with medical information systems

RESEARCH

- the use of collections (databases) of histories to increase insight in the relationship between complaints, diseases, diagnoses and therapy
- the increase of epidemiological knowledge

Summary

In this thesis a study is described which was performed to explore the possibilities of computer-assisted history taking to support patient care. A system was developed by which the patient himself enters his medical data into a computer. The system enables an unexperienced user, i.e. a patient, to answer questions asked to him by an "intelligent" computerized questionnaire. In developing this system, use has been made of a fourth-generation programming package. The system appeared to be user-friendly and was easily adaptable in the pilot phase of the study.

During automated history-taking, 99 patients were presented with the medical questionnaire on the screen of a computer terminal in the form of multiple choice questions. By pressing one of several function keys, the patient could indicate his answer. His choice appeared immediately as full text on the screen for verification. At the end of a session, all answers were immediately printed and given to the patient for further verification. All patients had a regular history taken directly after the automated interview. The conventional history was written in the medical record. The doctor had no prior knowledge about the contents of the computerized interview.

As part of our research, the ergonomic aspects of the system and the patient's responses to it were investigated. We studied how questions should be presented to the patient, and at what instants the patient had problems in using the system. On the average, patients needed 54 minutes to answer the main part of the questionnaire; the mean time needed to complete the entire questionnaire was 66 minutes. During this total time, on the average 222 answers were given. The speed by which the patients answered the questions was correlated with age; there was no relationship with sex. It could be observed that older patients were considerably slower in getting familiarized with the system than younger ones. About 70% of the patients completed the full questionnaire, and more than 80% completed the main part of it, although only a limited time (about one hour) was available. 10% of the patients were unwilling to continue answering questions after about one hour.

The reactions and opinions of the patients regarding the automated system for history taking were also studied. Of a total group of 99 patients who participated in our study, 50 took part in the evaluation of the usefulness of the system. The majority of the patients were positive about the questionnaire as a whole: 92% had the opinion that the questionnaire was useful, and 84% found it easy and interesting. About 75% had the opinion that the interview was not too lengthy or annoying; 72% stated that it was

not too difficult or unnecessary. We found no differences between age groups and sexes for these items. About 70% of all patients answered that they could express most or all of their complaints with the help of the computerized questionnaire. In the age group of 40 - 60 years, this percentage was lower (45%); these older people did not have more complaints than the younger groups.

The answers from the computerized interview were compared with those of the regular, written interview. The nature and frequency of complaints in both types of interviews were also compared. To that end, the written history data were transcribed to a computerized format. In comparing the written answers with the computerized ones, it was found that patients gave twice as many positive answers using a computer terminal themselves, than they did during the oral interview. The percentage of fully similar indications in both types of records was 36%, of which the negative responses constituted almost two-thirds. Of all strongly positive answers, 52% were identical in the written and the computerized record. On the average, each patient indicated a complaint by answering a question with "often" or "always" 4.5 times when no corresponding information was present in the written medical record.

In order to evaluate the differences in the semantic content of the two types of interviews, a subset of all histories was offered to three internists, who were asked to write down diagnostic hypotheses that they generated on the basis of the data in the medical history. The computerized questionnaires caused more diagnostic hypotheses to be generated (204), than the written record (171), i.e., about 20% higher. The diagnostic hypotheses for the computerized questionnaire were given with more certainty (38%) than for the written record (25%).

A further point of investigation concerned the usefulness of the different types of medical histories from the viewpoint of the physicians. The internists, who evaluated the usefulness of the different types of patient histories, had the opinion that in 54% the information content of the written medical history was good or excellent. For the computerized record, this was only 28%. The doctors thought that main complaints were better expressed in the medical record (52%) than in the computerized questionnaire (15%).

A last point that has been studied was the relationship between the primary diagnostic hypotheses and the final diagnoses. The latter were made by the internists on the basis of the complete medical records, after

the patients had been discharged from the hospital. We compared all diagnostic hypotheses of the three doctors with each other to obtain intra- and inter-observer variabilities. This was also done in comparing the diagnostic hypotheses, generated on the basis of the patient histories, with the final diagnoses, made from the complete medical record after discharging the patient. Large discrepancies were found between the doctors, irrespective of the type of record. The average agreement between two doctors was only 32%, while the average intra-observer agreement was 51%. The inter-record agreement varied from 25% to 35%. It has been found that 33% of the final diagnoses were already reflected in the diagnostic hypotheses derived from the written medical history. For the computerized history, this fraction was 22%.

Samenvatting

In dit proefschrift wordt een onderzoek beschreven dat is uitgevoerd om de mogelijkheden te onderzoeken van computer-ondersteund anamnese afnemen als ondersteuning van de patiëntenzorg. Met behulp van een ontwikkeld computerprogramma kan de patiënt zelf zijn medische gegevens in de computer brengen. Het programma stelt de onervaren gebruiker i.c. een patiënt, in staat om vragen te beantwoorden die door een "intelligente" geautomatizeerde vragenlijst worden gesteld. Voor de ontwikkeling van dit programma is gebruik gemaakt van een vierde generatie programmeerpakket. Het programma bleek gebruikersvriendelijk te zijn en was gemakkelijk aan te passen tijdens het vooronderzoek.

99 patiënten hebben de medische vragenlijst aangeboden gekregen op het scherm van een computer terminal, in de vorm van meerkeuze-vragen. Door een van de beschikbare functietoetsen in te drukken kon de patiënt een antwoord aanwijzen. Voor controle verscheen dan onmiddellijk de gemaakte keuze op het scherm. Na afloop werden de antwoorden op papier gezet en aan de patiënt gegeven ter verdere controle. Bij alle patiënten werd daarna een anamnese afgenomen op de gebruikelijke manier. De gegevens hiervan werden in het medisch dossier geschreven. De arts was op dat moment nog niet bekend met de inhoud van de geautomatizeerde anamnese.

Een onderdeel van ons onderzoek waren de ergonomische aspecten van het programma ten aanzien van de patiënt. We bestudeerden hoe vragen aan de patiënt het beste konden worden gesteld en waar de patiënt problemen had met het gebruik van het programma. Patiënten hadden gemiddeld 54 minuten nodig om het hoofddeel van de vragenlijst te voltooien; voor de hele vragenlijst waren gemiddeld 66 minuten nodig. Gedurende deze totale tijd werden gemiddeld 222 antwoorden gegeven. De snelheid waarmee de patiënten antwoorden gaven was gecorreleerd met de leeftijd, niet met het geslacht van de patiënt. We hebben geobserveerd dat oudere patiënten langzamer wenden aan het programma dan jongere. Ongeveer 70% van de patiënten heeft de gehele vragenlijst beantwoord en meer dan 80% heeft het hoofddeel van de vragenlijst beantwoord, hoewel slechts beperkte tijd (ongeveer een uur) beschikbaar was. 10% van de patiënten wilde na een uur niet meer verder gaan met beantwoorden.

De reacties en meningen van de patiënten met betrekking tot het geautomatizeerd anamnese afnemen werden ook onderzocht. Van de totale groep van 99 patiënten die aan het onderzoek deelnamen, deden 50 mee met de evaluatie over het gebruik van het programma. De meerderheid van de patiënten was positief over het gebruik van de vragenlijst als geheel:

92% was van mening dat de vragenlijst nuttig was en 84% vond het gemakkelijk en interessant. Ongeveer 75% was van mening dat de vragensessie niet te lang en niet vervelend was. 72% gaf aan dat het niet te moeilijk en niet overbodig was. We vonden geen verschil tussen de leeftijdgroepen of per geslacht voor deze vraagonderwerpen. Ongeveer 70% van alle patiënten antwoordde dat ze de meeste of al hun klachten kwijt konden met behulp van de geautomatizeerde vragenlijst. In de leeftijdgroep van 40 tot 60 jaar was dit percentage lager (45%): deze oudere patiënten hadden niet meer klachten dan de jongere.

De antwoorden van de geautomatizeerde vragenlijst werden vergeleken met die van de gebruikelijke geschreven anamnese. De aard en de frequentie van de klachten in beide interviews werden ook vergeleken. Daartoe werden de geschreven anamnestische gegevens overgezet in de geautomatizeerde vragenlijst. Bij vergelijking van de geschreven antwoorden met die van de geautomatizeerde vragenlijst bleek dat patiënten tweemaal zoveel positieve antwoorden gaven met gebruik van de computer terminal dan tijdens de mondelinge anamnese. Het percentage van volledig gelijke beantwoording in beide typen dossiers was 36%, waarvan de negatieve antwoorden bijna tweederde deel vormden. Van de sterk positieve antwoorden in het geschreven en geautomatizeerde dossier was 52% identiek. Gemiddeld gaf iedere patiënt 4,5 maal aan een klacht te hebben, door een vraag met "vaak" of "altijd" te beantwoorden, terwijl daar geen informatie over gevonden kon worden in het medisch dossier.

Teneinde de semantische verschillen van de twee typen interview te evalueren, werd een deel van alle dossiers aan drie internisten gegeven, met de vraag om hun diagnostische hypothesen die zij naar aanleiding van deze gegevens konden genereren op te schrijven. De geautomatizeerde vragenlijst was aanleiding voor meer diagnostische hypothesen (204) dan de geschreven anamnese (171), dit is ongeveer 20% verschil. De diagnostische hypothesen voor de geautomatizeerde vragenlijst werden met meer zekerheid gegeven (38%) dan die voor de geschreven anamnese (25%).

Verder is het nut onderzocht van de verschillende typen anamnesen gezien vanuit de artsen. De internisten, die het nut van de verschillende typen anamnesegegevens beoordeelden, waren van mening dat in 54% de informatie van het geschreven medische dossier goed of uitstekend was. Voor het geautomatizeerde dossier was dit slechts 28%. De artsen vonden dat de hoofdklachten beter tot uiting kwamen in het medisch dossier (52%) dan in de geautomatizeerde vragenlijst (15%).
Een laatste punt dat is bestudeerd, is de overeenkomst tussen de eerste diagnostische hypothesen en de uiteindelijk diagnoses. De laatste werden

gesteld door de internisten op basis van het volledige medische dossier, nadat de patiënten ontslagen waren uit het ziekenhuis. We vergeleken alle diagnostische hypothesen van de drie artsen met elkaar om de intra- en interbeoordelaarsvariabiliteit te kunnen vaststellen. Dit gebeurde ook door de diagnostische hypothesen, die waren gevormd op basis van de anamnese, te vergelijken met de einddiagnoses op basis van het volledige medisch dossier bij ontslag van de patiënt. Grote verschillen werden gevonden tussen de artsen, onafhankelijk van het type dossier. De gemiddelde overeenkomst tussen twee artsen was ongeveer 32%, terwijl de gemiddelde intrabeoordelaarsovereenkomst 51% was. De overeenkomst per dossier wisselde van 25% to 35%. 33% van de einddiagnoses kon worden gevonden in de diagnostische hypothesen die waren gesteld op basis van het geschreven dossier. Dit was 22% voor diagnoses gesteld naar aanleiding van de geautomatizeerde vragenlijst.

Appendix for chapter 1: System description

Different types of questions with corresponding answeroptions.

A) Global frequency
Question:
Do you ever have complaint X ?
Answeroptions:
Never, Once, Seldom, Sometimes, Regularly, Often, Always.
These answeroptions are displayed on an enlightened strip above the green keys.

B) Global intensity
Question:
How much trouble does complaint X usually cause you ?
Answeroptions:
No trouble, Little trouble, Moderate trouble, Much trouble.
The meaning of the first answer (0 = No trouble) is displayed on the screen, the other answers are displayed on an enlightened strip above the blue keys.

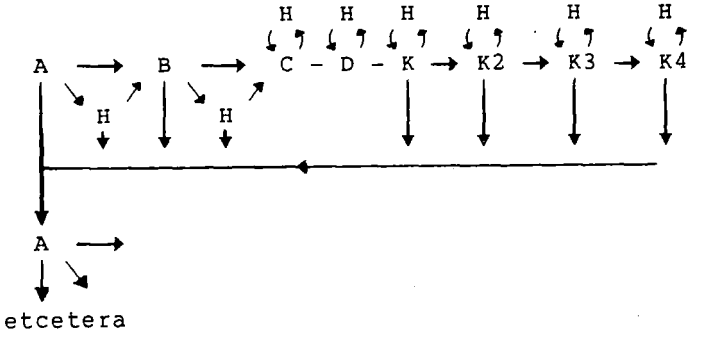
C) Duration
Question:
How long does complaint X usually last ?
Answeroptions:
1 = Shorter than half an hour
2 = Between half an hour and one hour
3 = Between one and three hours
4 = Between three and six hours
5 = Between six and twelve hours
6 = Between half a day and one day
7 = Longer than a day
These answer options are displayed on the screen. A numeric code may be entered with help of the numeric keypad.

D) History
Question:
Since when are you troubled by complaint X ?
Answeroptions:
1 = Since one week
2 = Since one week up to a month
3 = Since one up to six months
4 = Since six months up to one year
5 = Since one up to two years
6 = Longer than two years ago
7 = Some earlier time trouble once
These answeroptions are displayed on the screen.
An answer may be given with use of the numeric key pad.

