

The Austrian Case Study III: Documentation practices in an oncology clinic

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INTRODUCTION

As outlined by many authors, implementation of electronic patient records is not only a technical problem but rather implies a mutual transformation of work processes and technology. Berg (2001) discloses some of the major myths that are usually connected with system development in the health care sector. In contrast to seeing implementation of information systems as a technical endeavour that can be left to the IT department, he claims for a sociotechnical approach that strives for synergy of the information system with primary work processes (patient care activities) and secondary working processes (management, support).

With the introduction of computer systems and the integration of documentation systems across various sites in healthcare organizations, it becomes crucial to allow access to patient-related data that stem from different sources and have been collected for various purposes. This involves standardization efforts. However, patient records can not be seen as mere depositories of information for future reference. Ethnographic work studies in health care settings have pointed out how patient records play an active role in the work processes. This is confirmed by our findings that we discussed in the first report (Tolar and Wagner, 2005). The concept of ordering systems (Wagner and Tolar, 2006) helps to understand how integration of interdependent activities across local practices is achieved.

Fitzpatrick (2004) shows that there is a difference between the archival patient record and what she calls the “working patient record”. While the actual physical patient record (in the form of a folder with all kinds of documents) may be a focal point of reference for physicians and nurses during the treatment of a patient, the set of documents that they work with comprises many more documents that also incorporate a clinician centred view, e.g., providing an overview of tasks to be done. Tailorability and flexibility are central qualities of all the documents that are used, as they allow for adjustments to the personnel’s actual needs. They are appropriated and even generated in a specific way that is dependent on individual as well as purpose-dependent preferences. Ellingsen and Monteiro (2003) point out that redundancy, supplementary information, and even ambiguity are not necessarily counter-productive, but are part of practical everyday collaborative work allowing for different perspectives on the same data that are the prerequisite of successful communication and coordination. Winthereik and Vikkelso (2005) look specifically at one part of the patient record, the discharge letters that are written after a patient’s stay at the ward, to inform the general practitioner about measures taken and the further treatment to be provided. They describe how the letter serves a double role as informational tool and accounting device.

Overall we can see that adaptability and tailorability of documentation systems is important to allow for specific perspectives supporting the task at hand – and often one device is used to support multiple tasks – rather than having a standardized “fit for all” version of the data provided. Collaborative work in health care cannot be conceptualized as mere information exchange. There are multiple translations involved: Data have to be interpreted from different perspectives, including both a medical perspective and the perspective of workflow organization. This is reflected in the documentation systems and the way they are appropriated by the involved actors. With the integration of different sites in an effort to enable integrated care across disciplines, the question of how to account for the variations of work practices in standardized information systems becomes virulent and cannot be dealt with in terms of local work settings and user-led development, as Ellingsen and Monteiro (2006) point out.

This leads to some questions: What variation is significant? What can be standardized and dealt with in the same way? How can standardization be achieved and at the same time variation still be possible? What are the basic elements of documentation systems that allow for continuous reconfigurations and adaptations?

Case Study

The fieldwork was carried out at three of five oncology clinics in Vienna selected for the introduction of a new, unified electronic patient record system. The clinics form part of the KAV, the association of hospitals, nursing homes, and geriatric centers run by the city of Vienna.

This second report follows up on the first report that analyzed work practices in one of the three clinics that still use a paper-based documentation system. In the second report at hand we present the results from another of the three clinics where they have a well-functioning computer system in place. It is based on an ethnographic study of work practices in this clinic.

For this study we decided to focus on the outpatient and day clinic, as it was suggested that this is where the new computer system would be introduced first. We started out with initial interviews and presentations of our project. This allowed us to get first information on structures and documentation practices as physicians and nurses describe them. We then did participant observations following doctors and nurses through their working day. Our focus was on the practices of documentation that are tightly connected to the coordination of tasks between individuals. During the observations we had the opportunity to talk to doctors and nurses. And we carried out additional interviews to clarify open questions and get a deeper understanding of the work processes. Another focus was on the artifacts used, the use of the computer system, and the setting, i.e., the working environment with the arrangement of rooms, computers, and other resources. To capture this we took photos of relevant work situations and documents. These will be used in the following to illustrate the work processes.

Current Status

As the implementation process of the unified electronic patient record took longer than expected, and is still ongoing, we have changed our strategy: Instead of comparing work practices before and after the introduction of the computer system, we did an in-depth study of the work practices and artifacts used in the three clinics comparing computer-based and paper-based documentation systems.

THE CLINIC – ORGANIZATION AND WORK PROCESSES

Organization

The clinic (ONC3) is part of HOS3, a large community hospital in Vienna. It consists of three wards, an outpatient and a day clinic. Two of the wards are mainly dedicated to generally internistic patients (one is for gastroenterology and hepatology and the other one is a general internistic ward with gastroenterology and hemato-oncology), whereas the third ward specializes on hematological and oncological diseases. ONC3 also hosts an “admission ward”, where patients are received in cases of emergencies during the day or on weekends. They are provided with initial treatment before it is decided whether they have to be admitted to one of the wards at HOS3 (surgical or medical department, etc.) or can be sent home again. The staff at

ONC3 consists of 24 medical doctors (of which 14 are allocated to the oncological unit), 8 interns and 69 nurses (28 for the oncological unit). Each of the three wards houses 32 beds, however, they regularly have to put additional beds in the corridors.

ONC3 deals with general internistic diseases related to stomach, bowel, blood, and liver. Other diseases (heart, lung, kidney, diabetes, etc.) are covered by other internistic departments at the hospital. Like ONC1 and ONC2, ONC3 claims that they cover the whole range of oncological diseases. However, one doctor mentions that they have two main groups of oncological patients: those diagnosed with breast cancer and those with stomach and intestinal cancer.

In 2005 1.622 patients had visited the outpatient clinic and 854 the day clinic, i.e., a total of 2.477 patients that made up for 12.804 visits. The outpatient clinic of ONC3 does not only take up oncology patients, but also hosts a general medical unit as well as units for gastroenterology and endoscopy. Most patients come for the oncology unit. In 2005 the three other units together had a total number of 5.276 visits. They are institutionally separated (different medical personnel) but share, e.g., the reception, with the oncology unit. On an average day the outpatient and day clinic has 80 to 100 oncological patients, about 20 who come with generally internistic problems and another 20 for endoscopies.

The development of the electronic documentation system

In ONC3 a dedicated computer system is used for medical documentation. It is called "oncological documentation system", but it also comprises workflow support. The system is only used for oncological patients, i.e., at the oncology unit of the outpatient clinic, the day clinic, and one of the three wards.

The development of the system was initiated in 1987. In 1992 the hospital moved to a new building; from then on the system had been used and constantly adapted until 2000. A great deal of the implementation is due to the initiative of one of the senior physicians who is working at the outpatient and day clinic (S). He was mainly responsible for the design of the interface and the structure of the system that he did by himself in the beginning. Later on the programming work had been taken over by a software company. The system was designed in modules, growing out of the needs of the daily work practice of doctors and also nurses. S describes its roots:

"In principle it is there to support the procedures in the outpatient clinic. It is a historically grown program, i.e. it was not designed from the start knowing what it should provide later on, but it simply emerged from the daily routine. In the past I was sitting in front of the patients and – as it is probably done by and large in the hospitals today – I was writing progress notes, status, prescriptions, and patient letters. And this redundancy at some point for me was the reason to think about what could be done, and from this intention the program has grown" (INT3, p. 7).

So initially highly redundant procedures, especially the ordering of chemotherapies, were supported.

"Substantially we have patients with chronic diseases, and so it is all about the same things again and again: The patient comes with a carcinoma, receives chemotherapy and for this reason comes every week. And of course it is lunacy if you have to write the same thing each week. So for these patients an electronic documentation is optimal" (INT3, p. 8).

In the next step, other measures to be taken, like blood tests or x-rays, were added. Over time the protocols that were originally designed for the sake of ordering chemotherapies only grew to a powerful tool of managing all patient-related tasks. Today, connected to the process of ordering chemotherapies there are: the protocols for the pharmacy, the codes for accounting, and therapy plans for doctors that describe the measures in detail for each of the protocols. A time planning system is included for the administration of appointments (INT3, p. 9). An important milestone for the system was the implementation of the interface to the hospital information system (HIS) from where basic patient data are taken over.

S describes that there was some resistance by physicians in the beginning. However, he says that when they saw that the system worked well, others who were not involved in the beginning also wanted to join in (INT3, p. 17-18). Today the ordering of chemotherapies has to be done in the computer system. S emphasizes that it is important to involve everybody. Nurses' needs were also considered:

“And following in the course of time it was rather that everybody wanted to take part, medical-technical assistants, nurses, and so on. So from them on for each new development we always thought about how to again facilitate procedures. For example we had these sheets to order blood tests from the laboratory, [...] where you have to check off each single test. This had to be done by the nurse [...] which is a lot of work for 60 to 80 patients a day. So we wanted to replace this form. By automatic electronic ordering this was achieved” (INT3, p. 18).

Today the system supports many tasks in the daily work at ONC3. In the outpatient and day clinic it covers the whole trajectory of a patient's visit, from arranging the appointment to writing of the patient letter. It is widely used by doctors and nurses. However, still a considerable amount of work has to be done otherwise. Requests to most of the other departments at the hospital and to external laboratories and other institutions can only be done manually. The original aim of replacing patient folders was not achieved.

Since the late 1990s resources are scarce and the system could not be further developed. So today the technology that it was built on is outdated. S says that *“since about 2000 there is stagnancy, this is noticeable: There is no money any longer for anything. That's how it is, unfortunately”* (INT3, p. 10). He says that they are stuck on an intermediate level of their original intentions. Today especially an interface to external laboratories would be needed to have all the blood results accessible, as they have recently changed their procedures and now tell patients who receive chemotherapies to let blood tests be done before they come to ONC3. S mentions that overall, constant updates are necessary to adapt the system to changing requirements, summing up, *“[The system offers] many functions that ease our lives, but work is also a dynamic process”* (INT3, p. 6).

The outpatient and day clinic

The outpatient and day clinic of ONC3 is located on the first floor of the central wing of the hospital building that hosts all the examination and treatment units, for a total of 19 medical departments and other institutions.



Figure Counter and hallway at the outpatient and day clinic of ONC3

The patients arrive at the counter. From there they get to the waiting area. All the consultation rooms and the room where blood is taken are directly accessible. The consultation rooms are called “bunks” by the personnel, as they do not have windows (only small inlets for light near the ceiling). Through big sliding doors they are on the other side connected to a hallway that leads to further examination rooms, rooms for preparations and retreat for the personnel, and the day clinic. The first three rooms on the left side of the corridor and one room on the opposite side are reserved for the oncology unit, whereas the next three rooms host the gastroenterology, endoscopy, and general internistic unit.

At the end of the hallway it opens up to a larger space where 9 beds and 4 chairs are placed. This is the day clinic. The room for the preparation of the infusions is next to this area and has a window for the nurses to be able to watch the patients. Sanitary facilities for patients and personnel are located on the floor opposite the counter outside the area of ONC3.



Figure Day clinic with a window to the room where infusions are prepared

Each of the rooms at ONC3 is equipped with at least one computer. In the consultation rooms the nurses and the doctors each have their own computers. Two computers are positioned in the counter room. One is primarily for the use of the secretary, whereas the other one is often used by nurses passing by. Other important facilities are the photocopying machine in the hallway and the pneumatic post in the counter room. The archive with all the folders for current patients is also located in the counter room in two cupboards. Older folders are stored in cupboards along the hallway.

