

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

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INTRODUCTION

In a previous paper Schmidt and Wagner (2005), using fieldwork material from architecture, have introduced the concept of *ordering systems*. *Ordering systems* are based upon the combination of specialized coordinative practices and coordinative artifacts. They are crucial in helping manage interdependencies that transcend local interactions. All of us are familiar with the ordering systems for organizing meetings - a complex of calendars, clocks, agendas, minutes, mailing lists, room IDs, etc.; or with those that ensure due process and administrative accountability - files and folders, archives, standard operating procedures, organizational charts, circulation lists, schedules, etc. We find more specialized ordering systems in architectural offices where they help manage vast distributed collections of sketches, models, CAD plans (multiple levels, multiple versions), detail drawings (multiple versions), standard components, correspondence with external partners (e.g., consultants, authorities), records of construction process.

Ordering systems play an essential role in health care institutions with their thousands of patients and patient-related documents as well as multiple transactions across organizational boundaries. In this paper we describe the ordering systems in use in an oncology clinic in Vienna. The aim of this initial fieldwork was to better understand the complexity of work practices, with a focus on documentation. Documenting (in different forms, using a diversity of artifacts and techniques) serves a number of purposes, and it is to a large extent done by nursing staff, among them:

- Managing the smooth flow of work (Bowers et al., 1995), by ensuring that patient data are in the right place at the right time and that they are continuously updated
- Reporting and accounting
- Communicating with external units and services
- Research
- Ensuring accountability to legal and forensic inquiries

Many studies have looked into these issues, and we do not want to replicate them. Our specific focus is on how integration of interdependent activities across local practices is achieved. For this purpose we study the *coordinative artifacts* in use in the clinic that serve to regulate, curtail, contain, suppress, harmonize, standardize, interrelate, synchronize, etc. local practices.

Case Study

The fieldwork was carried out at two 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. With a staff of 32.000 the KAV is one of the biggest health service institutions in Europe with an average of 400.000 stationary patients per year.

The report is based on an ethnographic study of work practices in this clinic that is still ongoing. In the initial phase of the fieldwork we were able to observe documentation practice before the implementation of the new system.

For this report the material collected at one of the two departments is used. We started out with initial interviews and presentations of our project at the outpatient and day clinic and at the wards. This allowed us to get first information on structures and documentation practices as physicians describe them. We then did participant observations on all the sites in the clinic, i.e., outpatient and day clinic as well as one of the wards, 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 artefacts used 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

At the time of writing the report the vendor for the system had been chosen. The computer system to be introduced had a broad range of functionalities that are described in detail in the requirements document. These requirements were discussed in meetings of physicians from four of the five participating departments. However, the implementation of the system is still to be realised. In a customising process the chosen system is going to be tailored to the needs of the departments in cooperation between the vendor, physicians in their role as users of the system, and others, among them pharmacy and IT personnel.

THE CLINIC – ORGANISATION AND WORK PROCESSES

The clinic (ONC1) is part of HOS1, a large community hospital in Vienna. It consists of four wards (A to D), an outpatient and a day clinic, with a staff of 24 medical doctors, 10-11 interns, and about 100 nurses. There is a considerable and increasing throughput of patients: per year 4.500 to 5.000 admissions to the wards, 5.500 to 6.000 patients in the day clinic and about 10.000 visits to the outpatient clinic. Many patients have to come regularly for check-ups during and after therapy. So doctors and nurses know them, remember their diagnoses and medical history, but also sometimes build up more personal relationships. ONC1 tries to ensure that patients see the same doctor each time they get admitted to a ward.

Patients come to the outpatient clinic for suggestions for a therapy, for clinical examinations (auscultation, physical examination, blood tests, biopsies, and so forth) before, during, and after treatment, and if they have acute problems. For some treatments they will be hospitalized in one of the wards, but many (chemotherapies and other infusion therapies) are administered in the day clinic.

Oncology is highly interdisciplinary. There is the need to cooperate with surgical departments, urology and gynecology, with radiology, nuclear medicine, and the laboratory, as well as with other departments that provide treatments like the pharmacy and radiotherapy. The clinic is embedded in a network of institutions and maintains relationships with them. How requests and results are exchanged is a crucial issue that is closely related to documentation.

The outpatient clinic

The outpatient clinic is located on the ground floor of the clinical building. The central place to go to for the patients is the counter in the waiting room. That's where they are received by the nurses and wait to be called by the doctor or to a blood test. The consultation rooms and the laboratory are down the hallway.