It is always possible to 'escape' the presented answeroptions with one of the following answers:
I don't understand, I don't know, No answer.
These answer options for each question are visible on an enlightened strip above the red keys.

Other types of questions are:
K) Complaint: What kind of accompanying complaints do you have ?
L) Left/Right: Where do you have the complaint ?
N) Counting: How many/much
P) Location: At what location do you have the complaint ?
Z) Disease: What kind of disease do you have ?
The K, L, P and Z type of questions may be answered with more than one answer. The answer options are displayed on the screen. The numeric keys are used for answering; the escape answers may be used as well.

Structure to question an item



Description of the screens used in the questionnaire

The items are phrased as simply as possible in the Dutch language; here a literal translation is given instead of using medical terms. In some cases questions only appear dependent on the answer given to an earlier question. These questions are indicated with a '>' in the list.
The A, B, C and D questions are standard questions with standard answeroptions but they are uniquely phrased for each item. Here only the entries are presented in the way they are shown on the screens. The K, P, L, N and Z questions are not standard, the phrasing and answeroptions depend on the item. In the column Nba the number of answeroptions is given for each of these questions. These questions mostly are to be answered with more than one answer. For that reason the question is repeated after the first answer and another answer might be given. In the column Nbq the maximum number of answers that might be given per entry is indicated. If no indication is presented, the default value is one.
In some cases the B question and the corresponding answeroptions are incorporated into a K question. This is indicated by (B). It is possible to answer this question with a standard B (intensity) type answer and with specific K type answers. Some items have the same answeroptions. This is indicated in the Nba column by: ',,'.

APPENDIX

Overview of the screens with their items and questions

For instruction an explication screen is used with an A, B, D, K and an end-of-screen question.
With the help of this screen the different question types are illustrated and the way of answering is explained.

Screen Nr	Itemgroup	Items	Questions Type	Nba	Nbq
1	Main complaint				
		Complaint	Yes/No		
		> Reason of visit	K	6	3
		Frequency	A		
		Beginning	D		
		Cause	K	8	4
		Concern	K	3	
		Intensity	(B)K	6	4
		Help	K	5	4
2	Presence of disorder of general function: Do you ever have problems with:				
		Eating	A		
		Swallowing	A		
		Stomach or bowels	A		
		Urinating	A		
		Breathing	A		
		Moving	A		
		Social life	A		
		Sleeping	A		
3		Thinking	A		
		Remembering	A		
		Exercise	A		
		Seeing	A		
		Hearing	A		
		Weight	A		
		Blood pressure	A		
		Metabolism	A		
		Nerves	A		
4	Presence of general disturbances: Are you ever troubled by:				
		Fatigue	A		
		Feeling weak	A		
		Feeling ill	A		
		Hunger	A		
		Thirst	A		
		Nausea	A		
		Dizziness	A		
		Fever	A		
		Nervousness	A		
	Subtotal: 4 screens with 33 items		A B D K 27 1 1 5		
			Nba= 28, Nbq=16		

APPENDIX

On basis of the answers given to the questions about disorders of functions and general disorders, on screen 2, 3 and 4, the order of the tractus screens (6-20) is determined. The selection is made according to the magnitude of the frequency answers of the corresponding disorder. The items about which the questions are asked in the mentioned screens can be found in the list of tractusscreens.

Screen order selection

Disorder/Disturbance	Nr.	Selected screen
Breathing	7	Lower airways
Exercise	8	Exercise
Eating	9	Mouth and throat
Swallowing	9	,,
Stomach and belly	10,11	Stomach and belly
Nausea	10,11	,,
Urinating	12	Urinary tract
(Female patient)	13	+ Gynaecology
Thinking	14	Head
Remembering	14	,,
Seeing	14	,,
Hearing	14	,,
Dizziness	14	,,
Moving	15,16	Limbs
Sleeping	19	Sleeping
Social life	20	General
Weight	20	,,
Blood pressure	20	,,
Metabolism	20	,,
Nerves	20	,,
Fatigue	20	,,
Weak feeling	20	,,
Illness feeling	20	,,
Hunger	20	,,
Thirst	20	,,
Fever	20	,,
Nervousness	20	,,

Example of screen order generation

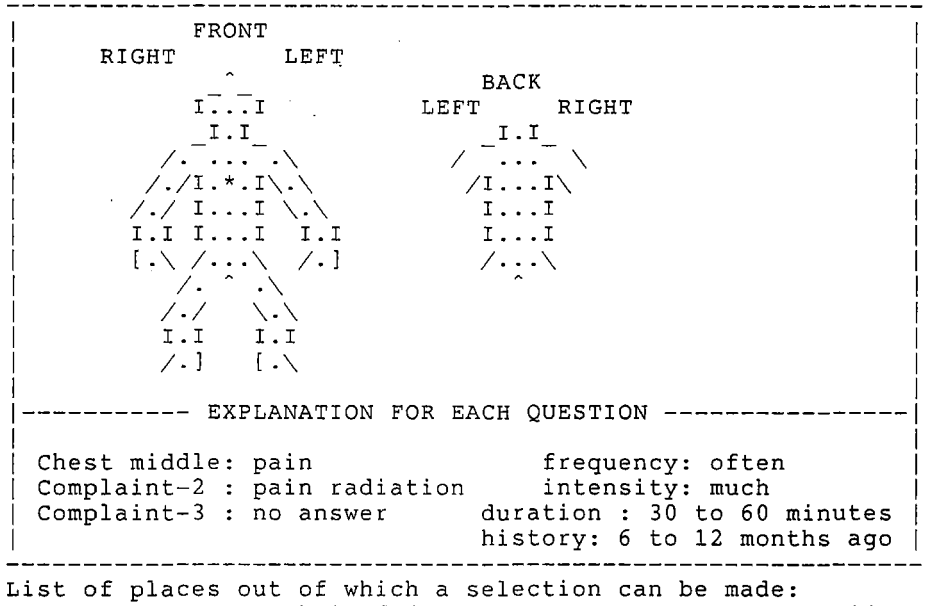
Answers on given disorders and disturbances:			Resulting in selected screens:	
Swallowing	: often	->	9	- Mouth and throat
Breathing	: regularly	->	7	- Lower airways
Movements	: regularly	->	15,16	- Limbs
Sleeping	: sometimes	->	19	- Sleeping
Fatigue	: sometimes	->	20	- General

The selected screens are followed by the remaining screens in a standard order.

5 Location of complaint(s)

With this screen the location of the complaints can be indicated using a stylized image front and backside of the body.

Example of an indicated complaint



List of places out of which a selection can be made:
Some regions are subdivided and/or some regions are divided into a left and right part.

Foreside:

Place	Subdivision	Left/right
Half part of head:		left/right
	half of head	
	eye	
	cheek	
	ear	
	anything else	
Head middle:		
	head	
	forehead	
	nose	
	mouth	
	anything else	
Neck:		
	neck	
	throat	
	thyroid	
	anything else	

Upper-chest		left/right
Upper middle chest		
Chest		left/right
Chest middle		
Upper belly		left/right
Stomach, upper belly		
Belly		left/right
Belly around the navel		
Abdomen:		left/right
	abdomen	
	hip	
	groin	
	anything else	
Abdomen:		
	abdomen	
	genitals	
	anything else	
Shoulder:		left/right
	shoulder	
	arm-pit	
	anything else	
Upper arm		left/right
Elbow		left/right
Forearm		left/right
Hand/wrist:		left/right
	hand	
	wrist	
	finger(s)	
	anything else	
Upper leg		left/right
Knee		left/right
Lower leg		left/right
Foot/ankle:		left/right
	ankle	
	foot	
	toes	
	anything else	

Backside

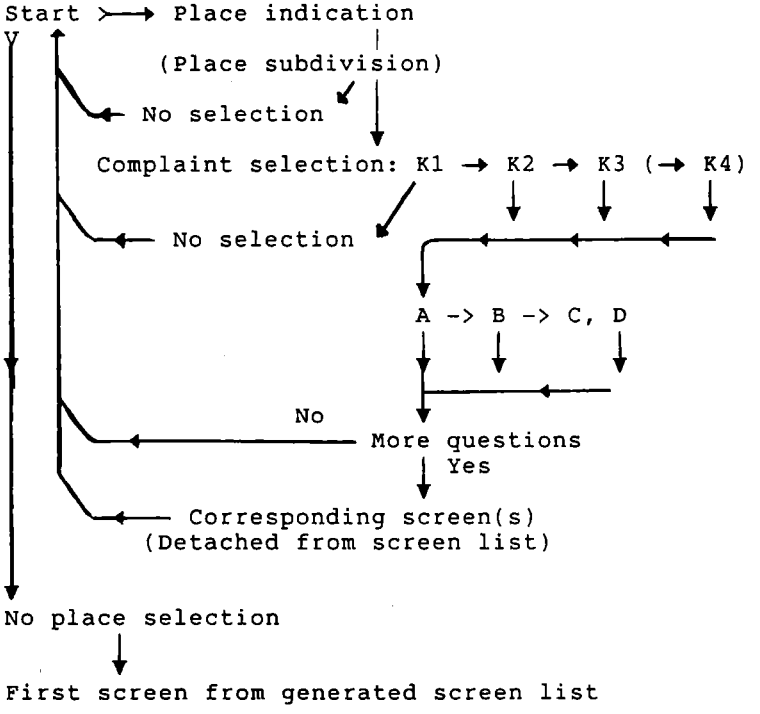
Nape of the neck:		
	nape	
	back of the head	
	anything else	
Upper shoulderblade		left/right
Back middle, under the nape		
Shoulderblade under		left/right
Upper middle back		
Back middle		left/right
Back middle		
Back below		left/right
Back below		
Buttock		left/right
Back below:		
	anus	
	back below	
	anything else	

APPENDIX

Number of points and possible locations

Point description / Subdivision	Number	Multiplication because of: Left/right division		
middle, undivided	8	→	8	→ 8
lateral, undivided	15	→	30	→ 30
middle, subdivided	5	→	5	→ 18
lateral, subdivided	5	→	10	→ 40
Total	33	→	53	→ 96
		Points in figure		Potential indications

Pathway in screen for location of complaint(s) along questions and screens



For each indicated location one may select one or more of the following 9 complaints:

- Pain
- Pain radiation
- Inflammation
- Skin disease
- Loss of blood
- Swelling
- Joint complaint
- Tingling
- Other complaint

APPENDIX

The complaints have to be selected using three (K) questions for the subdivided regions and using four (K) questions for the undivided places. After the selection of the complaint(s) the frequency (A), intensity (B), duration (C) and history (D) questions may be asked depending on the answers given.

Place-dependent screen selection

Indicated Place	selects screen: Nr.	Selected screen
head	14	Head
back of the head	14	,,
ear	6	Upper airways
forehead	6	,,
nose	6	,,
throat	6	,,
mouth	9	Mouth and throath
neck	9	,,
chest and upper backsides	7	Lower airways
	8	Exercise
stomach, belly and under backsides	10,11	Stomach and belly
abdomen	12	Urinary tract
(female patient)	13	+ Gynaecology
hip	15,16	Limbs
arms and legs	15,16	,,
back middle	17	Back
anus	11	Bowels

Description of the tractusscreens

Nr	Itemgroup / Items	Questiontype					Nba	Nbq
6	Upper air-passages:							
	Coldness	A	B		K		9	4
	Bleeding nose	A		D				
	Earpain	A				L	3	
	Earsinging	A	B			L	,,	
	Deafness	A	B			L	,,	
	Hoarseness	A		D				
	Phlegm	A			K		6	4
7	Lower air-passages:							
	Cough	A	B		K		8	5
	Pain breathing/coughing	A			K		5	3
	Shortwindedness	A	B	D				
	Wheezing	A	B	D				

8	Exercise:									
	Climbing stairs	A				K		8	4	
	Walking	A				K		,,	4	
	Sitting	A				K		,,	4	
	Emotions	A				K		,,	4	
	Palpitations	A				K		5	3	
9	Mouth and throat:									
	Toothache	A	B							
	Bleeding gums	A								
	Denture					K		4	2	
	Trouble swallowing	A	B			K		5	3	
	Fetching up food	A	B			K		5	3	
	Belching	A	B							
10	Stomach, belly:									
	Full feeling	A	B							
	Rumbling	A								
	Throwing up	A	B			K		8	4	
	Pain in stomach or belly	A	B	C	D		P	5	4	
	Defecation					K		6		
	Defecation alteration					K		8	3	
11	Windiness	A								
	Vast stools	A								
	Soft stools	A								
	Thin stools	A								
	Light stools	A								
	Blood with stools	A								
	Mucus with stools	A								
	Black stools	A								
	Haemorrhoids	A	B			K		4	3	
12	Urinary tract:									
	Pain with urinating	A								
	Urinateproblems	A	(B)			K		5	4	
	Clear urine	A								
	Troubled urine	A								
	Red urine	A								
	Purulent excretion	A								
	Sexual problems	A	B							
	Pain with cohabitation	A	B							
13	Female patient:									
	Menstruation					K		9	4	
	Loss of blood		(B)			K		4	3	
	Excretion	A	B			K		4	2	
	Loss of blood 'with cohabitation	A								
	Pregnancy						N	9		
	> Children						N	,,		
	> Pregnancy complaints					K		5	4	
	Anticonception					K		9	2	
14	Head:									
	Headache	A	B	C	D		P	7	4	
	Spectacles					K		3	2	
	Trouble w. seeing		B							
	Sight					K		7	3	
	Rings around lights	A								
	Speakingproblems	A	B							