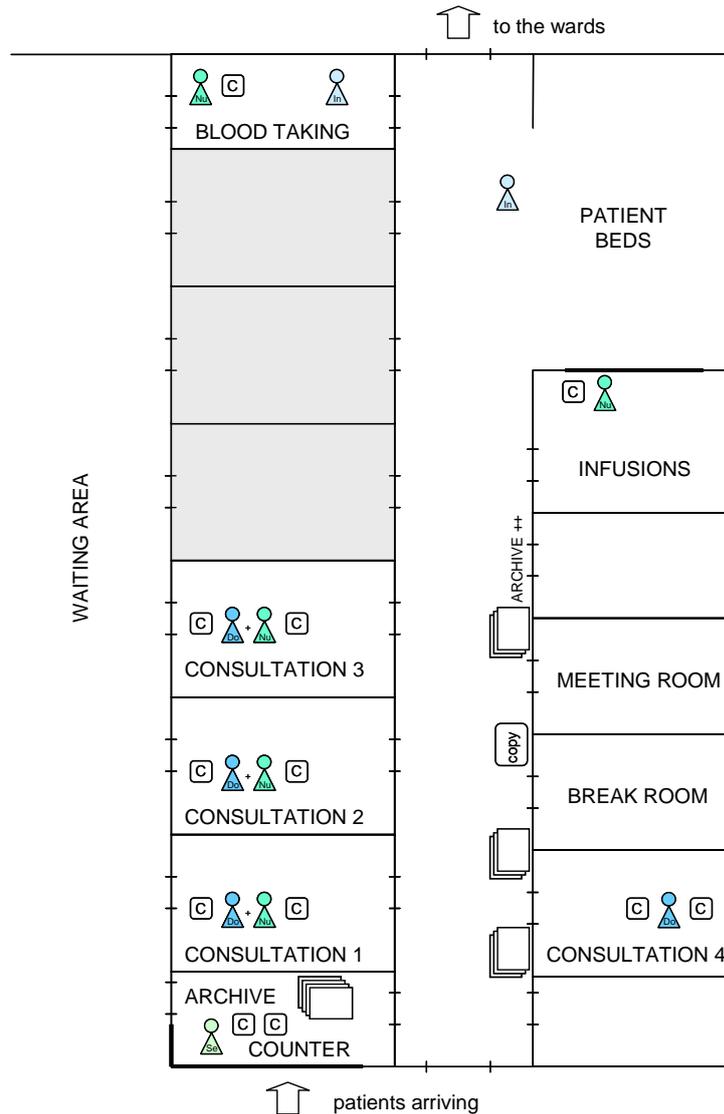


Figure Map of the outpatient and day clinic of ONC3

The outpatient and day clinic are distinct units (regarding accounting), but in the daily work practice they are tightly coupled (sharing personnel, counter, and unit for blood tests). Nurses and doctors who are assigned to the outpatient and day clinic do not work at the wards, only in cases of illness or lack of personnel. However, doctors from the outpatient and day clinic also have to do shifts at the wards during nights and weekends. Overall, five physicians are assigned to the outpatient and day clinic. Due to the shifts and compensatory time-offs, vacation, etc., there are usually three or four doctors present in the outpatient and day clinic each day. Some of them specialize on certain types of cancer, but none of them is restricted to treat only a certain group of patients. For all those cases where doctors need the support of others in deciding about a particular treatment, there is a discussion about oncological patients each Wednesday, and about hematological ones each Friday. Physicians work in close cooperation with nurses, i.e., one doctor and one nurse work together in each of the consultation rooms. However, it happens that one nurse has to support two physicians and constantly change between two rooms. For the blood tests there is one nurse and two interns who take the blood samples, administer infusions,

or set needles. Another one or two nurses work in the day clinic preparing the therapies. A secretary is responsible for the work at the counter.

Work processes

Oncological patients usually come to receive chemotherapy or they come for aftercare and checkups. They are supposed to come by appointment. Only acute patients come without. The appointment is for a certain date; a time is added, but this is only an approximate value: It is rather early for those who receive chemotherapy and later for those who only come for a blood test or to discuss examination results. For the chemotherapy a blood test has to be done. At ONC3 they do not have their own laboratory. Blood samples have to be sent to the hospital laboratory, which means that patients have to wait for up to one and a half hours for the test results. Then they are seen by a doctor, and only after that the chemotherapy can be ordered. So patients have to wait again for one or one and a half hours until the chemotherapy arrives from the pharmacy. To shorten waiting times for patients they are advised to do the blood tests at external laboratories, e.g., the day before, and come with the results.

In the following the work processes are described in more detail, including the use of the computer system. The main focus is on oncological patients; however, to capture the tasks of the secretary at the counter and the nurses in the blood room, other patients are also considered.

Receiving and administering patients at the counter

The counter is the central place to go or to call for patients. It is shared for the outpatient and day clinic and takes oncological patients as well as those that come for general internistic concerns and the endoscopy and gastroenterology unit. Patients are received by a secretary at the counter of ONC3. The tasks of the secretary are manifold: Her central role is that of an interface between patients and medical personnel.



Figure Secretary's place at the counter

Patients do not only come for appointments, they come to the counter or call by phone to make or change appointments, to talk to a doctor, or to receive other information. Especially early in the mornings there is often a long line of patients waiting in front of the counter. The secretary first checks if patients are at the right place, as there are many outpatient clinics in the same building and patients often get lost. Then she goes on to find out *"if he has an appointment – is it an*

emergency or does he only want to make an appointment" (INT7, p. 1). At their first visit patients receive a card with the patient label attached and with the address and telephone number of the hospital stamped onto it. On the patient label name, admission number, and social insurance number are noted so that the secretary sees where the patient belongs, i.e., whether or not s/he is an oncological patient. The card is also used to find the patient folder. Patients who come for the oncology unit bring their appointment sheet with them. They have received it at their last visit to ONC3. On this sheet the secretary sees what is planned for the patient, i.e., if s/he will have to have blood taken or receive chemotherapy, etc. If patients do not provide the appointment sheet, a second copy of the sheet can be found in the patient folder. Furthermore, the secretary sees on the list of appointments all oncological patients and the according measures scheduled for that day. For all other patients the appointments are written down by hand into two calendar books: one for medical and another one for psychological consultations. The secretary can also access the patient letters from their last visits to one of the general internistic wards on the computer.

For the administration the patient is called up in the HIS (hospital information system) either by using the barcode on the patient card or by entering the name or admission number. For patients who come for the first time, basic data (name, address, telephone number, occupation, nationality, marital status, employer, medical insurance, and family doctor) are entered into the HIS by the secretary. Patients who have been to any other hospital of the association before are already registered; however, only basic data can be taken over from the HIS—any information about diagnoses and treatments that has not been entered at ONC3 is not accessible. A new patient folder is prepared and patient labels are printed out. For all other patients who have already been to ONC3 before the secretary checks if the data are still correct and makes changes accordingly. Once the administration is finished, the secretary usually tells the patient to sit down in the waiting area to be called in later on for a blood test or a consultation.

The secretary takes care of examination results, i.e., she takes over the sheets that patients bring with them. The counter also hosts the pneumatic post system to send and receive examination requests and results and a fax machine. Some results are brought by carriers. From time to time the secretary checks for blood results in the HIS and prints them out. She brings current examination results that are needed for consultations to the doctors' rooms together with the patient folders. She also provides all other information that is necessary, i.e., the appointment sheet, requests from other institutions if there are any, etc. If a blood test has to be done at ONC3, the information goes to the nurses in the room where blood samples are taken, i.e., the secretary puts the patient's appointment sheet on a desk. She is also responsible to sort and put other results into the patient folders. The search for and provision of examination results is an important part of her work that takes quite an effort, as there are constantly nurses, patients, and doctors asking for the information.

Finally, the secretary organizes the transport of patients if necessary, e.g., by ambulance. Overall the working day of the secretary is filled with the reception of patients at the counter and on the phone, mediating in the communication between patients and doctors and checking for and providing necessary information for the consultations. This involves a lot of running around between the counter and the doctors' rooms, searching for patients, doctors, patient folders, and other information. The official opening time is from 7.30 to 10.30 a.m. However, the secretary says that the counter is opened until 1 p.m., but there will still be patients who need something afterwards (OBS4, p. 5).

Blood tests

The administration of blood tests is done in a room where two interns work together with one or two nurses. In the room there are two chairs for the patients where the blood is taken. The equipment is stored in cupboards; different kinds of request sheets are available.



Figure Room for blood tests

The nurses in the blood room are informed about the arrival of a patient by the secretary, who brings the patient folder, or for the oncology patients, the appointment sheet. They prepare the tubes and needles needed and put them into a carton tray for each patient. Patient labels are put on the tubes. For the oncology patients this can be done one day in advance, in most cases. They take the information about patients and blood tests from the list of appointments that they print out from the oncological documentation system (ODS).

The patients are called in by a nurse. Blood samples are taken by the interns. However, before they actually take the blood they ask patients for their date of birth and compare it to the date on the patient labels on the tubes to make sure that there are no mistakes. The nurses prepare the documents to request the blood tests. For the oncology patients who only need routine tests (i.e., tests that can be done at the hospital laboratory) the request sheets are printed out from the computer system. The nurses also have to issue a request electronically; this is done from the ODS in the “day service”. For other patients and special examinations (like nuclear medicine or external laboratories) the nurses have to fill in documents by hand.

For acute blood the tubes with the blood samples are put into a plastic folder together with the request and are brought to the counter to be sent to the laboratory by pneumatic post. This is the usual procedure for the blood tests for chemotherapies. For all those tests that are not needed the same day the tubes are collected on a shelf together with the requests from where they are picked up and brought to the laboratory at 11 a.m. For some special examinations the tubes are packed in a box to be transported by taxi.

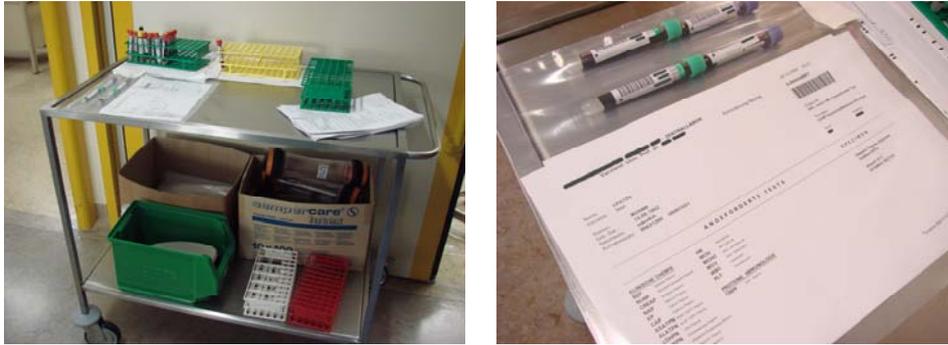


Figure Tubes prepared for blood tests and ordering form

All of the day the nurses are busy preparing blood tests, administering requests, and documenting their actions. For examinations in external laboratories, additional sheets have to be filled in (for the health insurance) and they have to be documented in a separate book. The procedures are manifold depending on the different institutions that are involved. To keep track the nurses have a book where they fill in alphabetically all the different methods of blood taking and the steps to be followed to send the blood and request the examinations needed for each service provider. For oncology patients the procedures are mostly routine—the requested values have been entered before and only have to be sent and printed out by the nurses. Demands and work loads change during the day: In the morning, mainly chemotherapy patients are treated; often they only need a needle if they already did their blood tests at an external laboratory. Later on there are more patients who come for aftercare. After 12 a.m. blood is only taken in cases of emergency. The nurses start their preparations for the next day, i.e., providing the tubes and other facilities for blood to be taken from oncology patients storing the carton trays in a shelf.



Figure Preparations for blood tests of the next day

Medical consultation

At ONC3 none of the doctors is especially assigned to the day clinic; they all see outpatients as well as those who come for the day clinic. They work in parallel (usually 3 or 4 doctors each day), i.e., they also share the patients. They try to assure some continuity so that one patient sees the same doctor most of the time. There is a great amount of rather routine tasks. Most of the patients have been to ONC3 before, so they know the procedures. They come for their chemotherapies or for checkups. There are also new patients or patients that have been sent by another institution. Many of the examinations are not done directly at ONC3, only the results are discussed with the patient, e.g., of blood tests or radiological examinations. However, they do auscultations or other manual or visual inspections. Punctures are also done at ONC3 in the beds of the day clinic.