Figure Counter in waiting room

Patients are sent to the outpatient clinic by general practitioners or specialists, with a more or less concrete question. Some diagnosis has already been formulated and patients seek advice as regards therapy, or if laboratory results are unclear, doctors suspect an oncology or hematology problem and send the patient to the clinic for further clarification. Some patients are referred from other hospitals, e.g., after breast surgery, with the question if they need after treatment or, in case they are metastasized, what kind of treatment they need. At the outpatient clinic decisions are made how to further proceed with a patient, and, accordingly, he/she is sent to other departments or further examinations. All kinds of clinical examinations are performed, from auscultation to physical examination and biopsies. Blood samples are taken and sent to the central laboratory.

Patients do not have to make appointments but can decide for themselves when they want to come, i.e., if they are sent by their family doctors they can just go to the outpatient clinic immediately. However sometimes patients have to come on a certain date. This is especially important if the patient had a chemotherapy, for example, and the blood count is supposed to change on a certain day after therapy. Bone marrow punctures are done in the morning so that patients do not have to wait too long and doctors are not constantly interrupted (INT3, p. 3).

One or two doctors are present at the outpatient clinic to talk to patients. An intern takes blood samples and records the medical history of new patients, if required. Three or four nurses work in two rooms behind the counter. One is responsible for the counter, receiving patients, checking what has to be done, and arranging whatever is necessary. Another one is taking care of blood tests, i.e., "doing the blood", as the nurses call it. And one nurse is "at the back", in the next room where the folders with all the patient documents are stored. However, the nurses usually do whatever they come across, saying that they "*won't let anyone just stand there and wait*" (OBS3, p. 2), i.e., they receive patients or carry out other tasks even if this is not their responsibility. So what the nurses do at the outpatient clinic is not really care, but rather administrative tasks. It rarely happens that they have to change bandages or take care of a patient who does not feel well. Most of the time they are busy managing the workflow. This includes providing the doctors

with the information they need and holding them up to date, i.e., tasks that have a lot to do with documentation.

Some doctors from the wards use the outpatient clinic to make appointments with their patients so that they can see them without being interrupted by their daily work. The nurses at the outpatient clinic also organize this.

Receiving patients: When patients arrive they hand over their 'patient's diary' to the nurse at the counter. She fetches the folder from the archive, checks if all relevant documents are there, hands the patient's diary over to the nurse responsible for the administration of services by putting it on the bottom of the pile of folders to her left. For patients who come for the first time to the outpatient clinic a new folder has to be prepared. First of all the nurses ask for their telephone number and write it down on the inside of the folder.

Administering patients: The first task for the nurses when patients arrive is to administer them, i.e., provide information about the patients and the kind of services they receive by entering it into a computer system. By processing the patients in the order of their arrival it is also assured that they are called in to the doctor in the correct order. Nurses can make a printout where patients are listed in the order of arrivals, i.e., in the order of entries into the administration system. They use this to get an overview of the number of patients to be treated or when patients complain about long waiting times.

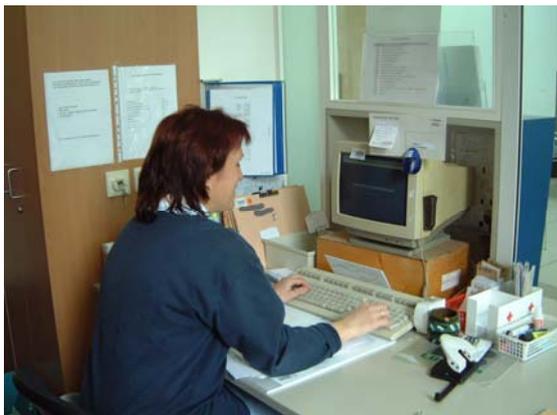


Figure Administration

The nurse sitting at the computer on the left side of the counter takes the folders, one by one, from the top of the pile to her left to process them. She searches for the patient by entering the patient's number into the search mask. First she checks if the diagnosis has been entered. For new patients she has to enter the name, date of birth, and insurance. She enters the diagnosis from the referral using the ICD10 coding system. Continuing the administration the nurse jumps over some of the entries. Then she has to enter the codes for the services that will be provided. To find out what is to be done with the patient, she first looks into the patient's diary, and if she cannot find what she is looking for, asks the patient, who may not know. She then has to search through the report done by the doctor on occasion of the patient's last visit, or the discharge letter from a ward if the patient has most recently been there, or the purpose is clear from the fact that, e.g., one week after a chemotherapy the usual blood count has to be done. Another source of information is the care sheet.