15	Limbs:									
		Trembling	A	B			K		8	3
		Cold feeling	A	B			K		,,	3
		Dead feeling	A	B			K		,,	3
		Strength weakening	A	B			K		,,	3
16		Pain in calves	A	(B)			K		5	4
		Problems moving	A	(B)			K		6	4
		Varicosity	A	B						
		Thick ankles	A	(B)			K		5	4
17	Back:									
		Pain in back	A	B	C	D		P	6	4
		Pain moving	A	(B)			K		6	4
18	Skin:									
		Itching	A	B						
		Eczema	A	B						
		Loss of hair	A	B						
		Blue stains	A	B						
		Scaling skin	A	B						
19	Sleeping:									
		Nightly urinating	A	(B)			K		3	2
		Cushions						N	9	
		Nightly awakening	A	(B)			K		5	6
		> Better by					K		5	3
20	General:									
		Allergic	A	(B)			K		5	4
		Chilly	A							
		Shiver	A							
		Sweating	A							
		Appetite					K		9	2
		Trouble with food					K		6	4
		> Complaints		(B)			K		6	5
		Weight					K		9	2
21	Consumption:									
		Alcohol						N	9	
		> Drink					K		4	3
		Smoking					K		9	3
		> Started					K		7	
		> Stopped					K		7	
		Diet	A				K		9	4
		Coffee						N	9	
		Liquor	A							
		Salt	A							

Tractusscreens	A	B	C	D	K	L	P	N
	--	--	--	--	--	--	--	--
Subtotal: 16 screens, 95 items =	71	41	3	7	45	3	3	5

Nba = 308, Nbq = 155

APPENDIX

Diseases: Z type questions

Questions about the occurrence of 40 diseases:
1) Which of the above diseases do you have at the moment ?
2) Which of the above diseases did you have the last two years ?
3) Which of the above diseases did you have longer than two years ago ?
4) For which of the above diseases do or did you take any medicine ?
5) For which of the above diseases were you hospitalized ?
6) For which of the above diseases did you have surgery ?
7) Which of the above diseases have (had) your parents ?
8) Which of the above diseases have (had) your brother(s) or sister(s) ?
9) Which of the above diseases occur(red) in your family ?

22 Disease group A
Jaundice, veneral disease, cystitis, poorness of blood, stress, sleeplessness, pain, inflammation.
Questions: 1, 2, 3, 4, 5
For each question a maximum of 4 diseases may be entered.

23 Disease group B
Cough, tonsils, pneumonia, appendix, womb, slipped disc, hernia, joints.
Questions: 1, 2, 3, 4, 5, 6
For each question a maximum of 4 diseases may be entered.

24 Disease group C
Arteriosclerosis, heartdisease, hartinfarct, hypertension, stroke, asthma/ bronchitis, tuberculosis
Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9
For question 1 - 3 a maximum of 3 and for question 4 - 9 a maximum of 4 diseases may be entered.

25 Disease group D
Gastric suffering, bowel disease, hepatic disease, gallstones, kidney disease, kidney stones, thyroid disease, diabetes.
Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9
For question 1 - 3 a maximum of 3 and for question 4 - 9 a maximum of 4 diseases may be entered.

26 Disease group E
Glaucoma, hormonal disease, rheumatism, gout, cancer, hereditary disease, congenital defects, epilepsia.
Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9
For question 1 - 3 a maximum of 3 and for question 4 - 9 a maximum of 4 diseases may be entered.

Subtotal 5 diseasescreens: 38 Z questions.

27 Medical consumption: K type questions

		Nba	Nbq
Frequency of visits to the general practitioner	K	6	2
Frequency of visits to a specialist	K	,,	2
Frequency of paramedical help	K	8	4
X ray	K	4	2
Medical examination	K	4	
> Rejected	K	6	2
Injuries	K	9	5
28 Varia			
Visits to the tropics	K	4	2
Working conditions	K	9	5
Working conditions	K	9	5
Age of father	K	7	
Age of mother	K	,,	
Deceased relatives	K	4	5
Subtotal 2 screens 13 K questions		Nba=33,	Nbq=17

Total number of questions

Description	Screen	Items	A	B	C	D	K	L	N	P	Z
Begin	4	33	27	1		1	5				
Location	1										
Tractus	16	95	71	41	3	7	45	3	5	3	
Disease	5	38									38
Rest	2	13					13				
Total	28	179	98	42	3	8	63	3	5	3	38

Number of different questions: 263 Sum Nba = 406, Nbq = 205.
The number of questions in the Nbq category is 205, this concerns the 63 K and 3 P questions that may be answered with more than one answer. The number of all the different types of questions is 263. 263 minus the the K and P questions gives 197. 205 plus 197 gives 402, this is the total amount of questions. Total of different answeroptions Nba is 406; plus the answeroptions from the A = 7, B = 4, C = 7, D =7 and the 3 escape answers gives 434. The questionnaire contains 28 screens with 179 items about which questions are asked with 402 questions offering 434 answeroptions. On top of these numbers the 96 different place indications in screen 5, using 8 questions, may be added. So a theoretical maximum of 768 questions might be answered when all the potential places would be indicated. For each indication three or four choices can be made out of 9 different complaints. These complaints may be specified with the answeroptions from the A, B, C and D type questions: A = 7, B = 4, C = 7 and D = 7 options. 260 help messages are programmed for the tractus screens, to give information when the red "Don't understand" key is pressed.

Appendix for chapter 2: Ergonomic aspects

Evaluation form for observations

Evaluatie formulier voor het invullen van de vragenlijst.

Patientnummer:
Observaties:

Gewenning:

- vult vanaf . . scherm vlot in.
- went erg langzaam
- went langzaam
- went redelijk
- went vlot
- went snel

Assistentie nodig:

- voortdurend
- bij ieder scherm een vraag
- om de paar schermen een vraag
- alleen de eerste paar schermen
- bij poppetje
- alleen uitleg scherm
- enkele vragen
- vult samen met partner in

Invulmoeilijkheden:

Moeite met vinden van de betreffende toets.
Moeite met vinden van vraag
Moeite met vinden van antwoord
Problemen met stoppen van opsplitsende vraag.
Moeite met overzien van scherm.
Kijkt te weinig naar helptekstvraag.
Moeite met lezen
Denkt lang over vragen na
Denkt alleen in begin lang over vragen na
Denkt niet lang over vragen na
Leest iedere keer alle antwoordtoetsen.
Leest vragen en antwoorden hardop voor (voor zichzelf)
Heeft tot en met scherm: . . . ingevuld.

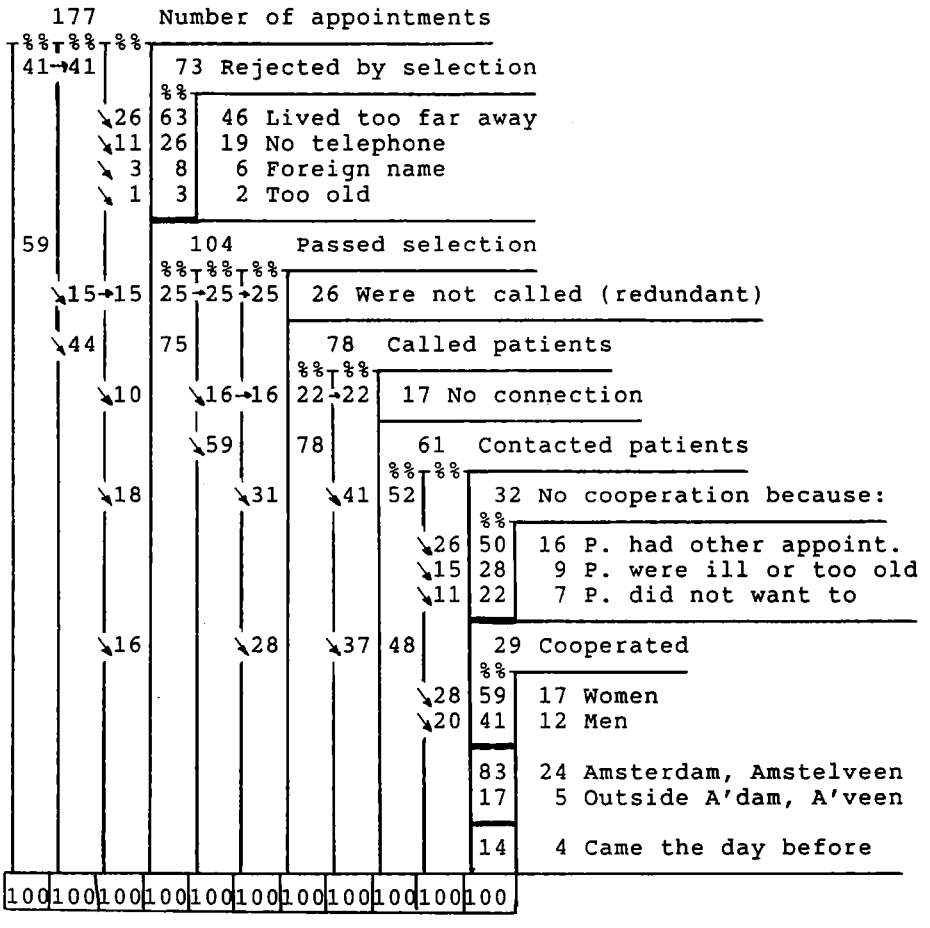
APPENDIX

Evaluatievragen patient (eventueel + enquete formulier):

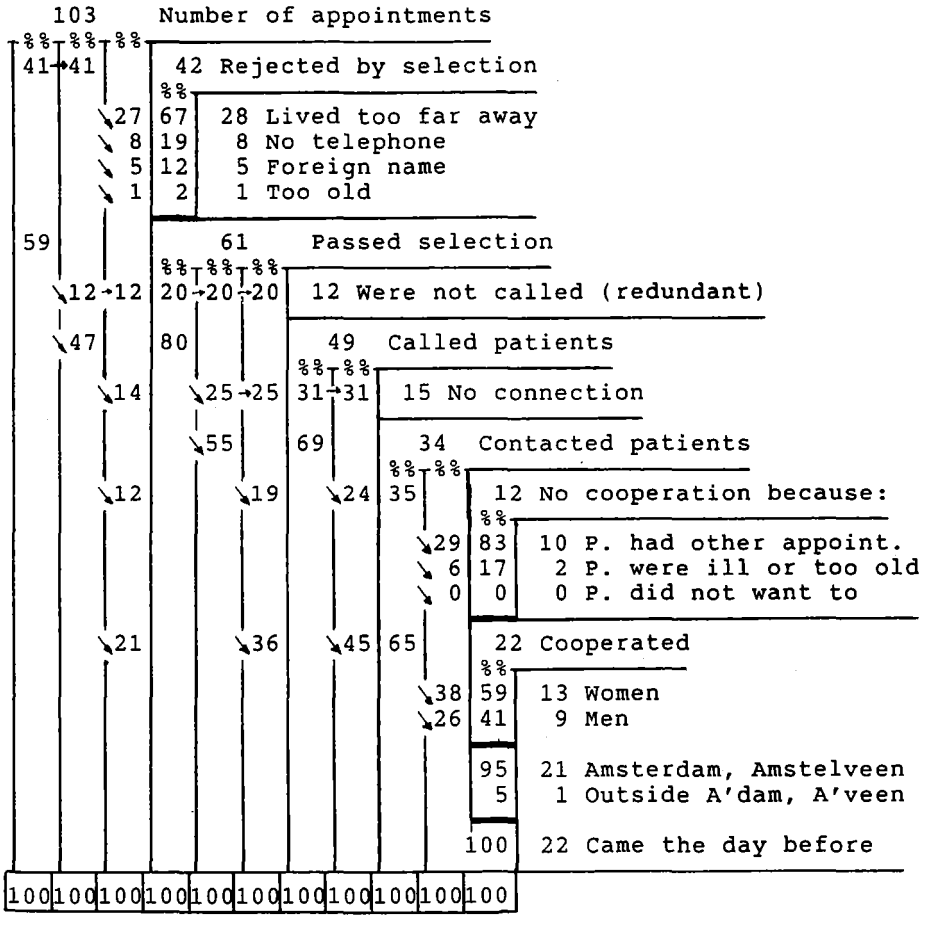
Tijdsduur: te lang, gewoon, te kort, moeite waard.
Klachten gevraagd: alle, sommige, te weinig, niet.
Invullen: vervelend, interessant, moeilijk, makkelijk, langdurig.
Went snel, matig, langzaam.
Helpt klacht onder woorden te brengen: goed , matig, sommige, slecht.
Inzicht in klacht veranderd, verminderd, verbeterd, niet veranderd.
Nuttig voor arts, overzicht voor arts.
Kan klachten zelf sneller aan arts vertellen.
Antwoordverslag nuttig voor andere artsen, voor mezelf.
Antwoordverslag bevat fouten, onvolledig, opmerkingen.
Evaluatie antwoordverslag door coassistent.
Hoofdklacht in status overzichtelijker.
Antwoorden niet in juist verband
Enthousiasme over antwoordverslag
Antwoorden kloppen niet: ..
Houding ten opzichte van methode
Voordelen/ nadelen.
Antwoorden extra in verslag
Tijdbesparing
Efficienter vragenstellen
Indeling moet wennen.
Overzichtelijkheid verslag.
Nuttige aanvulling voor anamnese.
Nuttige aanvulling voor diagnose.
Beinvloeding van patient contact pos/neg
Beinvloeding diagnose

Appendix for chapter 3, patient appreciations

Scheme of numbers of selected and contacted patients with appointments at 9.45 a.m.