Figure Doctor at his place in the consultation room

In the consultation rooms nurses and doctors work in tandems: One doctor cooperates with one nurse. When four doctors are present one has the room opposite the hallway, which means that patients have to go through another consultation room to reach it. In the rooms doctor and nurse have their own desks opposite each other, each with their own computer. The telephone between them is mounted on a swivel arm. The printer is reachable for both of them. The seat for the patients is at the short side of the doctor's desk. Additional chairs are there for relatives or companions on the wall behind the patient. The room also hosts a couch and light for examinations as well as a display board for x-rays and a wash basin.

The patient is called in by the nurse or the doctor. The doctor asks about his/her condition and looks through current examination results that are attached to the patient folder. In parallel, s/he calls up the patient on the computer. During the consultation the doctor might enter new diagnoses into the computer, prescribe additional medication, order a chemotherapy or a blood test and plan an admission to a ward. All this is done on the computer. There are also various possibilities to look up information in the computer. But when it comes to overview of a patient's trajectory, most of the doctors prefer the patient folder as the main source of information. Often they will have to look through older examination results. They mostly do this in the printed documents that they find in the patient folder. However, they can also look them up in the computer, either in tabular form where they see the last seven results or in graphical display. At the end of a patient's visit a new appointment is arranged. The appointment sheet is printed out and handed over to the patient. When the patient has left, the doctor enters the progress notes into the computer. Some patients call to learn about examination results. In these cases doctors often find sufficient information in the computer, so they do not have to get the patient folder.

Nurses assist doctors during consultations. That is, they make phone calls to arrange acute admissions to a ward and to organize examinations with radiology or external institutions, order special drugs or transport for patients. Sometimes they enter requests for blood tests or radiological examinations into the computer system. They copy or print out examination results to hand them over to patients. Nurses also do the admissions for all those patients who receive chemotherapies and some other therapies. They have only few tasks that can be labeled "care", i.e., sometimes the nurses make ECGs or take blood pressure and temperature or remove needles and treat wounds. During consultations nurses are usually present, so they take orders directly from the doctors to arrange for any immediate service. Often orders are not explicitly given, but nurses notice from the consultation what has to be done. In the following example a

doctor (D1) and a nurse (N) are working together. N is, on that day, also responsible to support another doctor (D2) who sits in a room on the other side of the hallway.

“D1 says “Let’s do [Pat. X] next, this is going to be fast.” [the patient comes for the next cycle of his chemotherapy] D1 takes the patient folder and looks through the results, N calls in the patient and tells him “You please go through backwards then.” [to the day clinic] D1 [has been working on the computer in the meantime] says that the chemo is ordered for today. He prints out the appointment sheet for Tuesday. The patient goes to receive his therapy.

N asks “next one is OK?” D1 affirms, N calls in the next patient, while D1 types the progress notes for the preceding patient. He receives a call on his mobile phone. N who had left the room comes back and puts the patient folder on the table in front of D1. On the phone D1 says that N is just listening and will be making an appointment for the ward. N takes the telephone and calls the ward immediately. She asks for a bed for the next week. D1 and N are on the phone simultaneously coordinating to arrange the appointment that has to be chosen in a way that a blood test can be done before. D1 tells N to enter it for Monday. N asks if the blood is to be taken “at our place”, D1 affirms. She asks for the values to be tested, D1 answers.

The next patient is present meanwhile. D1 explains his chemotherapy to him. [...] They arrange the therapy according to the patient’s vacation. D1 has a calendar in his pocket that he uses to look up the dates.

D2 comes by, N leaves the room with a patient folder.

D1 enters the therapy and the request for a blood test into the computer, N is back and takes away the needle from the patient. D1 writes the progress notes, he refers to the oncology meeting and writes among others “... holiday trip already planned ... therapy postponed ...” (OBS2, p. 3).

Doctors and nurses have a mutual awareness of open tasks and time and again they orient themselves about the workload. Nurses report to doctors about phone calls, incidents in the day clinic, or the condition of patients. They might write down, e.g., the blood pressure of a patient on the appointment sheet or put a Post-it note on the list of appointments if the doctor is not immediately available. During the day the nurses constantly check if there are blood results available. These can be called up in the computer and printed out. There are also other printouts (e.g., of progress notes) that have to be filed into the patient folders. Although nurses are assigned to doctors, there is also a strong cooperation among nurses. They take over tasks when they just come by or help out with information. Overall they are attentive to each other’s tasks.

There is a high workload and days are often quite hectic. One doctor says that they try to do the consultations fast, as they only get paid for a certain amount of overtime and hence avoid additional working hours. In the consultation rooms there is a constant come and go. The nurses often leave the room; other nurses and the secretary come by looking for something or someone. However, the atmosphere is very friendly and one of mutual support. There are different phases during the day. In the morning doctors are at their morning conference, and twice a week they have oncology and hematology meetings. That means that often patients and nurses have to wait. Chemotherapy patients arrive earlier in the morning, whereas patients for blood tests or consultations have their appointments later on. That is because chemotherapies take longer to be applied, especially if a blood test has to be done at ONC3. During the day it

may happen that doctors and nurses have to wait for blood results or chemotherapies as the pharmacy makes a daily break. The doctors are present until 1 p.m. Chemotherapies should be finished by that time; afterwards only the doctor on duty is there for emergencies. Around that time it gets calmer and there is more time for the nurses to do administrative tasks.

Therapies at the day clinic

Patients receive their chemotherapies and other medication (i.e., blood bottles or immunoglobulin, etc.) at the day clinic, and punctures are done. In the day clinic one or two nurses work together with an intern who does the application of the infusions.

In the room next to the beds of the day clinic the infusions are prepared by a nurse. In the morning those for accompanying medication are prepared, i.e., filled into a bottle and put into a carton tray for each patient. All the bottles are labeled with their ingredients and the patient's name. Later on, and repeatedly during the day, the chemotherapies are fetched by a carrier from the pharmacy. They are also put into the carton tray together with the "order form for cytotoxic drugs". Then they are brought to the patient to be applied by an intern.



Figure Preparations for chemotherapies

For some patients the nurses know what they receive because they have been coming for years, e.g., for one patient who comes three times a week they have a Post-it in their room with the therapy to be provided. The other patients are asked for their name and then the nurses check in the list of appointments what is to do, or if they come from a blood test it is clear that they will get a chemotherapy. Patients can choose if they want a bed or a chair.

The oncological documentation system

The oncological documentation system is used for medical documentation and workflow support (see above). At a patient's first visit basic information is taken over from the hospital information system (HIS). The doctors add specific information about the patient's condition. For chemotherapy patients it has to be ordered on the computer for that day, depending on the results of the blood test. The doctors might view or order blood tests or plan an admission to a ward. They can add medication and print out prescriptions from the system. Finally, they usually make a new appointment and print out the appointment sheet for the patient. The nurses use the system to administer blood tests and do admissions and reporting. All these functions and how they are used are going to be described in the following.

Doctors and nurses each have their own individual user IDs that they use to log into the system. For all relevant work processes their actions are traceable (INT8, p. 14). Nurses and doctors have slightly different rights, i.e., the main distinction is between two user levels with more or less rights. As the initiator of the system (S) describes it,

"They do not differ substantially, because it is recorded who does what. Why should a nurse not be able to print out an appointment sheet or write progress notes? For the name of the nurse is associated with it in the system and as part of the team she contributed, wrote something, whatever. It is clearly traceable. And it would be noticed if a nurse would order a chemotherapy: The pharmacy would immediately react, if there is the name of a nurse on the order" (INT8, p. 15).

Only for the doctors there is, e.g., a difference between regular doctors and interns. Interns are not allowed to order chemotherapies. They are able to write progress notes, but these have to be seen and can be changed by the doctors.

Before information about a patient can be administered in the oncological documentation system, the patient has to be registered in the general computer system of the association, the HIS (hospital information system). This is done by the secretary at the counter. She has to enter name, date of birth, address, telephone number, profession, citizenship, family status, employer, health insurance, and family doctor. For patients who have already been to another hospital of the association, these data can be taken over.

To be able to access the data in the oncological documentation system, the patient has to be activated. Once the data from the HIS have been taken over, the patient can be accessed and further processed. The basic data are checked from time to time by the doctors and updated or added if missing, e.g., telephone number or family doctor.

Erstaufrufe am	21.08.1998	Pat. Nr.	19980821001
Zuname	TESTPATIENTIN	Vorname	Eva
Geburtsname	Maier	Geburtsdatum	19.11.1943
Beruf	Angestellte	Vers. Nr.	114519111943
Geschlecht	W	Anrede	Frau
Telefon	2228795	Fax	
Strasse, Nr.	Erzherzog Karl Str. 137		
Postleitzahl	A-1220	Ort	Wien
Aufnahmezahl	12345	99000123	
Versicherung	WGKK	Wiener Gebietskrankenkasse A-1100 Wien	
Priv. Vers.			
Zureisler	ORTH	Orthopädische Abteilung des	
Hausarzt		Dr. Stefan A-1220 Wien	
Facharzt	ALFO	Dr. Alfons A-1220 Wien	
sonstige			

übernehmen ändern abbrechen

Figure Basic patient data in the oncological documentation system

One doctor explains how she uses the computer system by example of a patient's next visit on the 25th of July. Assuming that the patient is sitting next to her, she describes:

A4: He comes with this appointment sheet. I call up the patient on the computer. I see that he gets a chemo, that he brings blood results with him. I take the blood results, look at them, decide, whether it is alright. And if I decide "OK, it's alright", then I call up "protocols" [in the computer] and enter: new protocol – Avestin Irinotecan [name of the protocol], as starting date I enter the 25th.

TU: Then everything is taken over automatically for the 25th [a list appears with some substances, all dated for the 25th].

A4: Right, then I only need to – depending on what I want: If I see, he is in a good condition, he is young [the date of birth is visible on the screen in a window with basic patient data, which is opened in the background], he will tolerate it, then I only need to

accept it [she confirms the suggested dosages for all substances] and it is thereby ordered. This goes to the pharmacy, they receive the protocol and make the chemotherapy. If there are any questions they will call, but most of the time it is OK. Then I look again into the therapies [calls them up in the computer] Yes, there is a Kytril [medication added to the list of other medications]. This is done automatically: With the protocol it gets there [into the list]. Then I print out the prescription for him [issues it on the computer]. And then I call up “appointments” [function in the computer]. And because I know that it [the chemotherapy cycles according to the protocol] is biweekly [..and I assume that an earlier checkup will not be necessary as he did not respond too heavy with leukopenia to the last therapy..] I make the next appointment in two weeks. [...] So I have ordered the chemotherapy, have looked it up with all other medications, have printed out the prescription. Then I go into “appointments” and print the appointment sheet for the next visit, hand it over to him and are thereby finished. And then I write the progress notes” (INT5, p. 6-7).

Administering and documenting patient visits

When a patient is called up in the computer system, a menu for the patient appears giving the patient name, number, date of birth, and the main diagnosis. From this menu the basic data of the patient can be changed, the first anamnesis can be entered, as well as other general information about the patient. Each individual visit of a patient is documented separately. When calling up the function “visits”, a list appears.

Nr.	Aufnahme	Entlassung	Grund der Kontrolle	Station	A.Arzt/S.Arzt	Status
4	04.03.1999		Nachsorge-Kontrolle	M2AMB	HAB	offen
3	20.01.1999	29.01.1999	Chemo-Therapie	M2S46	HAB / RUC	
2	17.01.1999		Chemo-Therapie	M2S46	VED	
1	26.08.1998		Chemo-Therapie	M2AMB	VED	

Buttons:

Figure List of visits

For each visit (“Kontrolle”) of the patient an entry to this list is produced. The doctor has to enter the reason for the visit (“Grund der Aufnahme / Kontrolle”), e.g., chemotherapy or checkup. Sometimes this is used to indicate special events, e.g., stating “newly introduced patient: interposed and very late” (OBS8, p. 1) or “continuing the therapy after a long break” (OBS3, p. 2). The central menu for the administration of a patient visit appears.