Once she has found out what is to be done, i.e., what kind of service they are going to provide, she enters the corresponding four-digit code into the computer: First "1000", which stands for a

basic fee; all special services are listed with their codes and the list is hanging right above the computer screen. But anyway most of the nurses know the codes by heart. One code which is often used is “3302” for taking a blood sample. Next the nurse has to check if the patient provided a health insurance certificate for the current quarter of the year. She has to enter that into the computer and if it is missing asks the patient to fill in a replacement form instead. Finally, if the patient is new, or if they have run out of labels for the patient, she can print them out on the printer at her desk and put them into the folder. The administration is thereby finished. New patients are sent to the intern to record their medical history (anamnesis).

Leistungscode	Leistung
3250	ELG in Tube (Standardblutung)
3253	Standard ohne Kaliumoxalat
3266	Standardplatte mit Natriumoxalat
3275	Kleiner oder Natriumformiat
3291	Standard ohne Oxalat
3294	Lyophilisatstandard
3295	Standard
3302	Standard von Blut nach und kapillar
3305	Standard (i.e. 10) ohne Oxalat
3306	Standard (i.e. 10) ohne Oxalat
3312	Standard ohne Oxalat mit Natriumoxalat-Patient
3317	Standard ohne Oxalat
3321	Standard ohne Oxalat
3322	Standard ohne Oxalat
3248	Standard ohne Oxalat (i.e. 10) ohne Oxalat (i.e. 10) ohne Oxalat
8166	Standard
8163	Standard

Figure List with most frequently used codes

The nurse notes the request for services on the care sheet in the patient folder and checks if all relevant results are there. Missing information has to be organized until the patient sees the doctor. Depending on the kind of service they provide to the patient, the nurse moves the folder to one of the piles on the counter desk. There is one pile for each of the doctors who do patient consultations. The nurses regularly carry these folders to the doctor's rooms. There are also two piles of folders for the doctors from the wards who see their patients in the outpatient clinic. These two piles have calendars on top, as they only take a certain number of patients per day. Another pile of folders is to be further processed by the nurse sitting at the computer on the right side of the counter, the so-called 'blood workplace'.

The 'blood workplace': Blood tests are important routine at ONC1. Tumor markers give clues about the success of a therapy and are part of regular checkups. To do these kinds of tests the blood has to be brought to the central laboratory. It has to be indicated if it is an acute test with the results needed immediately, i.e., after a waiting time of one to three hours, or a routine test, the results of which are talked over with the patient, e.g., the next week.

For each blood test a request has to be entered into the computer system and the tubes have to be prepared. This is done at the blood workplace. The nurse works through the pile of folders on her desk. Information about what kind of test is to be done can be found on the care sheet, which is included in the patient folder. She sticks the patient label onto a sheet of paper and notes the blood test to be done. She collects these notes to process them later on all together. For urgent tests she highlights the patient's name on the labels with a marker. Then she places the labels on the tubes needed, puts them into a carton tray, and brings them to the room where interns take the blood samples.



Figure Blood workplace

From time to time the nurse takes the sheet with the patient labels and enters the requests into the computer. She has to enter a code for each of the values to be tested. So these are quite a number of codes to be entered for each patient. The nurses know most of them by heart, however, some they have to look up in a folder where the codes are listed grouped by diagnoses; for each diagnosis the necessary tumor markers are given.

Occasionally the nurses check the entries they have made. They look through the sheet with the patient labels and go through the entries that are displayed in a list on the computer. In this list they can see the state of their request, i.e., they see when the results are there and can print them out. It is important to check the entries because as one nurse explains, *“If they receive a blood sample at the central laboratory and do not have an appropriate request, they do not have to do it; they can just ignore it. If they are nice, they call us, but they don't have to”* (OBS7, p.7).