Scheme of numbers of selected and contacted patients with appointments at 8.00 a.m.



APPENDIX

Age distribution per subgroup and researchphase

		Subgroups								
Research phase		PRE			LIGHTS 1			LIGHTS 2		
Age:years	Total	2A	2B	2C	1A	1B	1C	2A	2B	2C
10 - 20	6	2	-	-	3	-	-	-	1	-
20 - 30	18	3	2	-	10	-	-	1	1	1
30 - 40	9	4	-	1	4	-	-	-	-	-
40 - 50	21	6	2	1	5	3	2	1	-	1
50 - 60	20	5	-	-	8	2	-	1	-	4
60 - 70	19	3	1	-	8	-	2	1	2	2
70 - 80	5	-	-	-	2	-	-	-	1	2
80 - 90	1	-	-	-	-	1	-	-	-	-
number pt	99	23	5	2	40	6	4	4	5	10
Mean age:	46	42	41	38	44	51	53	48	48	57

Male/female distribution of researchphases

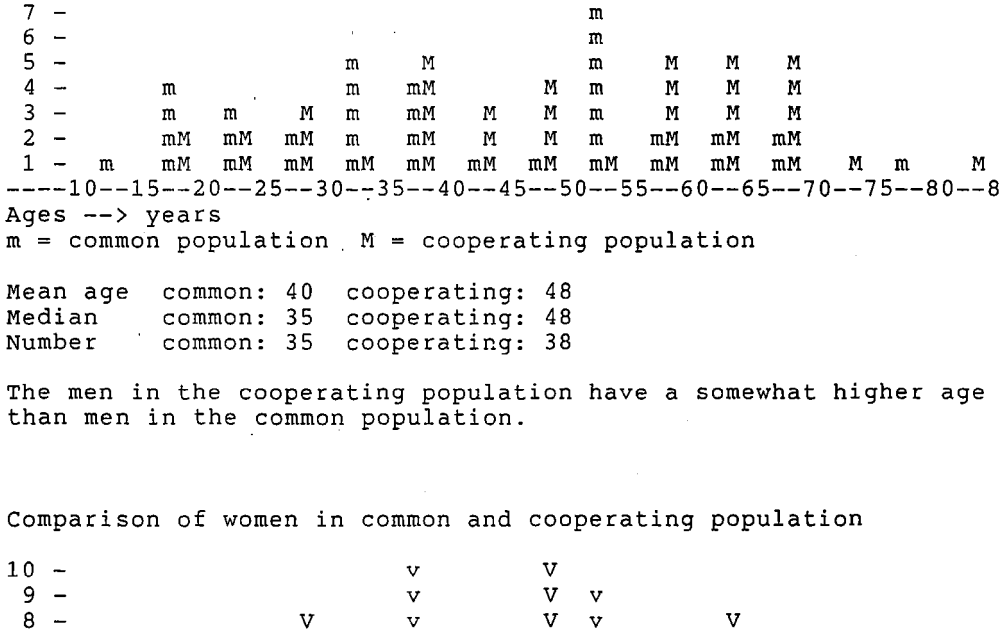
Numbers-%	total-%	PRE-%	LIGHT-%
men	38- 38	11-37	27-39
women	61- 62	19-63	42-61
sum	99-100	30-100	69-100

Overall age distribution for men and women

years	men	women
10 - 15		#
15 - 20	##	###
20 - 25	##	#####
25 - 30	###	########
30 - 35	#	#
35 - 40	#####	##
40 - 45	###	####
45 - 50	####	##########
50 - 55	#	#######
55 - 60	#####	#######
60 - 65	#####	########
65 - 70	#####	#
70 - 75	#	###
75 - 80		#
80 - 85	#	
mean	48	45
Median	48	47
number	38	61

APPENDIX

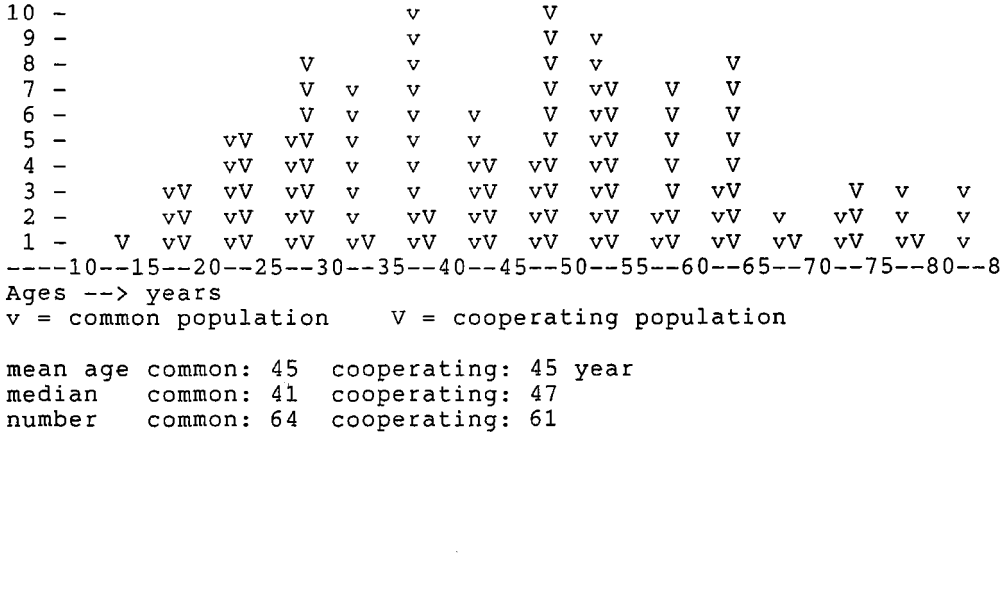
Comparison of the age distribution of men



Mean age common: 40 cooperating: 48
Median common: 35 cooperating: 48
Number common: 35 cooperating: 38

The men in the cooperating population have a somewhat higher age than men in the common population.

Comparison of women in common and cooperating population



mean age common: 45 cooperating: 45 year
median common: 41 cooperating: 47
number common: 64 cooperating: 61

APPENDIX

Questionnaire for the patient.

Enquetevragen, voor de patient, naar aanleiding van het invullen van de vragenlijst op de terminal.

Wat vond u van het invullen van de vragenlijst op de terminal? Per trefwoord ja of nee doorstrepen alstublieft.

te langdurig - ja/nee
vervelend - ja/nee — interessant - ja/nee
overbodig - ja/nee — nuttig - ja/nee
moeilijk - ja/nee — makkelijk - ja/nee
[] anders, te weten:

Heeft u het gevoel dat u uw klachten over uw gezondheid in deze vragenlijst kwijt kon ?

Zet een kruisje in het hokje: [] voor het gewenste antwoord.

[] Ik kon al mijn klachten kwijt
[] Ik kon de meeste klachten kwijt
[] Ik kon slechts een aantal klachten kwijt
[] Ik kon mijn klachten helemaal niet kwijt
[] weet ik niet — [] begrijp ik niet
[] geen antwoord
[] anders, te weten:

Hoe vond u de antwoordmogelijkheden ?

[] te uitgebreid — [] goed
[] voldoende — [] te beperkt
[] onvoldoende
[] weet ik niet — [] begrijp ik niet
[] geen antwoord
[] anders, te weten:

Welke klachten kon u niet kwijt in deze vragenlijst ?

Geef desgewenst een toelichting bij de klachten.

[] ik kon al mijn klachten kwijt
[] enkele lichamelijke klachten:
[] enkele psychische klachten:
[] enkele sociale klachten:
[] andere klachten:
[] mijn belangrijkste klachten:
[] minder belangrijke klachten:
[] weet ik niet
[] geen antwoord — [] begrijp ik niet

Bent u door het invullen van deze vragenlijst anders over uw klachten gaan denken ?

[] Mijn inzicht in mijn klachten is groter geworden
[] Mijn inzicht in mijn klachten is niet veranderd
[] Mijn inzicht in mijn klachten is veranderd
[] Mijn inzicht in mijn klachten is kleiner geworden
[] weet ik niet [] begrijp ik niet
[] geen antwoord
[] anders, te weten:

Uw antwoorden worden op papier gezet in een antwoordverslag. Zowel u als de arts krijgen een antwoordverslag.

Wat vindt u van het antwoordverslag ?

Per trefwoord ja of nee doorstrepen alstublieft.

nuttig - ja/nee overbodig - ja/nee
overzichtelijk - ja/nee onduidelijk - ja/nee
te lang - ja/nee te kort - ja/nee
[] anders:

Denkt u dat u dit antwoordverslag later nog eens doorkijkt?

[] nee [] misschien
[] waarschijnlijk wel [] zeker wel
[] weet ik niet [] begrijp ik niet
[] geen antwoord

Vindt u het belangrijk dat de arts dit verslag ook kan inzien?

[] niet belangrijk [] misschien
[] waarschijnlijk wel [] zeker wel
[] weet ik niet [] begrijp ik niet
[] geen antwoord
[] anders, te weten:

Aan de achterzijde kunt u desgewenst nog suggesties of opmerkingen over de vragenlijst, het antwoordverslag en dergelijke opschrijven.

Appendix for chapter 4: Quantitative comparisons

Inventory of answers and comparison of data

Introduction

Most items are first questioned with the so called frequency question. The frequency question is in the form:
Do you ever have complaint X ?
The answers out of which can be chosen, are:
Never, once, seldom, sometimes, regularly, often, always.
Also one of the 'escape' answers "Don't understand", "Don't know" or "No answer" can be given.
The answer of the patient and those based on the medical record are compared. This evolves in similar and different answers for each item per patient. See also next scheme:

Ordering of possible combinations of compared answers.
Horizontal rows: Answers of the patient
Vertical columns: Answers based on medical record data

	Neve	Once	Seld	Some	Regu	Ofte	Alwa	Dnun	Dnkn	Noan
Neve	NS Neg	- DL - .Light		- Denied - Moderate		- DM - - .Strong	- DS -	.	.	.
Once	PNR Not	. LPS. Light		PLD		. PBD.	Big. Dif	.	.	.
Seld	. Re	.Positive		.	PLD		. fer en	.	.	.
Some	. cog	RLD		.		. MPS. Moderate	PLD	.ce	.	.	.
Regu	. ni	Big Dif	RLD	Positive		.		PLD	.	.	.
Ofte	. zed	.fer en		.	RLD		. SPS. Strong		.	.	.
Alwa	.	. ce.	RBD.		RLD		Positive		.	.	.
Dnkn	- - - - - NI No Information - - - Neg NN	Light NL		Moderate NM			Strong NS		US Unknown		

APPENDIX

Ordering of similar and different answers:

Similarity: for presentation reasons the seven frequency answers are ordered in four groups: negative; light, moderate and strong positive.

TS - Similar data, total of equal patient answers and record answers. This group is subdivided in four groups: negative, light positive, strong positive and unknown answers.
NS - Negative: patient as well as medical record denies the presence of the complaint (both have never as frequency).
For the next subgroups the combination of several answers is used:
LPS - Lightly Positive: once and seldom and the combination with sometimes
MPS - Moderately Positive: sometimes and regularly and the combination with often.
SPS - Strongly Positive: often and always
US - Unknown: No information in medical record as well as from patient.

Differences: The following combinations are categorized as differences: These are in fact different expressions of positiveness of the occurrence of an item.

LD - Little Difference: Sometimes with Once, Regularly with Seldom, Often with Sometimes and Always with Regularly.
BD - Big Difference: Regularly with Once; Often with Once and Seldom; Always with Once, Seldom and Sometimes.
When the higher frequency answer is given by the patient the code is PLD or PBD; when the higher frequency answer is given on basis of the medical record the code is: RLD or RBD.
Denied: on basis of the information in the medical record the answer 'Never' is given, while the patient gave a positive answer.
In combination with the patient's answers three subgroups appear:
DL - Light: Once and Seldom
DM - Moderate: Sometimes and Regularly
DS - Strong: Often and Always
DL is a denying of a light positive answer of the patient.
DM and DS are more stronger denials of the answers of the patient by the medical record information.