Nr. 1/1 Aufnahme 26.08.1998 Entlassung Stat/Amb M2AMB aufnehmender Arzt VED
 verantwortl. Stat. Arzt
 verantwortl. Amb. Arzt VED

Grund der Aufnahme Chemo-Therapie

Größe 168 Gewicht 59 Körperoberfläche 1.7
 Blutdruck 150 / 90 Puls 80 Temperatur 36.7

Protokolle Symptome Status Wiederbestellung Grunddaten ändern Entlassung Auswahl einer Kontrolle
 sonstige Therapien Befunde Arztbrief Dekurs Drucken Kontrolle schließen beenden

Figure Menu for a patient visit

In this view the most important basic data is displayed as well as again the reason for the visit. The date is given and the name of the doctor, size and weight of the patient (these are important for the dosage of chemotherapies), blood pressure, pulse, and temperature. All the functions that are needed during medical consultation can be called up from this menu: diagnoses can be entered, blood results can be viewed, chemotherapies can be ordered, and new appointments can be made. Together all this information makes up the medical case history.

Entering diagnoses and status: At the first visit of a patient a thorough examination is done by the doctor (heart, lungs, ECG, blood pressure, pulse etc). The results and the patient history are recorded in the computer system.



Figure Entering diagnoses

The first and any further diagnoses are entered into the system, differentiating between main and secondary diagnoses. When entering the first letters, a list of diagnoses appears to be chosen from. To each entry in the list of diagnoses the corresponding ICD code is linked and appears upon entry of the diagnosis. It is also possible to enter diagnoses in free text; however, that means that they will not be connected with ICD codes. For each diagnosis the date is recorded, additional free text can be entered. For the main diagnoses of tumours, the classification and stadium can be added.

Viewing blood results: The computer system offers some possibilities to view the results of blood tests that have been done at ONC3. They can either be viewed as a list of single values or in a table. The table gives an overview of the development of parameters for seven points in time, i.e., seven weeks if a patient comes once a week, or two years if a patients comes in intervals of three months. To get more information, selected parameters can be displayed in graphs for the whole course of the treatment at ONC3. In the graphical display the connection between parameters and received therapy can be made, i.e., the vertical bars stand for chemotherapies, for each of them detailed information can be displayed.

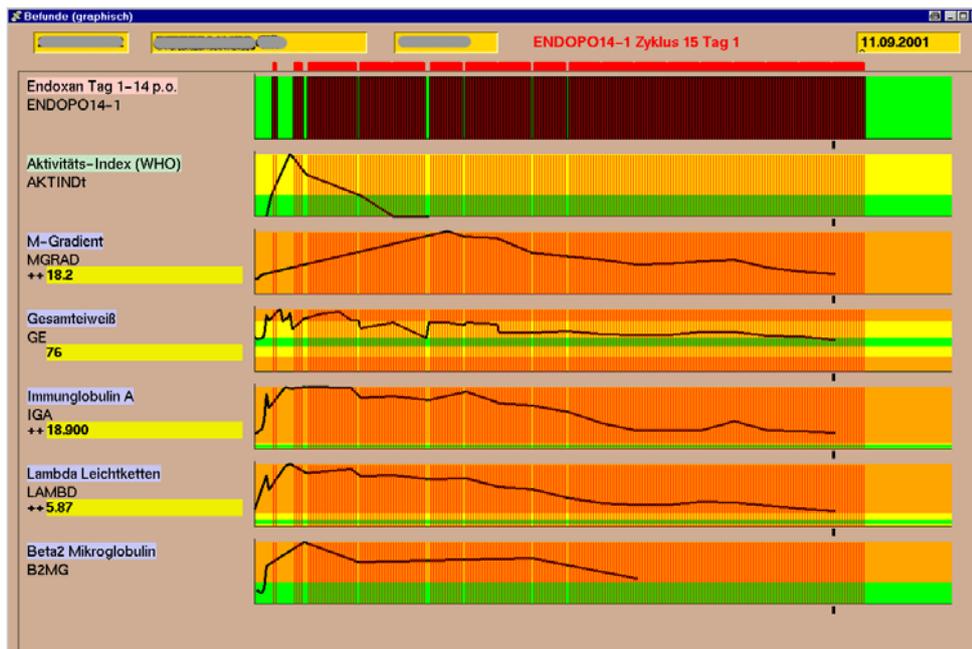


Figure Graphical display of the development of parameters

Ordering and viewing chemotherapies: The cytostatic drug to be applied has to be ordered by a doctor from the pharmacy each time a patient receives chemotherapy, i.e., often this has to be done weekly. To order a chemotherapy the doctor chooses “protocols” (“Protokolle”) from the main menu of the patient. A list of all cycles of previous and current chemotherapies for the patient appears. For each protocol there is a code (usually an abbreviation of the cytostatic drug with a number). The number of the cycle is given, begin and end date, the name of the doctor who ordered the chemotherapy, and the status (active, completed or aborted).

Protokoll	Zyklus	Beginn am	um	beendet am	Arzt	Status
NSMAMMA3M-1	2	24.06.1999	08:00		HAB	aktiv
NSMAMMA3M-1	1	01.04.1999	08:00	01.04.1999	HAB	abgeschlossen
CMFIV-1	5	13.01.1999	08:00	13.01.1999	HAB	abgebrochen
CMFIV-1	4	06.11.1998	08:00	12.01.1999	HAB	abgeschlossen
CMFIV-1	3	09.10.1998	08:00	13.10.1998	VED	abgeschlossen
CMFIV-1	1	26.08.1998	08:00	02.09.1998	VED	abgeschlossen

Figure List of chemotherapies for a patient

From this list the doctor can either choose an active chemotherapy or start a new protocol (“neues Protokoll”). To start a new protocol, the initial letters have to be entered and a list appears from which the protocol can be chosen. The protocol gives the cytostatic drugs for each cycle and the days of application (planned and accomplished). The dosage is calculated by the computer system from the weight and size of the patient, but it can be changed by the doctor, if required. Also, the dates can be changed for each day of application.

Kurzbez.	Zytostatikum	geplant		durchgeführt		Eh.Bz	User	Sta
TROPIV001	Tropisetron i.v.	1	12.01.99 15:00	5.00	1	12.01.99 15:00	5.00	
GEMIV001	Gemcitabine i.v. 1/2 h	1	12.01.99 15:00	2600.00	1	12.01.99 15:00	600.00	
TROPIV001	Tropisetron i.v.	8	19.01.99 15:00	5.00	8	19.01.99 15:00	5.00	
GEMIV001	Gemcitabine i.v. 1/2 h	8	19.01.99 15:00	2600.00	8	19.01.99 15:00	600.00	
TROPIV001	Tropisetron i.v.	15	26.01.99 15:00	5.00	15	26.01.99 15:00	5.00	
GEMIV001	Gemcitabine i.v. 1/2 h	15	26.01.99 15:00	2600.00	15	26.01.99 15:00	600.00	

Figure Details for a chemotherapy cycle of a patient

Additional measures are incorporated into the protocol. If a blood test or an x-ray is to be done this is automatically included in the planning system upon ordering the cycle of the chemotherapy. Other medication that the patient has to take at home during the chemotherapy is also taken up into the computer system automatically, i.e., it appears in the list of “other therapies” (see below). The order for the cytostatic drugs is sent to the pharmacy when confirmed by the doctor. It does not have to be printed out and signed. The pharmacy will then produce the drugs, and it will last for up to one and a half hours until it arrives at ONC3. If there are any problems or any further information is necessary or a therapy has to be cancelled once it has already been ordered via the computer system, this is done by phone.

With the process of ordering, the information is available in the computer system. The whole cycle of the chemotherapy is included in the planning system for measures, i.e., the new appointments for the according days are done automatically. The code for accounting is also automatically associated with the chemotherapy protocol. And the information about the therapy is available for the appointment sheet and other lists providing an overview of the therapies applied.

According to S there are hundreds of protocols (INT3, p. 14). The protocols can be changed and adapted to new requirements by the doctors (not by assistant doctors). Old protocols remain in the system even if they are no longer used to keep the documentation consistent. For each protocol the doctors can print out a therapy plan. The therapy plan comprises the cytostatic drugs as well as accompanying medication that has to be applied. It gives details about “the sequence for the application of the therapy: Whether it starts with the antiemetic or with the chemotherapy or else. [...] The procedure is recorded once according to a standard and is then applied each time in the same way, even by new colleagues or for patients with rare diseases. [...] And we have the data here – where we need them” (INT3, p. 9-10).

ZYTOSTATIKA - THERAPIEPLAN

Protokoll: EP IT AX 01-1 **Epirubicin/Taxol Protokoll**

TAG 0 16.11.1999 Dienstag

21:00 Fortecortin 20mg Tabl. p.o.

TAG 1 17.11.1999 Mittwoch

09:00 Navoban 5mg Amp. i.v. über 1min
 Fortecortin Amp. i.v. über 5min in 100ml NaCl 0.9%

09:05 Epirubicin 90mg/m² in 250ml NaCl 0.9% i.v. über 15min

09:20 Zantac 50mg Amp. i.v.
 Dibondrin 30mg Amp. in 100ml NaCl 0.9% i.v. über 5min

10:00 Paclitaxel 200mg/m² in 500ml NaCl 0.9% i.v. über 3std
 !!! nur beigelegte Infusionsleitung + Filter verwenden !!!

21:00 Zantac 300mg Tabl. p.o.

TAG 2 18.11.1999 Donnerstag
 bis

TAG 4 20.11.1999 Samstag

09:00 Navoban 5mg Tabl. p.o.
 21:00 Zantac 300mg Tabl. p.o.

TAG 5 21.11.1999 Sonntag

09:00 Navoban 5mg Tabl. p.o.
 Tavanic 250mg Tabl. p.o.
 Neupogen 30M ioE Amp. s.c.

21:00 Zantac 300mg Tabl. p.o.

TAG 6 16.11.1999 Dienstag
 bis

TAG 12 28.11.1999 Sonntag

09:00 Tavanic 250mg Tabl. p.o.
 Neupogen 30M ioE Amp. s.c.

21:00 Zantac 300mg Tabl. p.o.

TAG 13 29.11.1999 Montag
 bis

TAG 15 01.12.1999 Mittwoch

09:00 Tavanic 250mg Tabl. p.o.

Figure First of two pages of a therapy plan

Ordering and viewing other medication: There is a similar procedure to order other therapies, i.e., drugs that the patient has to take at home. These can also be chosen in the computer system from a predefined catalogue. It is done from the main menu via "other therapies" ("sonstige Therapien"). When the function is called up, a list of all medication for a patient appears.

Medikament	Dosis	Einheit	Appl.	Verabreichung	Beginn Dat.	Ende Dat.	Bemerkung
Dexamethason p.o.	20.00	mg	p.o.	1-0-0	23.11.1998	23.11.1998	von EPI/TAXOL-1 aktiviert
Ranitidin (Zantac) p.o.	300.00	mg	p.o.	1-0-0	24.11.1998	05.12.1998	von EPI/TAXOL-1 aktiviert
Granisetron p.o.	2.00	mg	p.o.	1-0-0	25.11.1998	28.11.1998	von EPI/TAXOL-1 aktiviert
G-CSF s.c.	30.00	ME	s.c.	1-0-0	28.11.1998	05.12.1998	von EPI/TAXOL-1 aktiviert
Ofloxacin p.o.	400.00	mg	p.o.	1-0-0	28.11.1998	08.12.1998	von EPI/TAXOL-1 aktiviert
Tarivid Tabl.	200	mg	p.o.	1-0-0	21.01.1999	27.01.1999	
Augmentin Tabl.	625	mg	p.o.	1-1-1	14.04.1999		
Tramal retard Tabl.	200	mg	p.o.	1-0-1	22.06.1999		
Tramal 30gitt				bei Schmerz	22.06.1999		
Nasivin Tropfen				2x tgl	22.06.1999		

 Auswahlliste Handelsname Medikamente

Figure List of drugs to be taken at home for a patient

For each drug the name is given, and the dosage, as well as how it is to be taken, e.g., "p.o." per orally or "s.c." subcutaneously once, twice, or three times a day, or in case of pain. Begin and end date are given. In the list also those drugs appear that have been activated by a chemotherapy

protocol. In the upper window previous drugs are listed and in the lower window those that are currently taken by the patient. If a new drug is to be added by entering the initial letters, a list of drugs will appear from which the doctor can choose. For some of the drugs the prescriptions can be printed out from the system and handed over to the patient.