Medical consultation: When a patient sees the doctor, the patient folder should be ready. During the consultation doctors look through the documents in the folder, checking results from different kinds of tests (x-rays, computer tomographies, blood tests,...). They might look up drugs in the computer, write prescriptions (either printing them out on the printer in their room or writing them by hand) or call one of the wards to see if they have a free bed for the patient. S/he might also send the patient to another department for examinations or treatments they do not provide themselves. What s/he has to do quite often is the admission to the radiology department. This can be done electronically; however, appointments are still arranged by phone. The idea is to stay in control of their own time planning, although this is *“laborious ... as we have a high frequency of [radiological] examinations”* (OBS4, p. 7). During the consultation it can turn out that a blood count is needed. The doctor uses the care sheet to specify the necessary blood tests and tells the patient to go back to the counter with his/her folder so that the nurses can make the arrangements. Finally s/he writes down the next appointment, e.g., a regular examination after three months, into the patient's diary and hands it over to the patient. The result of the consultation is documented.

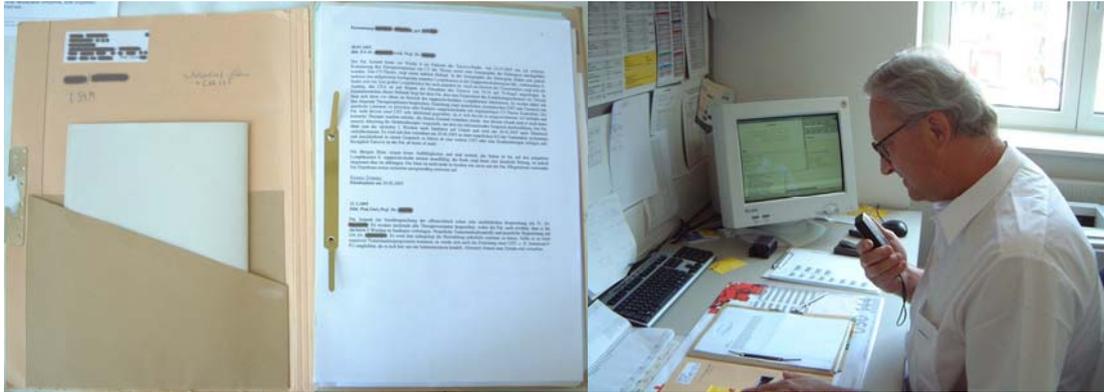


Figure Dictating the medical report

When the patient has left the doctor talks a short report into a dictaphone. While dictating s/he may look up results in the folder, interrupting the recording while s/he searches through the documents. Each visit produces about half a page or more of text, which has to be typed by one of the secretaries.

Maintaining patient folders up to date: Another important task for the nurses that keeps them busy all through the day is to maintain patient folders up to date, i.e., filing medical documentation, results, and discharge letters. There is one nurse who is responsible to check if there are new documents and file them into the patient folders. Medical documentation comes in constantly (every two hours) from the secretary's office. The last page is printed out and replaces the former last page. Results have to be seen by a doctor and initialed. Exam results come at about two o'clock in the afternoon. Then they are printed out and brought to the doctor, who looks through them the next day in the morning. A nurse files the signed results.

The day clinic

The day clinic is on the ground floor opposite the outpatient clinic. The main room for the patients is a bright and friendly room with large windows. The radio is running in the background. There are 12 couches in the room with dividers between them so that patients have some privacy. In the same room there is the counter where the nurses receive patients. There is also a sideboard with drinks, snacks, and breakfast in the morning. For lunch they can choose between three meals. Patients use a small desk in the centre of the room while they are eating, waiting for a free couch, or for their transportation. Two other rooms are there for patients who need more privacy or who want to have their relatives with them. Down the hallway there is the doctor's room for patient consultations and the laboratory.



Figure Day clinic

In the day clinic ambulant chemotherapies are done, as well as ambulant infusion therapies, that are necessary for other reasons, e.g., blood bottles, if patients have high-grade anemia, or a concentrate of thrombocytes that are given if thrombocytes get too low in the course of a therapy, or antibiotic medicine, or immunoglobulin for infection problems that cannot be solved otherwise, or infusions for the metabolism of bones if there are metastases in the bones, or the like.

In contrast to the outpatient clinic, patients in the day clinic are scheduled for a certain day, however, they do not have to come at a certain time. Only some arrive “out of the order” when they need a therapy immediately. There are patients who are quite experienced: *“Some patients realize for themselves how they are, [this patient] for example – he comes to get an infusion when he does not feel well and then he gets three blood bottles”* (OBS6, p. 5).