NI - No Information: in the medical record no information can be found about this item.
This is coded as "Don't know" for the medical record answer. The here given answer is an indication of the number of times information about the item is not present in the medical record. This category can be subdivided on basis of the patients' answers in the following groups:
NN - Negative: Never
NL - Light: Once and Seldom
NM - Moderate: Sometimes and Regularly
NS - Strong: Often and Always
PNR - Not Recognized: the patient has answered negatively(never) about the presence of this item in contrast to the medical record information (Once, seldom, sometimes, regularly, often and always).
PNE - Not Expressed: patient answered: "Don't understand", "Don't know" or "No answer" while an answer could be given on basis of the medical record.

To present these codes the next types of tables are used:
Description of tables

Table type 1:

	Similar						Different			
Item group	TS	NS	LPS	MPS	SPS	US	PLD	PBD	RLD	RBD
Items	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.

In the first table the number of combinations between similar data is given: NS, LPS, SPS and US.
These numbers give an indication of the rate of similarity between the direct answers of the patient and the answers based on the information of the medical record. In the column TS the total of these similar data is given. The second group in the first table presents the number of combinations of positive answers that differ more or less from each other: P- or R-, BD and LD.

Table type 2:

	Denied			No Information Record					Patient	
Item group	DL	DM	DS	NI	NN	NL	NM	NS	PNR	PNE
Items	.	.	.	.	.	.	.	.	.	.
	.	.	.	.	.	.	.	.	.	.

In the second table the number of denied information is given. Next in the second table is the group of cases in which no information could be found in the medical record in contrast with a valuable answer of the patient and the other way round.

Number of answers given by the patient and on basis of the medical record information and comparisons of these answers, ordered per itemgroup.

.1 Itemgroup: Airways

The questions concerning the upper airways are answered by 93 patients and those concerning the lower airways by 92 patients. In the next table the percentages of these numbers of patients are given.

Percentages	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Bloodnose -Pat	72	2	15	6	1	1	1	0	1	0
Record	3	1	1	0	1	0	0	94	0	0
Earpain ---Pat	63	2	6	25	2	1	0	0	0	0
Record	6	0	0	1	0	0	0	92	0	0
Hoarseness-Pat	49	1	17	20	4	5	1	1	0	0
Record	22	0	0	6	3	1	1	67	0	0
Earsinging-Pat	60	2	8	23	2	3	1	1	0	0
Record	23	0	0	5	2	1	0	69	0	0
Deafness --Pat	65	1	8	12	3	1	5	1	4	0
Record	60	0	2	10	1	2	1	24	0	0
Wheezing --Pat	62	2	5	22	2	1	0	3	1	1
Record	68	8	2	8	1	1	0	12	0	0
Coldness --Pat	6	1	29	47	13	3	0	0	0	0
Record	9	0	1	9	6	6	0	69	0	0
Cough -----Pat	17	0	22	37	12	3	7	0	1	1
Record	57	0	2	12	18	8	0	3	0	0
Breath/cough-P	67	0	10	20	1	1	0	0	0	0
pain Record	45	0	2	2	1	0	0	50	0	0
Phlegm ----Pat	37	2	16	26	12	6	1	0	0	0
Record	56	2	1	9	12	2	0	18	0	0
Shortbreath--P	39	0	18	26	7	8	1	0	0	1
ness Record	74	2	1	13	5	2	0	2	0	0
Mean Pat answ	49	1.3	14	24	5.4	3.1	1.6	0.6	0.7	0.4
Record data	38	1.2	1.0	6.8	4.8	2.3	0.2	46	0	0

APPENDIX

Numbers / Airways	Similar TS	NS	LPS	MPS	SPS	US		Different PLD	PBD	RLD	RBD
Bloodnose	5	2	1	1	-	1	-	-	-	-	-
Earpain	5	4	-	1	-	-	-	-	-	-	-
Hoarseness	17	10	1	5	-	1	-	2	-	2	-
Earsinging	17	13	-	4	-	-	-	2	-	-	-
Deafness	59	45	3	7	3	1	-	-	1	-	-
Wheezing	55	45	3	6	1	-	-	3	-	-	-
Coldness	19	1	2	14	2	-	-	-	-	2	-
Cough	46	14	1	25	6	-	-	1	-	-	-
Breath/coughp.	32	29	-	3	-	-	-	-	-	1	-
Phlegm	46	24	3	19	-	-	-	2	-	-	-
Shortbreathn.	44	31	3	9	1	-	-	4	-	-	-
SUM	345	218	17	94	13	3	-	14	1	5	0
Percentages	34	21	1.7	9.2	1.4	0.3		1.4	0.1	0.5	0

Numbers / Airways	Denied DL	DM	DS		No Information Record NI	NN	NL	NM	NS		Patient PNR	PNE
Bloodnose	-	1	-	-	86	64	15	6	1	-	1	-
Earpain	-	2	-	-	86	55	8	22	1	-	-	-
Hoarseness	7	3	-	-	61	35	9	14	3	-	1	-
Earsinging	4	3	-	-	64	41	5	16	2	-	2	1
Deafness	3	4	-	-	21	14	2	3	2	-	1	4
Wheezing	3	10	-	-	11	7	2	2	-	-	5	5
Coldness	3	4	-	-	64	4	23	36	1	-	1	-
Cough	17	21	-	-	3	-	2	1	-	-	2	2
Breath/coughp.	3	7	1	-	46	32	6	8	-	-	1	1
Phlegm	13	14	1	-	17	10	1	6	-	-	-	-
Shortbreathn.	14	20	2	-	2	-	1	1	-	-	5	1
SUM	67	89	4	-	461	262	74	115	10	-	19	14
Percentages	6.6	8.7	0.4		45	26	7.2	11	1.0		1.9	1.4

.2 Itemgroup: Circulation

The item group Circulation is formed by the item groups "Pain and shortbreathness" (94 patients), part of item group "Limbs" (92 patients) and the item group "Nightly complaints" answered by 89 patients.

Percentages	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Pain and shortbreathness during:										
Staircase -Pat	48	0	11	21	7	5	7	0	0	0
ascending Rec	65	1	1	17	9	4	1	2	0	0
Walking ---Pat	67	1	5	13	5	5	2	0	0	1
Record	74	0	0	11	5	1	0	9	0	0
Sitting ---Pat	72	1	6	13	5	0	1	0	1	0
Record	70	1	0	11	1	0	0	17	0	0
Emotions --Pat	54	0	5	29	7	1	1	0	2	0
Record	15	0	0	12	3	1	0	69	0	0
Palpitat. Pat	52	1	13	22	6	3	0	1	1	0
Record	56	0	1	18	9	3	1	12	0	0
Pain in ---Pat	58	0	9	20	7	4	2	0	0	1
calves Record	34	1	0	7	4	3	0	51	0	0
Varicosis -Pat	70	2	4	4	3	0	8	4	3	1
Record	3	1	0	1	1	1	0	92	0	0
Thick -----Pat	60	0	9	16	4	4	4	1	0	1
ankles Record	63	0	0	11	12	4	1	9	0	0
Nightly ---Pat	26	2	17	24	17	7	8	0	0	0
urinating Rec	49	0	1	7	16	6	2	19	0	0
Nightly ---Pat	9	2	18	27	19	16	8	0	1	0
awakening Rec	17	0	2	13	12	9	2	44	0	0
Mean Pat answ	52	0.9	9.6	19	8.1	4.5	4.1	0.6	0.9	0.3
Record data	45	0.4	0.5	11	7.1	3.2	0.8	32	0	0

Pain and shortbreathness during:	Numbers	Similar						Different			
	TS	NS	LPS	MPS	SPS	US		PLD	PBD	RLD	RBD
:Staircase ass	63	41	3	18	1	-	-	1	2	1	1
:Walking -----	65	54	1	9	1	-	-	-	2	-	-
:Sitting -----	54	50	-	4	-	-	-	-	-	1	-
:Emotions ----	21	10	1	8	-	2	-	1	1	2	-
Palpitations -	62	40	2	18	2	-	-	1	-	1	-
Pain in calves	36	24	1	9	1	1	-	1	1	-	-
Varicosis ----	15	3	1	2	1	8	-	-	-	-	-
Thick ankles -	67	49	2	12	4	-	-	3	-	3	-
Nightly urinat	44	21	1	19	3	-	-	3	-	1	1
Nightly awake	28	3	4	15	5	1	-	8	-	1	1
SUM ---	455	295	16	114	18	12	-	18	6	10	3
Percentages---	49	32	1.7	12	1.9	1.3	-	1.9	0.6	1.1	0.3

Numbers	Denied				No Information Record						Patient	
Circulation --	DL	DM	DS		NI	NN	NL	NM	NS		PNR	PNE
:Staircase asc	7	10	3	-	2	-	-	1	1	-	4	-
:Walking -----	3	10	2	-	8	6	2	-	-	-	3	1
:Sitting -----	5	9	1	-	16	11	1	4	-	-	7	1
:Emotions ----	1	3	-	-	63	39	2	22	-	-	2	-
Palpitations -	8	3	-	-	11	3	2	5	1	-	6	2
Pain in calves	1	4	2	-	46	28	6	12	-	-	1	-
Varicosis ----	-	-	-	-	77	61	5	5	6	-	-	-
Thick ankles -	3	5	-	-	8	5	1	2	-	-	1	2
Nightly urinat	12	10	1	-	17	2	3	11	1	-	-	-
Nightly awake	5	6	1	-	38	4	10	21	3	-	1	-
SUM ---	45	60	10	-	286	159	32	83	12	-	25	6
Percentages---	4.9	6.5	1.1	-	31	17	3.5	9.0	1.3	-	2.7	0.6

.3 Itemgroup: Upper gastro intestinal tract
The item group of the Upper gastro intestinal tract is formed by the itemgroup Mouth and throat (94 patients) and the items of the Gastro-intestinal tract (98 patients).

Percentages	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Toothpain -Pat	67	1	15	11	0	0	0	0	5	1
Record	1	0	0	0	0	0	0	99	0	0
Toothflesh-Pat	73	2	7	9	3	1	1	0	2	1
bleeding Rec	0	0	0	0	0	0	0	100	0	0
Swallowing-Pat	69	0	7	16	3	3	0	0	0	1
trouble Record	59	0	0	3	7	3	0	28	0	0
Fetching --Pat	71	1	15	10	2	0	0	0	0	1
up food Record	32	2	0	2	3	0	0	61	0	0
Belching --Pat	28	1	12	32	12	10	4	0	1	1
Record	33	0	0	12	7	4	0	44	0	0
Full ------Pat	30	1	15	37	7	9	1	0	0	0
feelings Rec	10	0	0	1	6	8	1	73	0	0
Rumbling --Pat	18	0	18	35	12	15	0	0	1	0
Record	7	0	1	4	5	2	0	81	0	0
Throwing up-Pt	53	1	23	15	1	6	0	0	0	0
Record	58	3	1	4	2	3	0	29	0	0
Stomach ---Pat	26	0	18	28	16	9	2	0	1	0
pain Record	54	2	0	9	15	12	1	6	0	0
Mean Pat answ	48	0.8	15	21	6.4	6.0	0.9	0	1.2	0.6
Record data	28	0.8	0.2	3.9	5.2	3.7	0.2	58	0	0

APPENDIX

Mouth, gastro intestinal 1	Numbers Similar							Different			
	TS	NS	LPS	MPS	SPS	US		PLD	PBD	RLD	RBD
Toothpain	6	-	-	-	-	6	-	-	-	-	-
Toothfleshbl.	3	-	-	-	-	3	-	-	-	-	-
Swallowingtr.	50	41	-	8	1	-	-	1	-	1	-
Fetching up f.	26	21	-	4	-	1	-	-	-	-	-
Belching	28	10	-	13	3	2	-	4	-	-	-
Full feelings	17	5	-	9	3	-	-	-	-	1	2
Rumbling	13	2	1	9	-	1	-	1	-	1	-
Throwing up	39	30	3	5	1	-	-	1	-	-	1
Stomach pain	49	19	2	24	4	-	-	3	-	1	-
SUM	231	128	6	72	12	13	-	10	0	4	3
Percentages	27	15	0.7	8.4	1.4	1.5	-	1.2	0	0.5	0.3

Mouth, gastro intestinal 1	Denied			No Information Record					Patient	
	DL	DM	DS	NI	NN	NL	NM	NS	PNR	PNE
Toothpain	1	-	-	-	87	63	14	10	-	-	-
Toothfleshbl.	-	-	-	-	91	69	9	11	2	-	-
Swallowingtr.	6	7	-	-	26	22	1	3	-	-	2	1
Fetching up f.	6	3	-	-	56	43	9	4	-	-	3	-
Belching	6	14	1	-	39	14	6	15	4	-	2	-
Full feelings	2	3	-	-	72	23	12	33	4	-	1	-
Rumbling	3	1	1	-	78	16	13	37	12	-	-	-
Throwing up	16	10	1	-	28	20	5	2	1	-	2	-
Stomach pain	15	17	1	-	6	1	1	2	2	-	5	1
SUM	55	55	4	-	483	271	70	117	25	-	15	2
Percentages	6.4	6.4	0.5	-	56	31	8.1	14	2.9	-	1.7	0.2

.4 Itemgroup: Stools

The item group stools has been answered by 98 patients.