Viewing and entering other treatments and results: The system also offers a view on all the therapies that have been provided under “tumor therapies” (“Tumor Therapien”). In this view all the measures that have been provided at ONC3 are included automatically. Other therapies like radiotherapy that are done at other sites can be entered from a catalog or in free text. The date and the providing institution of the therapy can be entered.

Tumor Therapien	Art	von	bis	Erfolg	Arzt/KH	Rez./Progr.
CMF Protokoll i.v.		07.11.1998			im Hause	
CMF Protokoll i.v.		08.11.1998			im Hause	
CMF Protokoll i.v. (12 Zyklen)		06.11.1998			im Hause	
EPI/TAXOL		19.11.1998			im Hause	
EPI/TAXOL		24.11.1998			im Hause	
CMF Protokoll i.v.		06.11.1998			im Hause	
CMF Protokoll i.v.		06.11.1998			im Hause	
CMF Protokoll i.v.		13.01.1999			im Hause	
CMF Protokoll i.v.		14.01.1999			im Hause	
Nachsorge Mammakarzinom 3-monatig		20.03.1999			2MED	
Nachsorge Mammakarzinom 3-monatig		30.03.1999			im Hause	

abbrechen

Figure List of all tumour therapies

A similar procedure can be applied to enter the results of examinations that have been provided by other institutions, e.g., x-ray or computer tomography.

Making appointments and ordering blood tests: To fix the date for a patient’s next visit, “appointment” (“Wiederbestellung”) is called up from the patient menu. A list of planned measures for the patient appears. Planned cycles of chemotherapies and other measures that have been ordered before are automatically displayed in this list. Additional measures like blood tests can be entered. This is done by doctors or nurses. Therefore abbreviations are used, e.g., #BB means “blood count” or #KOKLIN means “clinical control”. The calendar that is displayed in the upper left gives the numbers of patients that are already scheduled for each day. S says “so I can try to distribute the patients evenly over the days, not to have 30 one day and 60 on the next” (INT3, p. 8-9). Finally,

the appointment sheet is printed out (“Wiederbestellung drucken”) and the patient visit is thereby ended.

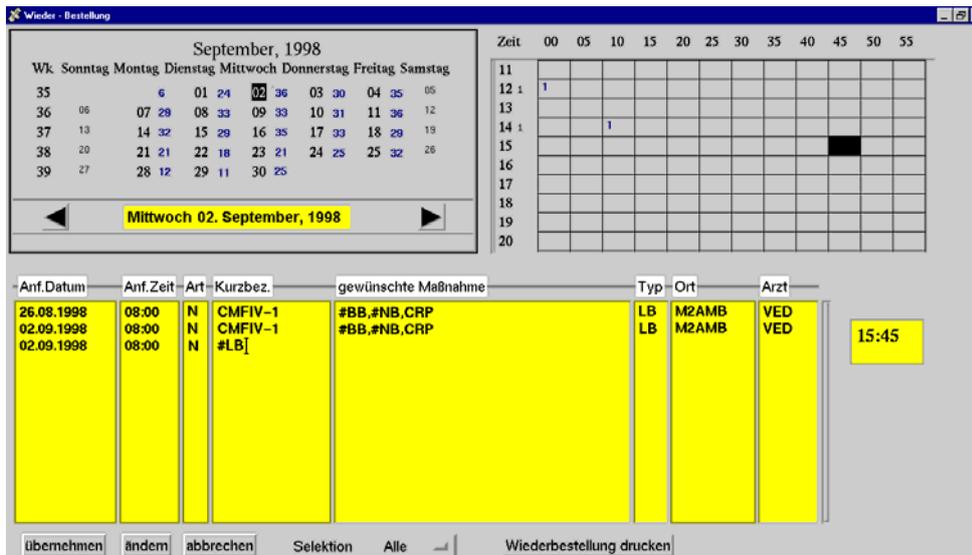


Figure New appointment with list of planned measures for a patient

Entering progress notes: The progress notes are directly entered into the computer by the doctors after the visit of a patient. The window below is used to enter the current notes, whereas in the upper window the notes from the last visit or any other visit can be displayed, giving for each the number, date and responsible doctor.

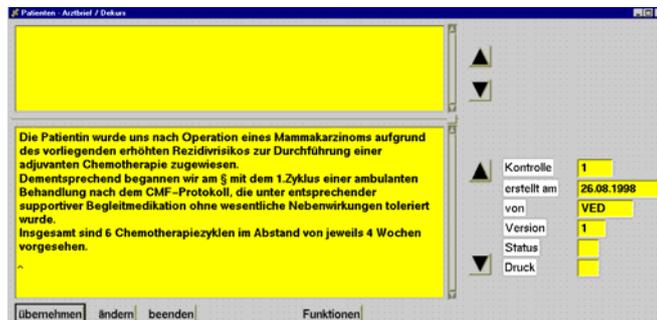


Figure Entering progress notes

The progress notes are mainly used for the communication between doctors: to provide information for the family doctor or to document the trajectory of the disease and the treatment for use at future visits of the patient either by the same or another doctor.

Usually they are held rather short. Most of the time only keywords and abbreviations are used, e.g., "GC good, PLT and Leuko further decreasing, dose of Velcade reduced to 2,0, NA 4.7." (OBS8, p. 2), where GC stands for general condition and NA for next appointment. Often values of certain parameters are included; this can also be done automatically. There might be hints on consultations of other doctors or a discussion in the oncology meeting. The progress notes are printed out and included in the patient folder. But they can also be viewed individually or displayed as a list on the screen.

Sometimes the progress notes are used to write patient letters. For that aim there are a number of alternative formats. All the text from the progress note for one visit is taken over into the letter automatically. If the progress notes are intended to be used for a patient letter they are written in whole sentences and provide more detailed background information. So the patient letter is

clearly for an external target audience like general practitioners and is thereby easily discernable from the other progress notes.

During consultations doctors and nurses work in parallel, each on their own computer. While doctors order chemotherapies and do the medical documentation, nurses check for blood and other results, order blood tests, and make admissions. Sometimes nurses take over tasks that are usually done by doctors, e.g., making new appointments. When patients call to reschedule an appointment this is also done by the nurses.



Figure Doctor's and nurse's place from the viewpoint of a patient

With the ordering of chemotherapies the doctors have to do a lot of work on the computer during the consultations. Sometimes patients are irritated; however, most of them are familiar with the necessary procedures. They see the screen and what the doctor enters into the computer. Sometimes this is used in the communication with the patient, e.g., the doctor showing the list of medication on the screen to the patient, asking if this is what s/he actually takes (OBS7, p. 1).

The computer system is not only used during consultations but can also be used to enter information between two visits of a patient. One doctor gives an example:

“The patient is already gone, later on test results arrive, something pathological. I can enter it immediately, so that at the next visit of the patient in two or three weeks it won't be forgotten” (INT3, p. 9).

Day service and administering blood tests

The “day service” (“Tages-Betrieb”) offers a view of “*all activities of the system on one page*” (INT3, p. 19), i.e., chemotherapies, blood tests, etc., for all the patients at one day. For each service the current status is given: O stands for open (“offen”), V for requested (“versendet”), B for available results (“befundet”) and F for approved (“freigegeben”). At the start of the day O gives the numbers of planned single measures, e.g., single blood values to be tested.

aktive Maßnahmen
 von 01.09.1990 bis 21.04.2010 Anzeige 5 Min Protok. Kontr. Labor Röntgen Sym/Sta

selektierte Maßnahmen
 von 26.04.2000 bis 26.04.2000 Arzt ALLE Station M2AMB Pat.ges 52

Datum	Zeit	Pat.Nr.	Patient	Protokolle				Labor/Kontr.				Röntgen				Sym/Sta				Dekurse				Knr.	Arzt		
				O	B	F	V	O	B	F	V	O	B	F	V	O	B	F	V	O	B	F	V				
26.04.2000	07:00		Franz					26	26	26																7	BUX
			Helene					12	12	12																3	RUC
			Roman					26	26	26																3	BUX
	07:30		Gertrude					3	24	24	27															2	RUC
			Roman					13	1	13																3	BUX
	07:35		Gertrude					2	1	1	3															2	RUC
	08:00		Edith					12																		7	BUX
			Johanna					26	26	26																3	RUC
			Gottmar					12	12	12																1	RUC
			Richard	1	1																					4	RUC
			Johann					20	20	20																10	KIE
			Elfriede					12	12	12																3	BUX
			Christina					12	12	12																7	RUC
			Gertrude					26	26	26																7	BUX
			Stefan					12	12	12																8	BUX
			Franz					12	12	12																1	BUX
			Leopold					26	26	26																2	BUX
			Franz					26	26	26																5	RUC
			Walter					20	20	20																1	HAB
			Otto					26	26	26																2	BUX
			Kurt					19	19	19																3	HAB
			Friedrich					12	12	12																9	BUX
			Wilhela					27	27	27																2	BUX
			Elfriede					3	24	24	27															2	HIN

abbrechen Drucken Wiederbestellung Protokolle Labor/Kontr. sonst. Therapien versenden

Figure Overview of tasks for patients at one day in the "day service"

This view is used by the nurse who is responsible for the blood tests. When a patient arrives to have blood taken, the nurse sends the request for the tests to the laboratory by choosing the patient's name in the list and pressing "send" ("versenden") from the menu below. S/he has to indicate if it is acute or routine blood. The blood tests are prespecified, i.e., usually they have been decided at the patient's last visit and appear automatically in the list. However, the nurses can change or add single values if required. Once the blood tests are evaluated by the laboratory (i.e., one or two hours later) the numbers are displayed accordingly in the system. The same applies for chemotherapies: The display changes upon ordering, validating, and accounting for the chemotherapy. So this view can also be used by doctors and nurses to get an overview of the workflow and open services. There are links to the services for individual patients so that the chemotherapies or appointments can be called up and adapted for each of the displayed patients.

Admissions and reporting

Admissions have to be done for all those patients that have been taken up in the day clinic for chemotherapy or some other therapies. They are done by the nurses in the consultation rooms for all of their patients of the day each. For the admission they formerly had to fill in an admission sheet. This sheet is still necessary, however they can now fill in the data into the computer system and send the MEL* code electronically. One nurse emphasizes that she appreciates that as they had to do it by hand before (OBS 10, p. 2). The sheet is then sent to the admission and they receive the patient number for that day. Later on the information is transferred to the accounting department. At the end of the day the nurses produce a list with the ICD codes for the diagnoses and MEL codes for the services provided. They have to confirm the services provided for each patient in the computer system. This list is then sent electronically to the administration department of the hospital. The ward book that the nurses have to provide for

* MEL stands for "medizinische Einzelleistung" ("individual medical service") and refers to a catalog of services used to support accounting in all Austrian hospitals.

each day giving the number of patients is also produced by the computer system and printed out. Formerly they had to do this by hand.

For all other services provided at the outpatient clinic the nurses have to enter corresponding codes into the hospital information system (HIS), i.e., this is not supported by the oncological documentation system.

KEY ARTIFACTS AND WORK PRACTICES

The computer system in ONC3 successfully supports a great deal of the work processes. However, patient folders are still a central source of information, and various paper documents are used to provide information and support communication. In the following the central coordinative artifacts are described. Most of them are computer generated based on the data entered by doctors and nurses.