Percentages	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Windiness -Pat	5	0	15	39	17	18	2	0	1	2
Record	10	0	1	3	8	6	0	70	0	1
Vast stools-Pt	18	0	22	33	14	6	4	0	0	2
Record	50	0	1	19	2	12	1	13	0	1
Soft stools-Pt	17	2	14	36	9	10	5	1	3	2
Record	52	0	0	18	5	6	1	16	0	1
Thin stools-Pt	34	1	24	23	3	9	0	0	3	2
Record	60	1	1	13	1	4	1	17	0	1
Light stools-P	47	2	12	19	3	4	1	3	6	2
Record	65	4	0	2	1	1	0	26	0	1
Blood with-Pat	82	3	2	7	1	0	0	1	2	2
stools Record	78	1	0	10	0	0	0	10	0	1
Mucus with-Pat	55	2	5	19	5	2	0	7	2	2
stools Record	54	2	1	11	1	2	0	28	0	1
Black stools-P	77	0	6	9	1	0	0	2	3	2
Record	51	1	1	2	1	0	0	42	1	1
Haemorrhoids-P	47	6	4	19	4	3	5	8	1	2
Record	7	4	0	3	4	1	0	80	0	1
Mean Pat answ	42	1.8	12	23	6.5	5.9	1.9	2.5	2.4	2.0
Record data	48	1.5	0.6	9.2	2.6	3.6	0.3	34	0.1	1.0

Numbers Stools	Similar TS	NS	LPS	MPS	SPS	US		Different PLD	PBD	RLD	RBD
Windiness	20	1	1	12	3	3	-	2	-	-	-
Vast stools	39	11	3	17	7	1	-	3	-	2	1
Soft stools	33	13	-	14	4	2	-	6	1	2	1
Thin stools	35	24	2	5	2	2	-	5	-	2	1
Light stools	36	31	-	3	-	2	-	1	1	-	-
Blood with sto	81	71	2	7	-	1	-	-	-	-	-
Mucus with sto	54	38	2	11	1	2	-	1	-	1	-
Black stools	48	40	2	1	-	5	-	-	-	-	-
Haemorrhoids	21	5	1	5	-	10	-	4	-	-	-
SUM	367	234	13	75	17	28	-	22	2	7	3
Percentages	42	27	1.5	8.5	1.9	3.2	-	2.5	0.2	0.8	0.3

Numbers	Denied				No Information Record						Patient	
Stools	DL	DM	DS		NI	NN	NL	NM	NS		PNR	PNE
Windiness	2	7	-	-	67	4	12	39	12	-	-	-
Vast stools	16	20	1	-	13	5	2	6	-	-	2	1
Soft stools	11	21	3	-	15	3	3	9	-	-	1	4
Thin stools	18	14	-	-	16	5	3	6	2	-	4	3
Light stools	10	12	3	-	24	13	4	6	1	-	2	9
Blood with st	1	1	-	-	10	8	2	-	-	-	1	4
Mucus with st	3	4	-	-	26	16	3	7	-	-	-	9
Black stools	2	6	-	-	38	33	2	3	-	-	2	2
Haemorrhoids	-	2	-	-	69	40	9	15	5	-	1	1
SUM	63	87	7	-	278	127	40	91	20	-	13	33
Percentages	7.1	10	0.8	-	32	14	4.5	10	2.3	-	1.5	3.7

.5 Itemgroup: Urinary tract

The item group 'Urinary tract' has been answered by 91 patients, the questions for female patients are answered by 55 women.

Percentages	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Urinating -Pat	75	4	10	9	0	0	2	0	0	0
pain Record	89	1	0	5	0	1	0	3	0	0
Urinate ---Pat	75	1	9	9	3	2	0	0	1	0
problems Rec	62	2	1	14	10	4	1	5	0	0
Troubled --Pat	56	0	9	15	1	2	0	12	4	0
urine Record	78	2	2	3	1	0	0	13	0	0
Red urine -Pat	88	2	1	2	0	0	0	3	3	0
Record	80	3	2	0	0	0	0	14	0	0
Purulent --Pat	90	1	1	1	0	0	0	1	5	0
excretion Rec	13	2	0	0	0	0	0	85	0	0
Sexual ----Pat	63	0	8	7	3	0	1	0	19	0
problems Rec	3	0	0	0	0	0	0	97	0	0
Cohabitation-P	65	0	5	10	0	1	0	0	19	0
pain Record	2	0	0	0	0	0	0	98	0	0
Female patient:										
Excretion -Pat	25	0	16	27	11	4	0	2	15	0
Record	4	0	0	4	0	0	0	93	0	0
Cohabitation-P	69	0	0	2	0	0	0	0	29	0
bloodloss Rec	4	0	0	0	0	0	0	96	0	0
Mean Pat answ	69	1.1	6.4	8.6	1.7	0.9	0.4	2.1	9.5	0
Record data	40	1.3	0.7	3.1	1.3	0.7	0.1	52	0	0

Next question had to be answered positive:

Clear urine-Pt	5	0	0	13	15	14	33	13	5	0
Record	4	0	0	2	0	5	76	12	0	0

	Similar							Different			
Numbers											
Urinary tract	TS	NS	LPS	MPS	SPS	US		PLD	PBD	RLD	RBD
Urinating pain	64	62	1	1	-	-	-	-	-	1	-
Urinate probl	64	50	4	10	-	-	-	-	-	2	-
Troubled urine	44	39	1	4	-	-	-	-	-	-	-
Red urine ----	67	65	1	-	-	1	-	-	-	-	-
Purulent excr	19	12	1	-	-	6	-	-	-	-	-
Sexual probl -	19	2	-	-	-	17	-	-	-	-	-
Cohabitation p	19	2	-	-	-	17	-	-	-	-	-
Female pat. --	.	.	.	.	.	.	-	.	.	.	.
Excretion ----	11	1	-	2	-	8	-	-	-	-	-
Cohab. bloodl.	16	1	-	-	-	15	-	-	-	-	-
SUM ---	323	234	8	17	0	64	-	0	0	3	0
Percentages---	43	31	1.1	2.3	0	8.6	-	-	-	3	-

	Denied				No Information Record						Patient	
Numbers												
Urinary tract	DL	DM	DS		NI	NN	NL	NM	NS		PNR	PNE
Urinating pain	11	7	1	-	3	2	-	-	1	-	4	-
Urinate probl	4	2	-	-	5	5	-	-	-	-	13	1
Troubled urine	7	9	2	-	12	10	1	1	-	-	2	15
Red urine ----	2	1	-	-	12	11	1	-	-	-	4	5
Purulent excr	-	-	-	-	71	69	1	1	-	-	1	-
Sexual probl -	1	-	-	-	71	55	6	9	1	-	-	-
Cohab. pain --	-	-	-	-	72	57	5	9	1	-	-	-
Female pat: --	.	.	.	-	.	.	.	.	.	-	.	.
Excretion ----	-	-	-	-	43	13	9	19	2	-	-	1
Cohab. bloodl.	-	-	-	-	38	37	-	1	-	-	-	1
SUM ---	25	19	3	-	327	259	23	40	5	-	24	23
Percentages---	3.3	2.5	0.4	-	44	35	3.1	5.4	0.7	-	3.2	3.1

.6 Itemgroup: Nervous system

The item group nervous system is formed by the items about the head (95 patients), limbs (92-93 patients) and the back (85 patients).

APPENDIX

Percentages	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Headache --Pat	9	2	28	33	6	17	2	0	2	0
Record	51	0	4	15	14	12	2	3	0	0
Rings around-P	53	1	2	11	3	3	2	14	12	0
lights Record	1	0	0	0	0	0	0	99	0	0
Problems w --P	53	1	9	26	4	2	1	1	2	0
speak Record	13	1	0	4	1	1	0	80	0	0
Trembling -Pat	53	1	8	28	6	0	1	1	2	0
Record	15	0	0	6	2	0	0	76	0	0
Cold ------Pat	53	0	4	18	9	9	5	0	2	0
feeling Record	14	0	0	5	5	3	0	72	0	0
Dead ------Pat	54	0	9	16	11	1	3	2	4	0
feeling Record	17	1	0	9	11	2	0	60	0	0
Strenght --Pat	47	0	9	26	6	4	4	1	2	0
lowering Rec	41	0	0	10	5	0	0	44	0	0
Moving ----Pat	41	1	13	24	10	5	1	0	3	1
trouble Record	48	0	0	16	11	9	1	15	0	0
Back ------Pat	16	5	19	29	8	13	8	0	1	0
pain Record	27	0	1	14	11	6	1	40	0	0
Movement---Pat	38	2	16	20	8	6	2	2	5	0
backpain Rec	28	1	1	7	2	1	0	59	0	0
Mean Pat answ	42	1.3	12	23	7.1	5.9	3.0	2.0	3.6	0.1
Record data	25	0.3	0.6	8.5	6.2	3.3	0.4	54	0	0

	Similar						Different			
Numbers										
Nervous system	TS	NS	LPS	MPS	SPS	US		PLD	PBD	RLD	RBD
Headache -----	46	9	7	22	8	-	-	1	-	5	-
Rings a lights	24	-	-	-	-	24	-	-	-	-	-
Speaking probl	7	3	1	1	-	2	-	-	-	1	-
Trembling ----	12	6	-	3	-	3	-	-	-	-	-
Cold feeling -	14	5	1	5	2	1	-	1	1	-	-
Dead feeling -	26	10	-	10	1	5	-	2	-	1	-
Strenght lower	28	21	-	5	-	2	-	4	1	1	-
Moving probl -	46	23	3	17	2	1	-	-	-	3	1
Backpain -----	27	6	4	12	4	1	-	4	1	2	-
Movement backp	27	14	4	4	-	5	-	-	1	-	-
SUM ---	257	97	20	79	17	44	-	12	4	13	1
Percentages---	28	11	2.2	8.6	1.8	4.8	-	1.3	0.4	1.4	0.1

Numbers	Denied				No Information Record						Patient	
Nervous system	DL	DM	DS		NI	NN	NL	NM	NS		PNR	PNE
Headache -----	23	14	1	-	3	-	-	3	-	-	-	2
Light rings --	-	-	1	-	70	50	3	13	4	-	-	-
Speaking prob	2	5	1	-	74	43	7	22	2	-	4	1
Trembling ----	1	7	-	-	68	38	7	22	1	-	5	-
Cold feeling -	-	6	1	-	66	41	3	14	8	-	3	1
Dead feeling -	2	3	-	-	51	33	5	12	1	-	7	1
Strenght lowe	5	10	1	-	39	20	2	16	1	-	3	1
Moving probl -	9	10	1	-	13	9	-	3	1	-	6	3
Back pain ----	9	7	1	-	33	7	6	15	5	-	1	-
Movement backp	5	3	1	-	45	16	7	17	5	-	2	1
SUM ---	56	65	8	-	462	257	40	137	28	-	31	10
Percentages---	6.1	7.1	0.9	-	50	28	4.4	15	3.0	-	3.4	1.1

.7 Itemgroup: General and skin
This item group is formed by the items General-95 patients and Skin-84 patients.

Percentages	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Allergic --Pat	62	2	0	5	3	1	4	19	2	1
Record	79	0	0	6	6	2	1	4	0	1
Chilly ----Pat	37	0	15	24	7	9	6	0	0	1
Record	20	0	0	4	2	2	0	71	0	1
Shiver ----Pat	37	1	19	27	3	9	1	0	1	1
Record	11	0	0	1	0	0	0	87	0	1
Sweating --Pat	27	2	18	24	7	14	5	0	1	1
Record	26	0	0	8	11	4	0	49	0	1
Itching ---Pat	44	2	17	24	4	5	2	0	2	0
Record	32	1	0	6	4	6	0	51	0	0
Eczema ----Pat	69	2	5	10	6	2	4	0	2	0
Record	7	1	0	1	2	0	1	87	0	0
Hairloss --Pat	71	0	8	10	8	0	0	0	2	0
Record	8	0	0	1	1	0	0	89	0	0
Blue stains -P	54	0	12	24	4	2	0	2	2	0
Record	25	1	1	4	2	2	0	64	0	0
Scaling ---Pat	71	1	4	11	5	5	0	1	2	0
skin Record	2	1	0	2	1	4	0	89	0	0
Mean Pat answ	52	1.3	11	18	5.3	5.5	2.6	2.6	1.8	0.5
Record data	24	0.5	0.1	3.9	3.4	2.3	0.3	65	0	0.5

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Numbers / General	Similar							Different				
	TS	NS	LPS	MPS	SPS	US		PLD	PBD	RLD	RBD	
Allergic	65	55	-	8	1	1	-	-	1	1	1	
Chilly	11	8	-	-	2	1	-	2	-	-	-	
Shiver	5	3	-	-	-	2	-	-	-	-	-	
Sweating	28	8	1	16	2	1	-	1	-	-	-	
Itching	22	11	-	8	2	1	-	1	-	1	-	
Eczema	9	6	-	1	1	1	-	-	-	-	-	
Hairloss	7	4	-	2	-	1	-	-	-	-	-	
Blue stains	20	12	2	3	-	3	-	-	-	-	-	
Scaling skin	6	1	-	2	1	2	-	-	1	1	-	
SUM	173	108	3	40	9	13	-	4	2	3	1	
Percentages	22	14	0.4	5	1.1	1.6	-	0.5	0.3	0.4	0.1	

Numbers / General	Denied				No Information Record						Patient	
	DL	DM	DS		NI	NN	NL	NM	NS		PNR	PNE
Allergic	1	-	1	-	4	3	-	-	1	-	1	20
Chilly	2	7	2	-	67	23	12	23	9	-	4	-
Shiver	-	6	1	-	82	31	19	23	9	-	1	-
Itching	8	7	1	-	42	25	8	7	2	-	1	1
Eczema	-	-	-	-	72	50	6	12	4	-	2	1
Hairloss	1	1	-	-	74	56	6	12	-	-	-	1
Blue stains	2	6	1	-	51	30	7	13	1	-	3	1
Scaling skin	-	-	-	-	73	57	3	10	3	-	2	1
SUM	23	34	6	-	512	291	70	113	38	-	16	26
Percentages	2.9	4.3	0.8	-	64	36	8.8	14	4.8	-	2	3.3

.8 Itemgroup: General disorders

The itemgroup about General disorders is formed by the questions of two screens presented in the start of the questionnaire, it is answered by 99 patients.

Problems with function:	(Percentages) nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Eating ----Pat	58	1	6	15	13	3	4	0	0	0
Record	64	0	2	17	11	5	0	1	0	0
Swallowing Pat	78	1	3	13	3	1	1	0	0	0
Record	58	0	0	3	7	2	0	30	0	0
Stomach ---Pat	31	2	6	22	14	18	4	1	1	0
bowels Record	43	1	1	16	16	19	1	2	0	0
Urinating -Pat	75	2	7	9	2	4	1	0	0	0
Record	70	3	3	11	11	1	0	1	0	0
Breathing -Pat	62	2	7	17	6	3	3	0	0	0
Record	67	5	3	15	5	3	0	2	0	0
Moving ----Pat	44	3	3	25	12	6	5	0	1	0
Record	49	1	0	21	19	4	0	5	0	0
Social ----Pat	55	0	14	16	7	3	0	0	5	0
life Record	22	4	1	13	4	0	0	56	0	0
Sleeping --Pat	40	0	8	19	12	12	8	0	0	0
Record	29	0	1	13	13	7	1	35	0	0
Thinking --Pat	55	0	10	23	5	4	2	1	0	0
Record	2	0	0	1	4	0	0	93	0	0
Remembering-Pt	36	0	13	39	5	2	2	0	2	0
Record	3	0	0	0	1	1	0	95	0	0
Exercise --Pat	26	1	14	22	13	14	9	0	0	0
Record	64	1	8	18	5	1	0	3	0	0
Seeing ----Pat	47	1	10	21	9	4	6	0	1	0
Record	57	2	2	18	5	2	0	14	0	0
Hearing ---Pat	65	0	7	20	2	1	4	0	1	0
Record	60	0	1	14	1	1	1	22	0	0
Weight ----Pat	43	2	6	16	12	7	12	1	0	0
Record	45	2	4	23	10	7	0	8	0	0
Blood -----Pat	45	4	9	14	4	3	6	14	0	0
pressure Rec	26	3	1	8	7	3	2	47	2	0
Metabolism -Pt	39	4	1	9	4	2	3	35	2	0
Record	10	5	0	9	7	5	3	59	2	0
Nerves ----Pat	28	2	7	30	9	8	6	6	3	0
Record	39	1	0	24	8	1	0	26	0	0
Mean Pat answ	49	1.5	7.8	20	7.8	5.6	4.5	3.4	1.0	0
Record data	42	1.7	1.6	13	8.0	3.7	0.5	29	0.2	0

APPENDIX

Problems with functions	Similar							Different			
	TS	NS	LPS	MPS	SPS	US		PLD	PBD	RLD	RBD
Eating	56	41	2	12	1	-	-	2	-	2	-
Swallowing	58	49	0	9	-	-	-	1	-	2	-
Stomach/bowels	63	24	1	26	12	-	-	3	1	3	-
Urinating	70	58	3	9	-	-	-	1	1	-	-
Breathing	55	43	3	7	2	-	-	1	1	1	-
Moving	60	32	-	26	2	-	-	5	-	1	-
Social life	25	14	4	6	-	1	-	1	1	-	-
Sleeping	39	17	2	12	8	-	-	6	1	-	-
Thinking	5	1	-	3	-	1	-	-	-	-	-
Remembering	4	1	-	1	-	2	-	-	-	1	-
Exercise	30	18	-	11	1	-	-	10	4	-	-
Seeing	51	34	3	12	2	-	-	4	3	-	-
Hearing	63	48	2	10	2	1	-	1	2	-	-
Weight	55	28	4	18	5	-	-	5	2	-	1
Blood pressure	44	17	6	8	3	10	-	2	1	1	-
Metabolism	33	5	-	4	1	23	-	1	2	3	1
Nerves	33	11	2	17	-	3	-	5	-	2	-
Sum	744	441	32	191	39	41	-	48	19	16	2
Percentages	44	26	2.0	11	2.3	2.4	-	2.9	1.1	1.0	0.1

Disorder of function	Denied				No Information Record						Patient	
	DL	DM	DS		NI	NN	NL	NM	NS		PNR	PNE
Eating	4	14	4	-	1	-	-	1	-	-	16	-
Swallowing	2	6	-	-	30	28	1	1	-	-	-	-
Stomach/bowels	6	12	1	-	2	1	1	-	-	-	6	2
Urinating	7	4	-	-	1	1	-	-	-	-	15	-
Breathing	5	15	3	-	2	2	-	-	-	-	16	-
Moving	3	12	2	-	5	2	2	1	-	-	10	1
Social life	3	4	-	-	54	33	7	13	1	-	7	4
Sleeping	4	7	1	-	35	17	2	13	3	-	6	-
Thinking	1	-	-	-	91	51	9	25	6	-	2	-
Remembering	-	2	-	-	92	35	13	40	4	-	-	-
Exercise	15	19	11	-	3	1	-	1	1	-	7	-
Seeing	7	13	1	-	14	8	2	4	-	-	5	1
Hearing	4	7	-	-	21	15	2	4	-	-	1	-
Wheight	5	8	3	-	8	4	1	2	1	-	11	1
Blood pressure	3	2	-	-	39	25	4	9	1	-	3	4
Metabolism	-	-	-	-	37	26	3	7	1	-	8	14
Nerves	6	13	5	-	23	11	-	8	4	-	6	6
SUM	75	138	31	-	458	260	47	129	22	-	119	33
Percentages	4.5	8.2	1.8	-	27	15	2.8	7.7	1.3	-	7.1	2.0

.9 Itemgroup: Disturbances

This itemgroup is answered by all 99 patients.

Percentages	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Fatigue ---Pat	8	0	4	29	1	19	0	0	0	0
Record	24	1	0	7	26	24	2	15	0	0
Weak ------Pat	26	1	8	24	14	19	6	0	1	0
feeling Record	29	1	0	9	15	11	0	34	0	0
Illness ---Pat	17	1	17	43	5	11	5	0	0	0
feeling Record	32	1	1	16	6	1	0	42	0	0
Hunger ----Pat	39	0	17	14	14	10	5	0	0	0
Record	60	0	1	6	3	2	0	28	0	0
Thirst ----Pat	36	1	20	20	11	8	3	0	0	0
Record	38	0	0	4	3	6	1	47	0	0
Nausea ----Pat	35	2	14	30	5	10	3	0	0	0
Record	42	2	2	8	13	1	0	31	0	0
Dizziness -Pat	27	1	25	27	5	12	2	0	0	0
Record	44	2	0	22	6	3	0	22	0	0
Fever -----Pat	55	2	22	12	4	4	1	0	0	0
Record	55	6	0	7	2	4	0	25	1	0
Nervousness-Pt	13	2	8	34	12	19	10	0	1	0
Record	7	0	0	10	21	7	0	55	0	0
Mean Pat answ	29	1.1	15	26	11	12	6.1	0	0.2	0
Record data	37	1.5	0.4	10	11	6.6	0.3	33	0.1	0

General	Similar							Different			
Disturbances -	TS	NS	LPS	MPS	SPS	US		PLD	PBD	RLD	RBD
Fatigue ------	54	5	-	29	20	-	-	6	-	4	-
Weak feeling -	40	13	1	19	6	1	-	5	-	1	-
Illness feel -	27	9	5	13	-	-	-	4	-	1	-
Hunger -------	32	27	1	2	2	-	-	4	-	-	-
Thirst -------	27	15	1	6	5	-	-	1	-	1	-
Nausea -------	43	20	3	19	1	-	-	1	1	-	-
Dizziness ----	41	18	5	16	2	-	-	6	1	1	-
Fever --------	48	36	2	7	3	-	-	2	-	1	-
Nervousness --	31	2	-	23	5	1	-	5	1	2	-
SUM ---	343	145	18	134	44	2	-	34	3	11	-
Percentages---	38	16	2.0	15	4.9	0.2	-	3.8	0.3	1.2	0

	Denied				No Information Record						Patient	
Numbers												
Disturbances -	DL	DM	DS		NI	NN	NL	NM	NS		PNR	PNE
Fatigue ------	2	13	4	-	15	2	-	11	2	-	1	-
Weak feeling -	2	11	3	-	33	9	6	9	9	-	4	-
Illness feel -	7	14	2	-	42	6	7	20	9	-	2	-
Hunger -------	13	14	5	-	28	9	4	11	4	-	3	-
Thirst -------	9	12	2	-	47	21	11	14	1	-	-	-
Nausea -------	9	13	-	-	31	14	5	9	3	-	1	-
Dizziness ----	15	10	1	-	22	7	6	8	1	-	2	-
Fever --------	11	6	1	-	26	14	10	2	-	-	4	-
Nervousness --	2	3	-	-	53	9	7	24	13	-	2	-
SUM ---	70	96	18	-	297	91	56	108	42	-	19	0
Percentages---	7.9	11	2.0	-	33	10	6.3	12	4.7	-	2.1	0

.10 Overview of all item groups

Percentages

Itemgroup	nev	onc	sel	som	reg	oft	alw	dnk	noa	unk
Airways ---Pat	49	1.3	14	24	5.4	3.1	1.6	0.6	0.7	0.4
Record	38	1.2	1.0	6.8	4.8	2.3	0.2	46	0	0
Circulation-Pt	52	0.9	10	19	8.1	4.5	4.1	0.6	0.9	0.3
Record	45	0.4	0.5	11	7.1	3.2	0.8	32	0	0
Stomach ---Pat	48	0.8	15	21	6.4	6.0	0.9	0	1.2	0.6
bowels Record	28	0.8	0.2	3.9	5.2	3.7	0.2	58	0	0
Stools ----Pat	42	1.8	12	23	6.5	5.9	1.9	2.5	2.4	2.0
Record	48	1.5	0.6	9.2	2.6	3.6	0.3	34	0.1	1.0
Urinary ---Pat	69	1.1	6.4	8.6	1.7	0.9	0.4	2.1	9.5	0
tract Record	40	1.3	0.7	3.1	1.3	0.7	0.1	52	0	0
Nervous ---Pat	42	1.3	12	23	7.1	5.9	3.0	2.0	3.5	0.1
system Record	25	0.3	0.6	8.5	6.2	3.3	0.4	54	0	0
General ---Pat	52	1.3	11	18	5.3	5.5	2.6	2.6	1.8	0.5
skin Record	24	0.5	0.1	3.9	3.4	2.3	0.3	65	0	0.5
Disorders -Pat	49	1.5	7.8	20	7.8	5.6	4.5	3.4	1.0	0
Record	42	1.7	1.6	13	8.0	3.7	0.5	29	0.2	0
Disturbances-P	29	1.1	15	26	11	12	6.1	0	0.2	0
Record	37	1.5	0.4	10	11	6.6	0.3	33	0.1	0
Mean:Pat answ.	48	1.3	11	20	6.8	5.6	3.0	1.7	2.1	0.4
Record data	37	1.1	0.7	8.4	5.8	3.3	0.4	43	0.1	0.1