Patient folders and identification of patients

Different colors of patient folders denote the different groups of patients at ONC3: They stand for general internistic patients or specific diseases (e.g., liver patients have light blue folders, and dark blue stands for clotting patients who receive Macomar). The psychologist uses separate folders of another color. There are yellow stickers for patients with infections to advise caution when taking blood samples and others for patients who take part in a clinical study.



Figure Patient folders in the archive at the counter

The folders for oncology patients are green. The current folders (i.e., folders from patients that have been called up in the computer system in the last 400 days) are stored in closets at the counter that are left open during the day. The patient folders are organized by the patient ID, i.e., the number patients receive at their first visit at the outpatient and day clinic. The sequential number (the last part of the ID that serially numbers the patients for each year) is noted on the folders and used to bring them into a consecutive order. The folder in this example (see figure) is for a patient who first came to the outpatient clinic of ONC3 in the year 2003 and was numbered

569. A patient label is put on the folder to identify the patient: It contains a barcode and in human-readable text the patient's name (first line on top of the barcode), indicates whether the patient is male or female (in the upper right), followed by the patient's address and date of birth as well as information about the insurance (e.g., whether the patient has complementary insurance), and on the left underneath the barcode the insurance number and the whole patient ID (including information about the hospital and the department within the hospital).

The patient folders contain information about the patients' trajectories for the treatments and examinations to be provided at the outpatient and day clinic. When a patient is admitted to a ward the patient folder is transferred to the ward for the duration of the patient's stay there. The patient folders contain copies of external examination results. For all the measures that are taken at ONC3 the contents of the folders are mainly printouts from the computer system. The anamnesis is printed out. Blood results are printed out individually. Sometimes printouts of cumulative results in tabular form are done, these are also included in the folder. Therapy plans are printed out for chemotherapies. The progress notes are printed out each time a new one is added. One copy of the appointment sheet is stored for each visit of a patient. S explains that it is in the responsibility of each doctor what s/he prints out to be stored in the folder. He says that he would, for example, not always print out a new list of diagnoses if only a small detail was added (INT8, p. 3-4).

At their first visits the patient folders are prepared and the patients receive a small card with their patient label on it. The address of ONC3 is stamped onto the back side of the card. The secretary explains *"The stamp is there to give the patient the telephone number. And there is also the patient label. When the patient provides the card, you know if he is here for the general or for the oncological outpatient clinic. And there are name, ID and insurance number on it, just the most important information"* (INT7, p. 3). Patients are told to bring it along at each of their visits. This is crucial to quickly locate the corresponding folder. Otherwise the ID has to be looked up in the computer.

The secretary explains that upon the arrival of an oncology patient, she used to search for the folder in the closets behind her and bring it to the corresponding bunk. However, due to lack of personnel they have introduced a new procedure: They prepare the folders one day in advance (INT7, p. 2-3). To be able to do this the list of appointments (see below) is used and the folders are arranged in different piles for each of the doctors. When a patient arrives the folder is transferred to another pile (that of the current patients), and from time to time the secretary distributes the collected folders to the doctors.

The secretary bringing the patient folder indicates that a patient has arrived. The nurse in the consultation room puts the folders on a sideboard in the order of the patients' arrival times. However, she puts those folders last where patients still have to do a blood test. Each of the folders is directly accessible for nurses to search through them or bring additional sheets to be put into the folder or attached onto them. Current examination results (e.g., from a blood test or from nuclear medicine) or sheets of informed consent for a chemotherapy and the appointment sheet are attached to the folders with a paper clip.

The number of the folders gives an estimate of the workload. From time to time during the day, doctors and nurses turn to the folders just to get an impression of how much work is still waiting for them. During the consultation the doctors use the patient folders to look up information about therapies and examinations. Most of the information is also accessible on the computer; however, most of the doctors prefer to read it from the printouts, e.g., of the progress notes.

Maintaining patient folders up-to-date is a main task for the nurses. They sort in signed examination results and constantly check if all relevant information is available.

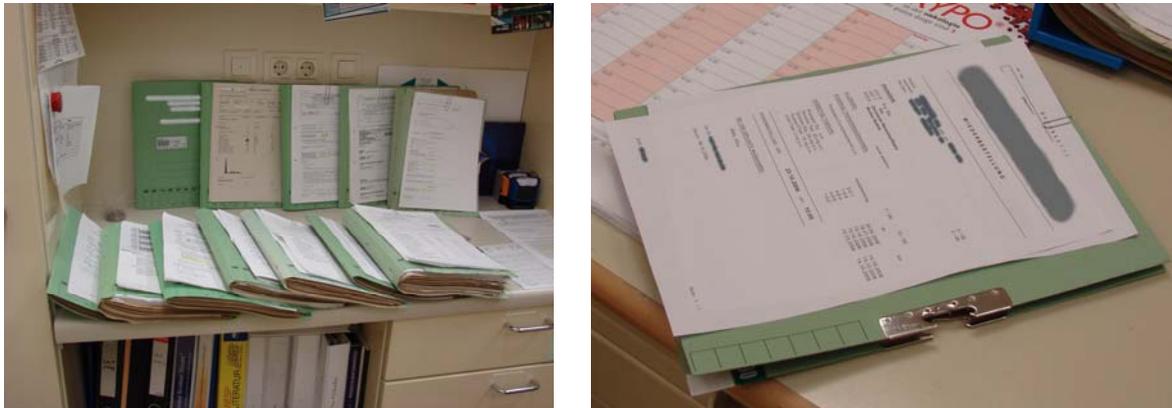


Figure Patient folders in the consultation room

For those patients who receive chemotherapy, the folders travel to the day clinic for the nurses to do the care documentation. It is handwritten and included in the patient folder. The nurses document the chemotherapy and additional medication that patients have received and how they tolerated it.

Folders of patients that have not been to ONC3 for more than a year are archived. One nurse mentions that they try to archive all the folders that are not needed any longer as they do not have enough space to keep them (INT8, p. 2). The archiving procedure is quite time consuming. To archive a folder, all clips and pictures have to be removed and its content has to be scanned. Then it has to be checked if the archiving procedure in the hospital information system is completed. This happens if a patient has not been called up in the system for 400 days. If a signature for an examination result is missing it has to be done manually. The folders are then transferred to the basement. If a patient whose folder is already archived comes again, a new folder has to be set up and the administration has to be done anew. To receive an archived folder, e.g., to have access to external examination results that are not in the oncological documentation system, it has to be ordered by e-mail.

List of appointments

The list of appointments (“Wiederbestelliste”) is the central sheet to support the workflow. It is used throughout the outpatient and day clinic and is perceived as very useful by the nurses (OBS6, p. 3). It gives an overview of all oncological patients for a day, i.e., it comprises information about all the oncological patients of the outpatient and the day clinic. The patients are listed in alphabetical order. For each patient the name is given and the patient ID, followed by the planned measures with appointed times and the codes of the doctor that they are assigned to, as well as the one that they have seen at their last visit.

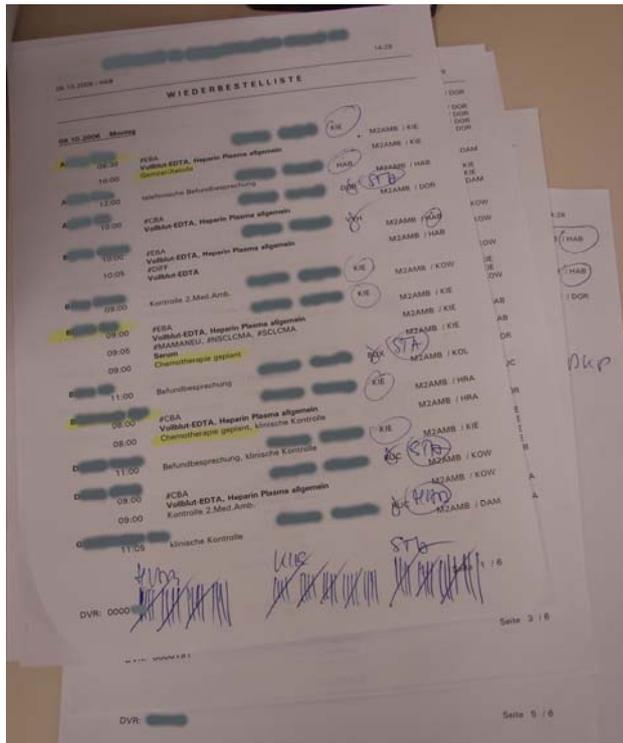


Figure List of appointments

The list is generated the day before or in the morning by one of the doctors, usually a senior physician at the outpatient and day clinic. He uses it to assign patients to doctors, distributing them evenly among those on duty that day and trying to assure patients are seen by a doctor who they are already familiar with. In the example sheet (see figure) it can be seen how patients were distributed to the three doctors. Patients who come for their first visit are not yet in the computer system. Their names are added to the list by hand and it is indicated if they are male or female. For short-term appointments patient labels may be stuck onto the list. It also happens that appointments have to be cancelled, e.g., if a patient has been taken up on a ward in the meantime. In this case the name is crossed out on the list. The list is copied and distributed all over the outpatient and day clinic. Each doctor and nurse have their own copy. For all preparatory work earlier printouts of the appointment list are used (without the assignments of patients to doctors and current changes).

For the secretary at the counter the list of appointments is the main source of information for oncological patients, as she does not use the computerized oncological documentation system. She takes the list of appointments to get the patient folders one day in advance. During the day she checks off the patients that have arrived. The list also gives her the information for which of the doctors each patient is scheduled. Accordingly she distributes the patient folders to the consultation rooms.

The nurses who are responsible for the blood tests also use the list of appointments for preparations one day in advance. On the list abbreviations are given for the tests to be performed, i.e., the values to be tested, e.g., for certain tumor markers. But it also provides additional information. On the list the nurses see what kind of tubes to use. This is especially helpful for nurses who are still on training. However, as one student nurse adds, the number of tubes to be prepared is not provided. Overall she appreciates the detailed information given on

the list *“because you also see what patients receive otherwise. So you cannot overlook for example that an IV has to be applied”* (OBS9, p. 7).

For the preparations the nurse follows a routine procedure using the list of appointments (see OBS9, p. 3-4): In a first step she gets the patient labels for all the patients who have to have a blood test done. To facilitate work, the labels from previous visits are stored in alphabetical order in a drawer. She marks the names on the list where labels are missing to print them out from the computer system later on. When looking through the labels she checks if the patient ID on the stored labels is still valid and sorts out old ones. Checking the patient IDs is also important because there are many patients with the same family name. For these patients the names on the labels are highlighted with a marker. In a second step, the order forms for special examinations that cannot be done in the local laboratory are filled in and patient labels are stuck onto them. And finally, in the third step, the actual tools to take the blood samples are prepared, i.e., patient labels are put on tubes according to the tests to be done. Small labels are used for the central laboratory. The labels for external examinations are larger as they also contain information about insurance. A needle is added or a special cannula for patients who have a port-a-cath, i.e., a device for frequent intravenous access. For all those patients who have a port-a-cath, this is noted on the labels in the drawer or the nurses just know. Patients who are going to get an IV are marked yellow on the list of appointments. The prepared tubes, needles, and order forms are stored in carton trays in a shelf, giving a good estimate of the workload for the next day.

When a patient arrives the nurse checks for the tests to be done on the current list of appointments, as there might be changes in the examinations to those that are given on the list that they have used for the preparations a day before. She prints out the order form from the computer system and checks off the patient name on the list of appointments.

In the consultation rooms doctors and nurses each have their own lists of appointments. The nurses find anything that is planned in advance for that day on the list of appointments or on the appointment sheets for each individual patient. They use these sheets to prepare whatever is needed for the consultation, e.g., they check if blood results are available.