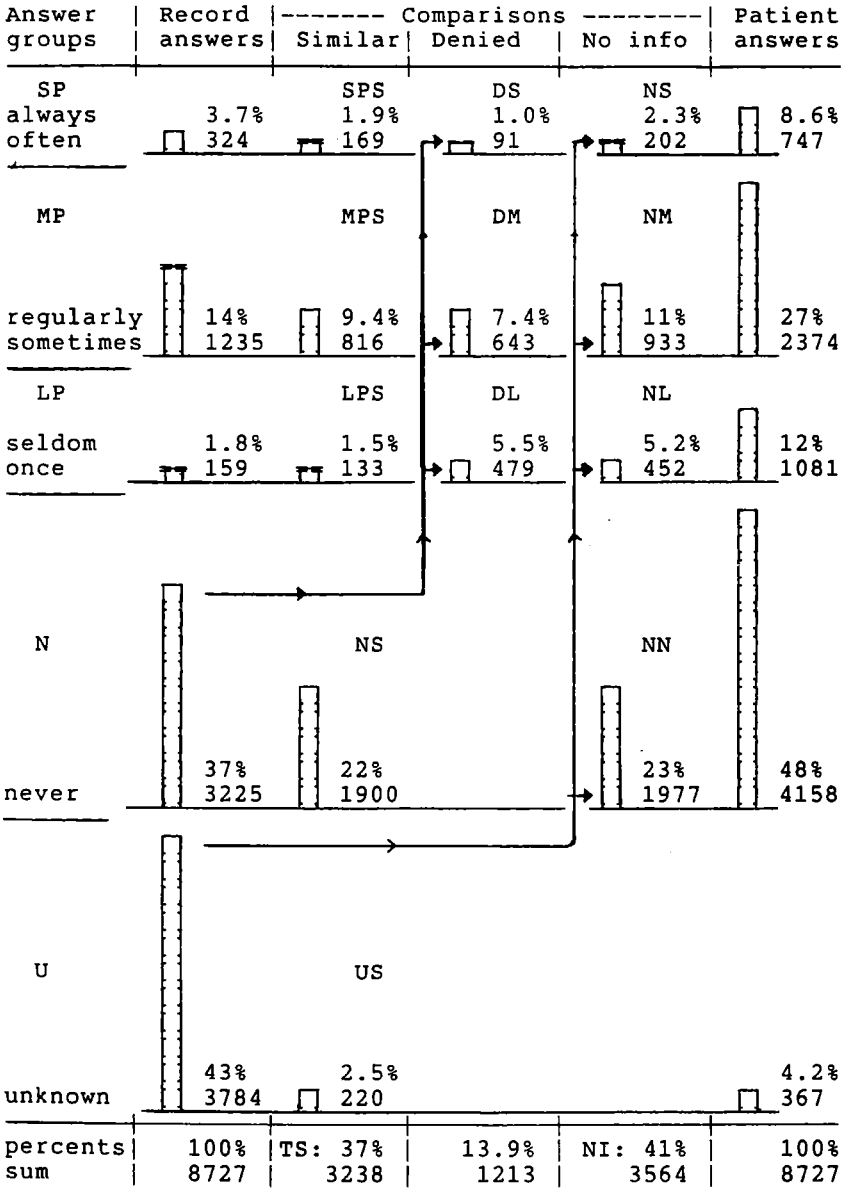
APPENDIX

Percentages	Similar							Different			
Item groups	TS	NS	LPS	MPS	SPS	US		PLD	PBD	RLD	RBD
Airways	34	21	1.7	9.2	1.4	0.3	-	1.4	0.1	0.5	0
Circulation	49	32	1.7	12	1.9	1.3	-	1.9	0.6	1.1	0.3
Gastro-intest	27	15	0.7	8.4	1.4	1.5	-	1.2	0	0.5	0.3
Stools	42	27	1.5	8.5	1.9	3.2	-	2.5	0.2	0.8	0.3
Urinary tract	43	31	1.1	2.3	0	8.6	-	0	0	0.4	0
Nervous system	28	11	2.2	8.6	1.8	4.8	-	1.3	0.4	1.4	0.1
General	22	14	0.4	5	1.1	1.6	-	0.5	0.3	0.4	0.1
Disorders	44	26	2.0	11	2.3	2.4	-	2.9	1.1	1.0	0.1
Disturbances	38	16	2.0	15	4.9	0.2	-	3.8	0.3	1.2	0
Mean	37	22	1.5	9.4	1.9	2.5	-	1.9	0.4	0.8	0.1

Percentages	Denied				No Information Record						Patient	
Item groups	DL	DM	DS		NI	NN	NL	NM	NS		PNR	PNE
Airways	6.6	8.7	0.4	-	45	26	7.2	11	1	-	1.9	1.4
Circulation	4.9	6.5	1.1	-	31	17	3.5	9.0	1.3	-	2.7	0.6
Gastr intest	6.4	6.4	0.5	-	56	31	8.1	14	2.9	-	1.7	0.2
Stools	7.1	10	0.8	-	32	14	4.5	10	2.3	-	1.5	3.7
Urinary tract	3.3	2.5	0.4	-	44	35	3.1	5.4	0.7	-	3.2	3.1
Nervous syst	6.1	7.1	0.9	-	50	28	4.4	15	3.0	-	3.4	1.1
General	2.9	4.3	0.8	-	64	36	8.8	14	4.8	-	2	3.3
Disorders	4.5	8.2	1.8	-	27	15	2.8	7.7	1.3	-	7.1	2.0
Disturbances	7.9	11	2.0	-	33	10	6.3	12	4.7	-	2.1	0
Mean	5.5	7.4	1.0	-	41	23	5.2	11	2.3	-	3.2	1.7

APPENDIX

Overview of number of answers and comparisons



APPENDIX

Specification of number of given answers

Percents and number of answers given by the patient

never	once	sel-dom	some time	regu larl	of-ten	al-ways	dont unds	dont know	no answ	un-know
47.6	1.3	11.1	20.4	6.8	5.6	3.0	0.0	1.7	2.1	0.4
4158	110	971	1784	590	486	261	1	148	183	35

Percents and number of answers based on medical record

37.0	1.1	0.7	8.4	5.8	3.3	0.4	0.0	43.1	0.1	0.1
3225	94	65	729	506	292	32	0	3765	6	13

APPENDIX

Combinations of compared answers
Sum of vertical columns: Answers of the patient
Som of horizontal rows: Answers based on medical record data

ANSW	Neve	Once	Seld	Some	Regu	Ofte	Alwa	Dnun	Dnkn	Noan	Unk
Neve	NS	- DL -		Denied - DM -		- DS -					
3225	1900	30	449	554	89	55	36	0	60	39	13
Once											
94	38	9	19	18	3	3	0	0	2	2	0
Seld		LPS				PBD					
65	15	2	12	22	10	0	2	0	1	1	0
Some	PNR								PNE		
729	155	11	69	282	87	84	29	0	3	9	0
Regu				MPS							
506	54	6	15	115	138	117	50	0	7	3	1
Ofte											
292	16	0	7	41	77	83	64	0	3	1	0
Alwa		RBD				SPS					
32	3	0	0	0	5	6	16	0	2	0	0
Dnkn	- - - - -	NI	No Information	- - -					US		
3765	1977	52	399	752	181	138	64	1	66	127	8
Noan	0	0	1	0	0	0	0	0	4	1	0
Unkn	0	0	0	0	0	0	0	0	0	0	13
	NN	NL		NM		NS			Unknown		
8727	4158	110	971	1784	590	486	261	1	148	183	35

Percentages

ANSW	Neve	Once	Seld	Some	Regu	Ofte	Alwa	Dnun	Dnkn	Noan	Unk
Neve	NS	- DL -		Denied - DM -		- DS -					
37	22	0.3	5.1	6.3	1.0	0.6	0.4	0	0.7	0.4	0.1
Once											
1.1	0.4	0.1	0.2	0.2	0.0	0.0	0	0	0.0	0.0	0
Seld		LPS				PBD					
0.7	0.2	0.0	0.1	0.3	0.1	0	0.0	0	0.0	0.0	0
Some	PNR								PNE		
8.4	1.8	0.1	0.8	3.2	1.0	1.0	0.3	0	0.0	0.1	0
Regu				MPS							
5.8	0.6	0.1	0.2	1.3	1.6	1.3	0.6	0	0.1	0.0	0.0
Ofte											
3.4	0.2	0	0.1	0.5	0.9	1.0	0.7	0	0.0	0.0	0
Alwa		RBD				SPS					
0.4	0.0	0	0	0	0.1	0.1	0.2	0	0.0	0	0
Dnkn	- - - - -	NI	No Information	- - -					US		
43	23	0.6	4.6	8.6	2.1	1.6	0.7	0.0	0.8	1.5	0.1
Noan	0	0	0.0	0	0	0	0	0	0.0	0.0	0
Unkn	0	0	0	0	0	0	0	0	0	0	0.1
	NN	NL		NM		NS			Unknown		
100	48	1.3	11	20	6.8	5.6	3.0	0.0	1.7	2.1	0.4

Appendix for chapter 5: Appraisal by internists

Toelichting en enquete voor de internist of assistent.

De patient heeft een vragenlijst ingevuld, waarvan de antwoorden zijn afgedrukt in bijgaand antwoordverslag. De patient heeft zelf ook een antwoordverslag.
Het is mogelijk dat de patient slechts een deel van de vragenlijst heeft ingevuld (wegens tijdgebrek), het antwoordverslag is dan korter dan normaal (= vier pagina's).

Over het gebruik van het antwoordverslag bij de anamnese worden hier enkele vragen gesteld.

- Enquetevragen

Zet een kruisje in het [] voor het antwoord dat u wilt geven, schrijf er desgewenst een toelichting bij.

- 1 - In welke fase van de anamnese heeft u het antwoordverslag gebruikt ?
[] Eerst hele anamnese afgenomen (eventueel plus lichamelijk onderzoek), daarna antwoordverslag ingekeken
[] Eerst hoofklacht gevraagd, daarna antwoordverslag bekeken en rest van tractussen gevraagd
[] Eerst antwoordverslag bekeken en toen anamnese afgenomen
[] Anders, te weten:

- 2 - In hoeverre komen de gegevens in het antwoordverslag overeen met uw indruk over de belangrijkste klachten van de patient ?

[] volledig
[] voor het belangrijkste deel
[] enigszins
[] nauwelijks
[] niet
[] Anders, te weten:

- 3 - In hoeverre komen de gegevens in het antwoordverslag overeen met uw indruk over de bijkomende gegevens van de patient ?

[] volledig
[] voor het belangrijkste deel
[] enigszins
[] nauwelijks
[] niet
[] Anders, te weten:

- 4 - In hoeverre zou u alleen op grond van de gegevens in het antwoordverslag een indruk kunnen krijgen van de belangrijkste klachten van de patient ?

[ ] volledig
[ ] voor het belangrijkste deel
[ ] enigszins
[ ] nauwelijks
[ ] niet
[ ] Anders, te weten:

- 5 - In hoeverre zou u alleen op grond van de gegevens in het antwoordverslag zich een beeld kunnen vormen van de algehele toestand van deze patient.

[ ] volledig
[ ] voor het belangrijkste deel
[ ] enigszins
[ ] nauwelijks
[ ] niet
[ ] Anders, te weten:

- 6 - Als u, naast de patient, alleen de gegevens van het antwoordverslag zou hebben, in hoeverre zou u de gegevens in het antwoordverslag dan kunnen gebruiken voor verdere anamnesevragen en onderzoek bij deze patient ?

[ ] volledig
[ ] voor het belangrijkste deel
[ ] enigszins
[ ] nauwelijks
[ ] niet
[ ] Anders, te weten:

- 7 - Welk antwoordverslag vindt u het meest bruikbaar ?

[ ] Het volledige antwoordverslag
[ ] Het antwoordverslag zonder de antwoorden nooit, zelden en geen antwoord.
[ ] Beide
[ ] Geen van deze
[ ] Anders, te weten:

Op de achterzijde kunt u desgewenst verdere opmerkingen over het gebruik van dit antwoordverslag bij deze patient schrijven.

Curriculum Vitae

Martinus J. Quaak werd op 12 november 1950 te Bruinisse geboren. In 1969 behaalde hij het diploma HBS-B op het Eerste Christelijk Lyceum te Haarlem. Daarna volgde hij de studie in de geneeskunde aan de Vrije Universiteit te Amsterdam, waar hij in 1980 het artsdiploma behaalde. Hierna verrichtte hij bij de Vakgroep Medische Informatica van de Vrije Universiteit een onderzoek naar het gebruik van een geautomatiseerde vragenlijst. De vragenlijst werd aangeboden aan patiënten van de polikliniek Inwendige Geneeskunde van de Vrije Universiteit. Het onderzoek verrichtte hij in samenwerking met administratief en assisterend personeel, co-assistenten, assistenten en internisten van de Afdeling Inwendige Geneeskunde. Hij werkte het uit in samenwerking met medewerkers van de Vakgroep Medische Informatica. Vanaf 1985 werkt hij bij de afdeling Onderzoek en Ontwikkeling van het Medisch Onderwijs binnen de Medische Faculteit van de Rijksuniversiteit Utrecht. Hier werkt hij aan de ontwikkeling van computer-ondersteunde patiëntsimulaties voor gebruik in het onderwijs.

Colofon

Tekstverwerking:
Afdeling Medische Informatica,
Vrije Universiteit, Amsterdam
Computer: Digital Vax 11/750
Programma: WPS-PLUS/VMS V2.0
Zetwerk: DECpage V1.1
Printstijl: General 2
Lettertype: Century/Triumvirate
Printer: Digital LN03

Druk- en bindwerk:
Drukkerij Elinkwijk B.V., Utrecht
Druk: tweezijdig zwart offset
Papier: 90 grs houtvrij mat Multi Coated
Bindwerk: genaaid gebrocheerd
Omslag: 250 grs gesatineerd M.C.