One nurse talks about the list of appointments as “our list” (OBS2, p. 1). She says that on the list they see who is expected for the outpatient clinic for that day and what is to do: a blood test, the discussion of examination results, or chemotherapy, etc. Nurses use the lists individually, however, as one nurse comments, they do it in a similar way. They may highlight “their” patients with a marker, check them off if they are finished, or make annotations, e.g., if a patient receives anything additionally, like a concentrate of erythrocytes. Nurses are constantly aware of open tasks that still need to be completed; they work through a ‘list of tasks’ they have in their minds—to support this they use their copy of the list of appointments.

The doctors also use their copies of the list to have an overview of all the patients they are going to see that day. They have it lying on their desks in front of them. They also mark things or make annotations. Sometimes the list is used to support communication, i.e., a nurse might stick Post-it notes on the list of a doctor to notify him/her of important events or to provide information. At the end of the day the nurses have to confirm the provided services in the computer system; for this they also use the list of appointments with their annotations.

At the day clinic all the patients who receive chemotherapies, or where crossmatched blood is taken, are highlighted with a marker on the list of appointments. For some of them the list says “chemotherapy planned”, whereas for others the name of the therapy is provided. Throughout the

day the list is used to check if anything has been overlooked or to see how many patients are still to be expected.

Appointment sheet

The appointment sheet (“Wiederbestellung”) is the central sheet supporting a single patient’s trajectory while at the outpatient and day clinic. It is a computer-generated sheet that patients receive at the end of the consultation from the doctor. Another printout of the sheet is stored in the patient folder.

The sheet lists relevant information at one sight. It provides:

- name, date of birth and address of the patient, patient ID
- all the diagnoses and when they have been made (“Diagnosen”)
- all therapeutical interventions that have been taken so far, again with their dates (“Bisherige Therapiemaßnahmen”)
- all current medication and dosage (“Derzeitige Therapie”)
- date and time of the next appointment
- planned measures for the next appointment (“Bei uns geplante Massnahmen”)
- name of the doctor who made the appointment and date

The example of an appointment sheet (see figure) is only for a test patient, i.e., diagnoses and therapies are not realistic.

WIEDERBESTELLUNG

Patientin: **Mag. TESTPATIENTIN Eva**, geb. am 19.11.1943
 wohnhaft: A-1220 Wien, Erzherzog Karl Str. 137

DIAGNOSEN:

174.6	N. mammae links – Lokalisation Achselhöhlenende	7 / 98
197.7	hepatale Filiationen	11 / 98
401	Hypertonie essentiell	1 / 90
414.0	Koronare Herzkrankheit	1 / 80
531.0	Ulcus ventriculi Forrest III	4 / 99

BISHERIGE THERAPIEMAßNAHMEN:

Ablatio mammae sin.	7 / 98	
CM F Protokoll i.v.	8 / 98	- 10 / 99
Epirubicin/Taxol Protokoll	11 / 99	

DERZEITIGE THERAPIE:

	Verabreichung	ab	bis
Fortecortin Tabl. 5 mg p.o.	4-0-0	17.11.1999	17.11.1999
Zantac Tabl. 300.00 mg p.o.	0-0-1	18.11.1999	29.11.1999
Neupogen Amp. 30.00 ME s.c.	1-0-0	22.11.1999	29.11.1999
Tavanic Tabl. 250.00 mg p.o.	1-0-0	22.11.1999	02.12.1999

WIEDERBESTELLUNG AM: **26.11.1999** um: **09:00**

BEI UNS GEPLANTE MASSNAHMEN:

#CBA

OA Dr. **XXXXXXXXXXXXXXXXXX**

Datum: 14.11.1999

Figure Section of the appointment sheet

In the section of “planned measures” abbreviations are given for the blood tests to be done at ONC3, e.g., #CBA stands for “chemotherapy blood acute”, which means that acute blood has to be taken and a chemotherapy is planned for that day. Other measures are listed like a clinical checkup or a therapy to be continued. If the discussion of results is planned for that day, the kind of examinations that the patient has to provide is noted, e.g., a CT of abdomen and lungs or specific blood tests. These are marked as “external” on the appointment sheet. Also, the time of the appointment gives hints about the service to be provided: Patients who come for a chemotherapy usually have appointments early in the morning, e.g., at 8 a.m. Those with appointments around 11 a.m. come with external examination results to be discussed.

The appointment sheet serves multiple purposes: It is intended for use of the patient, giving the date of the next appointment and the examinations to be done. It is also there to provide information for the family doctor. While a patient is at the outpatient and day clinic of ONC3 it regulates the workflow. Appointment sheets are present in all the rooms and travel between significant places during a patient’s stay.

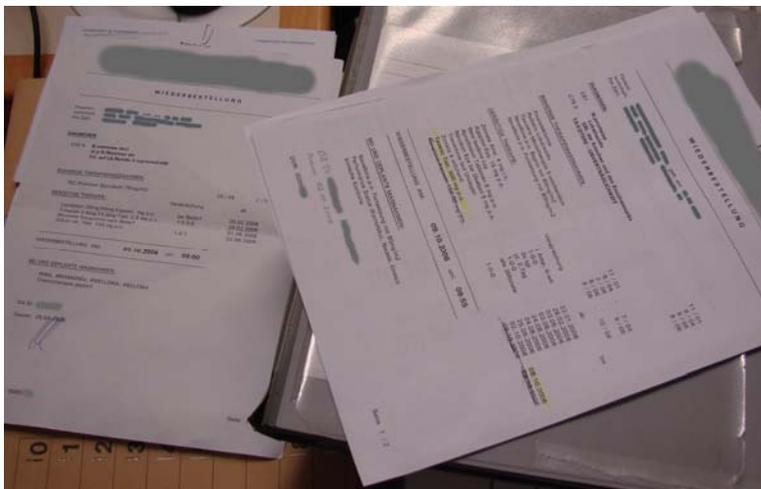
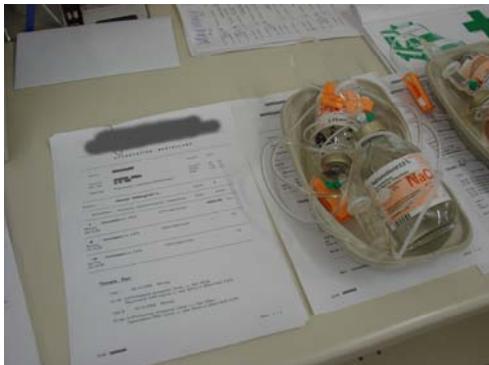


Figure Appointment sheets at the counter

When patients arrive they hand over the appointment sheet to the secretary at the counter. From the sheet she sees what is planned for that day and directs the patients accordingly to consultations or to have blood taken. If a blood test has to be done at ONC3, the appointment sheet is brought to the room where the blood is taken, indicating that the patient has arrived. The nurses check if the tubes that they have already prepared are right, as it happens that changes were made in the meantime. In a consultation the appointment sheet is central for the doctors, and often they look at it first. It tells them about what is to be done that day. Furthermore, during the consultation, doctors might turn to the appointment sheet to get a quick overview of the current state and the course of the treatment. A new appointment sheet is printed out twice from the computer system at the end of a patient’s visit. One printout is handed over to the patient, the other is put into the patient folder. If changes have to be made to the services for the next appointment, e.g., as an according decision has been taken in the oncology meeting or the patient had problems in the meantime, these are noted on the appointment sheet in the patient folder by hand. All the appointment sheets for each of the patient’s visits are stored in the patient folder.

Ordering form for chemotherapies

The ordering form for chemotherapies ("Zytostatika-Bestellung") provides information about the chemotherapy for a patient. The form incorporates a chemotherapy protocol; however, it is tailored to the application of the therapy on a certain date to a specific patient. It gives details not only about the infusion to be provided on that day, but about the whole therapy cycle. In the example (see figure) it is the first cycle of a scheme called "Gemzar 1000mg/m² i.v." This cycle comprises three days of weekly application. The order is for the first of the three days, the date is given, as well as the cytostatic drug to be applied, the duration, the solution to be used, and the dosage. In the header, name and date of birth of the patient are given as well as the diagnosis. A student nurse comments that she appreciates the listing of the diagnoses as this allows her to learn more about the treatments for different diseases (OBS10, p. 5). The order form also provides weight, size and body surface in square meters. This is needed for the dosage to be calculated. However, in ONC3 the calculation is done automatically by the computer system with the possibility to be changed by the doctor upon ordering the chemotherapy. At the bottom of the form the therapy plan is given in more detail, including concomitant medication. This is continued on the following page(s).



ZYTOSTATIKA - BESTELLUNG

Station: [REDACTED]	Telefon: 3250		
Patientin: geb. am: [REDACTED]	Gewicht: 59 kg Größe: 156 cm KOF: 1,57 m ²		
Diagnose: N.pancreatis; Lokalisation Pankreaskopf			
Schema: Gemzar 1000mg/m² i.v.	Zyklus: 1		
Zytostatikum	Applikation, Applikationsdauer, Trägerlösung	Dosis	Einheit
1 Montag 09.10.06	Gemcitabine i.v. 1/2 h	250ml NaCl 0.9%	1600.00 mg
8 Montag 16.10.06	Gemcitabine i.v. 1/2 h	250ml NaCl 0.9%	... mg
15 Montag 23.10.06	Gemcitabine i.v. 1/2 h	250ml NaCl 0.9%	... mg

Therapie - Plan:

TAG 1 09.10.2006 Montag
01:00 5-HT3-Rezeptor Antagonist 1Amp. i.v. über 30sec
Gemcitabine 1000 mg/m² i.v. über 30min in 250ml NaCl 0.9%

TAG 8 16.10.2006 Montag
01:00 5-HT3-Rezeptor Antagonist 1Amp. i.v. über 30sec
Gemcitabine 1000 mg/m² i.v. über 30min in 250ml NaCl 0.9%

Figure Ordering forms for chemotherapies in the day clinic

In ONC3 the order form is mainly used for the communication between doctors and the day clinic. When a patient has been seen by a doctor and it is decided that the chemotherapy is going to be applied, i.e., the chemotherapy has actually been ordered from the pharmacy, the nurse from the consultation room hands the order form over to the nurse in the day clinic. In the day clinic the nurse uses the form to prepare for the chemotherapy, i.e., she prepares the bottles with the solution substance and the devices for the application of the infusion. The name of the patient is written onto the bottles. When the chemotherapy arrives from the pharmacy it is brought to the patient to be applied by an intern. Upon completion it is checked off on the ordering form.

The order form is also used in the pharmacy where it is sent by the computer system and printed out to be entered into their local system.

List of patients in the day clinic

In the day clinic a calendar is used to give an overview of the patients currently in the day clinic. For each week there is a big sheet with lists of patient names for each day. It lies open on the desk in the room where infusions are prepared. When a patient arrives at the day clinic his/her name is written down on the calendar: on top of the list for all those patients who receive chemotherapies or other expensive infusions (blood bottles or immunoglobulin etc.) and at the bottom of the list for those who receive other infusions. Special needs are indicated, e.g., “Ery” is added for patients who receive a concentrate of erythrocytes.



Figure List of patients in the day clinic

The list supports the cooperation of the nurses in the consultation rooms with the nurse in the day clinic. When a patient has been seen by one of the doctors and is sent to the day clinic the nurse from the consultation room adds his/her name to the list, notifying the nurse in the day clinic that the patient has arrived and is ready for treatment. When the admission for the patient is finished the nurse adds a point before the name of the patient, again communicating the completion of the task to the other nurses. As there is a constant come and go of nurses in the day clinic, the list is a very simple means to share information, as one nurse explains: *“From the list you know on the one hand who is already there and on the other hand for whom the admission has already been done”* (OBS10, p. 2). Contrary to the list of appointments that lists all patients (not only those receiving chemotherapies) and comprises some pages, the list on the calendar provides an overview at one glance.

STARTING TO UNDERSTAND COMPUTER-BASED DOCUMENTATION

At first sight the work practice at ONC3 does not differ much from that at ONC1 and ONC2: Patient folders are still the main source of information. Although in some situations, e.g., when patients call to learn about examination results, the information in the computer system might be enough. However, for each patient visit the paper folder has to be provided. Keeping the folders up-to-date is a major task for the nurses. Paper documents are used throughout the outpatient and day clinic. These are computer generated, but they are used in a similar way as in the other departments. Current changes might be added by hand, relevant information is marked, and annotations are made individually. As the initiator of the system at the outpatient and day clinic (S) remarks: *“We sure have more paper than ever before, despite EDP”* (INT3, p. 16). However,

there are important differences for the daily work practice and in respect to evaluations that are possible through access to categorized data.

Supporting daily routines

A main advantage of the computer system is that *redundant procedures* are supported. This is especially important in oncology as there are a lot of routine procedures: patients coming for regular chemotherapies and having to do blood tests before therapies and for checkups. At ONC3 chemotherapy orders do not have to be filled in by hand for each cycle of the therapy. Rather, there is a huge amount of protocols that contain not only the cytotoxic drugs but entire therapy plans. This means that they include all the cycles and other measures that can be planned via the system. The dosage is calculated automatically and patient data is taken over from the system. The connection to the pharmacy is built into the system, i.e., orders are sent at the push of a button and do not have to be transferred by fax or mail. The same applies for the laboratory. Blood tests are specified by doctors in the system, routine combinations of values to be tested are automatically available. Nurses send the requests via the system and do not have to enter individual values into a sheet. An electronic appointment system is built into the system. This means that planning in advance is possible, not only for individual doctors but for the whole outpatient and day clinic. Through the integration of appointments with the planning of therapies and other measures, an overview of the current status for all patients of a day is achievable in a list that indicates the progress for each service. Also, the double entry of data is reduced. The coding of information in the system makes it directly useable for accounting purposes. The data only have to be checked by the nurses for each day and are then transferred by the computer system. Finally, the information of what is to be done with a patient is centralized to a single source. The central sheet for a patient is the appointment sheet that gives either the information as stored in the computer system or handwritten changes.

Besides these rather obvious advantages of supporting routine procedures, the use of computer-generated documents, and the fact that information has to be entered into the computer system, make a difference to paper-based documentation systems.

There is a *systematic overview* built into most of the printed documents. For example, the appointment sheet does not only provide the date and reason for the appointment but it also gives basic patient data, a list of all the diagnoses with their dates, a list of the medication that the patient is currently taking, and previous and current therapies. Also, when computer functions are called up, a comparable kind of overview is provided, e.g., upon entering new medication the list of all previous and current medication is displayed. That is, by way of using the computer-generated sheets and entering information into the computer, an overview of the trajectory of a patient is achieved at one sight. They provide more information than handwritten paper sheets in a structured manner. This is especially important in oncology as some of the patients already have a long medical case history, and overview is hard to achieve. The provided information is also tailored to the needs of the specific situation.

In the computer system almost all the *information is categorized*. There are a number of catalogs to support the administration of diagnoses, chemotherapies, medication, etc. These are either international classifications, e.g., ICD codes are used for the diagnoses and tumours can be classified according to WHO scales, or they are maintained by ONC3, like the chemotherapy protocols that can be generated and changed by the doctors. For the daily work practice, that means that doctors do not have to remember the exact name of a protocol to be applied but can choose from a list. The same applies for the diagnoses that can be chosen from a list by

entering the first letters, so that they do not have to know the ICD codes. Abbreviations are used, e.g., to specify blood tests. The long text appears automatically. Also, additional information is built into the system. For example, upon entering specific information about a tumour each entry into the classification scheme is explained. This is especially helpful for interns. S mentions that it is important to see what the individual values denote and that you have this information as long as the patient is still present (INT1, p. 2). Also, for the nurses on the list of appointments the tubes to be provided for the blood tests are specified. Again, this is especially helpful for student nurses. The therapy plans are another example of this strategy to make additional information available.

Statistical evaluations and clinical studies

As already mentioned, the reporting that is necessary for accounting is facilitated by the system. However, there is much more information available in the system about patients, their condition, and their treatments. It is only used internally by the department. At ONC3 they have about 10.000 patients who are documented in the system (INT8, p. 18). They make up for 120.000 visits and about 2 million examination results (most of them structured) that are accessible (INT3, p. 13). Through the coding of the data in the computer system, statistical evaluations are possible on a fine-grain level. S gives an example: It is possible to find all the patients with a certain diagnosis and a certain chemotherapy, who have certain blood values and have received medication from a certain doctor. He comments "*if anybody wants so, it would create extreme transparency*" (INT8, p. 18). In practice, the evaluations are used by individual doctors who need them for their research or to be able to answer to requests of firms who ask for their participation in larger clinical studies. With the computer system they can easily decide if they have enough patients who fulfill the study criteria, e.g., a certain diagnosis with a certain pretreatment. Two levels of evaluations are possible: a simple one that is accessible for all of the doctors and another more complex one that requires instruction. For clinical studies it is also possible to define study protocols. In these protocols special requirements are included. That is, upon requesting the chemotherapy, additional measures that are necessary automatically appear, e.g., blood pressure, pulse, general condition, or values of toxicity have to be entered (INT3, p. 12).

Preconditions for the successful use of the computer system

There are some preconditions that are crucial for the computer system to be successfully used. First of all, the *integration of all relevant data* is important. For the oncological documentation system it is important that all blood results are available in the system. They do not necessarily have to be graphically displayed. Being able to view more of them on one table rather than having to search through each of them on paper sheets is often enough. To make full use of the computer system and the evaluations that are possible, other data should also be available, including results of external examinations like x-ray or CT or information about treatments that have been provided at other institutions. Currently this information is mostly available on paper documents only, e.g., patient letters that patients bring with them. Some information about former stays at other hospitals of the association can be gained from the hospital information system. To be accessible in the oncological documentation system it has to be entered. Especially for the blood results, an interface to external laboratories would be useful.

It takes quite an effort to *maintain and adapt all the catalogs* that are used by the system. However, it is crucial that this can be done by the personnel and no external resources are

necessary. The catalog for the diagnoses used by the computer system is a modified version of the ICD catalog. S gives an example:

“The diagnoses for atrial fibrillation and flutter are the same, namely I 48. So in the patient letter it would always say “atrial fibrillation and flutter”, and this is not quite correct for the respective case. That means, for a patient who has only atrial fibrillation, it should not say atrial flutter. And it’s the same for many other diagnoses. This is why we simply extended the catalog for the daily work to be able to get reasonable diagnoses on the patient letters” (INT8, p. 16).

For the chemotherapies, the protocols are generated and changed by the doctors according to their needs. S emphasizes that it is important for them that they do not have to turn to a programmer:

“Because we often have the situation that we discuss a new therapy for a patient on Wednesday in the oncology meeting, and he comes the same or the next day. So it has to be possible to order the protocol. And this is what we achieved. From the beginning we could change and complement all the catalogs ourselves” (INT8, p. 7).

Overall, *constant adaptations* of the system to changing work practices are necessary.

We have seen that the computerized documentation system supports the work procedures at ONC3 in many respects. But it also takes an additional effort to hold the computer-based patient records complete. Some reasons for acceptance of the computer system can be identified (see also Tolar 2006):

- The system is specifically designed for oncology patients, supporting the management of a long medical history with repeated chemotherapies and blood tests.
- There is added value for those who use and have to enter data into the system, i.e., the doctors and nurses.
- The system combines paper-based components with computer support.
- Maybe the most important reason for the success of the system is that it evolved out of the daily work practice and integrates established routines of documentation with computer support.

A final remark: However successful the computer system is used, in this case, for the documentation of patient trajectories, the most important resource of information is often what doctors and nurses remember about a patient. S mentions that it is not difficult to take over a patient who comes for chemotherapy in a good condition. But for the discussion of a complex result this is not always possible, or it takes quite a time to go through all the information (INT3, p. 6). That is, the continuity of care, assuring that a patient is seen by the same doctor at each visit, is still crucial.

DISCUSSION AND FURTHER ANALYSIS

In the case study at ONC3 we have seen a computer system that has successfully been used for more than ten years and that has grown over time from the support of highly redundant procedures to extensive workflow support for doctors and nurses. Through the analysis of the work processes we have seen that paper documents and patient folders are still essential for documentation and cooperation. We have also seen that in some respects these documents are

different from those used at ONC1 and ONC2. The following questions are going to guide further analysis:

- *What is specific about oncology in regards to documentation?* In the first report (Tolar and Wagner, 2005) we have already pointed out some of the characteristics of work practice in oncology: Patients come repeatedly over years, making up for a large amount of data on therapies provided and examination results. A great deal of the work is focused on routine tasks: providing cycles of chemotherapies and doing blood tests. This means essentially doing the same things again and again. Especially in the outpatient clinic, patients often spend half of the day at the hospital, waiting for blood results and therapies. For the personnel this means that tasks are running in parallel and it is crucial to keep up-to-date about the current situation. We have seen that the role of documentation in this setting can be captured using the concept of ordering systems. Following up on the categories that have been developed in the former report, we are going to further investigate and compare for the three settings the significance of mobility and spatiality, redundancy, overview, and configurability.
- *What is common / specific about the organization in the three departments?* The three clinics share their principal aim: They have the same clientele of patients, i.e., they all claim to treat the whole range of oncological and hematological diseases. They provide the same treatments, namely chemotherapies. Surgical treatments and radiotherapy are provided by other departments. They all take patients on wards, outpatient, and day clinic. Although the tasks and structure are essentially the same, the organization of the daily work differs in some respects. At ONC3 they do not have their own laboratory, so patients have to wait for the blood tests or do them at external institutions. At ONC1 nurses are not present in the consultations rooms. The layout of rooms is different at the three clinics. These are only some examples of differences that might be significant for the documentation. In the final analysis we are going to further work on these differences, comparing the way how work processes are organized in the three settings.
- *What are the implications for the documentation practice?* In the next step we are going to investigate the consequences of the organization for documentation, focusing on the artifacts that are used. For example, in ONC1 the care sheet is used for communication between doctors and nurses who are located in different rooms. Special attention is going to be paid to computer support and how the oncological documentation system influences documentation and work practice.
- *What are possible building blocks of computer support?* To get to a more general analysis that transcends the specific settings at the three clinics, we are going to investigate the logics of coordinative artifacts trying to identify “the elements out of which coordinative artifacts and protocols are or could be combined and recombined” (Schmidt et al., 2007). By this we get to an understanding of the mechanisms of coordination that might help to identify options for computer use that do not interrupt, but support, cooperative work.

CONCLUDING REMARK

We could not follow our original plan of observing the work practice before and after the introduction of a computerized documentation system. However, the case studies of the three clinics give us the possibility of making comparisons across sites with different work practices

and ordering systems as well as across systems (paper-based and computer-based). We still hope to be able to keep on following the implementation process. However, at the time of writing the report it seems that our study will end before we can observe the new system in use.

MATERIAL

	date	interview partner	remark
INT1	13.12.2005	head of department, doctor	first talk
INT2	27.4.2006	nurse	
INT3	12.5.2006	doctor	
INT4	18.7.2006	doctor	
INT5	23.7.2006	doctor	
INT6	24.7.2006	doctor	talk
INT7	31.7.2006	secretary	
INT8	14.3.2007	doctor (and nurse)	

	date	observed persons	place
OBS1	17.5. 2006	doctor and nurse	consultation room
OBS2	19.5. 2006	doctor and nurse	consultation room
OBS3	22.5. 2006	doctor and nurse	consultation room
OBS4	23.5. 2006	secretary	counter
OBS5	30.5. 2006	secretary	counter
OBS6	7.6. 2006	doctor and nurse	consultation room
OBS7	9.6. 2006	doctor and nurse	consultation room
OBS8	30.6. 2006	doctor and nurse	consultation room
OBS9	9.8.2006	nurses and interns	blood taking room
OBS10	14.8.2006	nurses	day clinic

	date	participants
PRES	8.3.2006	doctors and nurses in the outpatient clinic

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