The work of the nurses in the day clinic is centered around organizing all kinds of therapies, i.e., they have to keep track of orders from different sites, not only the pharmacy in the hospital but also blood banks and other departments that provide medicine. They prepare the treatments for the interns who give them to the patients and they keep track of the results of blood tests. Two nurses work at the counter, one in the back room where the treatments are prepared. One doctor is in charge of patient consultations and two interns administer infusions and take blood samples at the bedside.

Preparations: As the patients come at appointed days many of the things needed can be prepared in advance. The folders for the patients are brought to the day clinic. The ‘schedule for the day’ (see below) is prepared, chemotherapies are ordered in advance, and the requests for the blood tests are entered into the computer. So, in the morning when most of the patients come, a considerable amount of work is already done, whereas in the afternoon the nurses have time to settle things for future patients. However, there are some things that cannot be done in advance, that is, acute blood or when the 24h urine quantity has to be entered, which is only known when the patient is there. To enter the requests the nurses use the ‘schedule for the next day’ that has already been prepared before. It contains information about what kind of blood tests have to be done. They proceed by entering the patient number and values to be tested. In the back room of the day clinic the treatments and blood tests are prepared.



Figure Entering requests

Blood tests for chemotherapies: All patients who receive a chemotherapy have to do a blood count immediately before. This is a small test that can be done in the laboratory directly at ONC1. Patients are given a small sheet of paper that says “TK BB” (day clinic, blood count) with a patient label and the date on it. With this sheet they go to the laboratory where blood is taken by a stick into the finger. Ten to 15 minutes later the result of the test is ready and the printout can be fetched from the laboratory. The nurses check the blood values and accordingly order the chemotherapy or send the patient to the doctor to decide.

Medical consultation: The nurses at the day clinic prepare the folders of patients who have to see the doctor. They are stored on a dedicated pile and brought to the doctor’s room from time to time where s/he works through them. Like the doctor at the outpatient clinic, s/he always takes the folder from the top of the pile and calls in the next patient who is waiting in the hallway in front of his/her room. Doctors are mainly confronted with patients who come to the day clinic regularly to receive their treatments. They will ask them about the previous therapy, look through the results of blood and other tests, plan future therapies, and make appointments. S/he enters the relevant information into the therapy sheet and the care sheet (for blood tests etc.) and writes appointments into the patients’ diaries and dictates a short report.

Ordering chemotherapies: To request a chemotherapy special forms are used (see below). These forms can be printed out from the computer. The request has to be signed by a doctor. The sheets are prepared in advance and some days before the chemotherapy is needed a carrier brings them to the pharmacy. The original stays with the pharmacy; at the day clinic they keep a copy. If they need a chemotherapy that was not previously planned they fax the sheet to the pharmacy, call them to say that it is OK, and send the original later on. They call the pharmacy to actually order the chemotherapy. A carrier then brings it from the pharmacy. The nurse who prepares and the intern who applies the chemotherapy sign on the copy of the sheet, which is then put back into the patient folder. All other therapies are documented in the so-called therapy sheet.

Documentation of services: This is done by one of the interns. S/he enters the admission number of the patient that s/he takes from the list in the ward book; the patient data appears on the screen. Then s/he enters ‘1’ for ‘discharged’ and ‘2’ for ‘improved’ (meaning the physical condition of the patient). For the diagnosis s/he enters the ICD10 code, e.g., C13.9; the diagnoses appears on the screen. S/he enters the treatments that the patient received. Then s/he marks the patient’s name on the list in the ward book with a “-” to indicate that it is done.

When there are mistakes in the entries or something is missing they are called by the discharge and then have to make the corresponding corrections.

The wards

The four wards have 94 beds altogether, three of them (A to C) have 27 beds each. Ward D has 13 beds and is special insofar as there are only single rooms and that they preferably take up patients that are treated by the head of the department. Single rooms are there for special chemotherapies where patients should be isolated. The ward also hosts two isolation units for patients after bone marrow or blast transplantations.



Figure The counter - receiving patients

The counter is the central place where nurses receive patients and their relatives or other visitors and personnel from other departments, like carriers. The interns and nurses use the computer to enter requests and prepare patient folders. Opposite the counter there is a lounge for patients where they can watch TV or have snacks and coffee. It is an open space that is separated from the hallway by a kitchenette. Behind the counter there is room for the ward nurse and a room for preparing treatments. The ward also has a break room for employees and the doctor's room at the end of the hallway to the right. Computers are at the counter, in the nurses' rooms, and in the doctor's room.

Oncology patients come to the ward for treatments that have stronger side effects or are longer, where patients have infusions of six or seven hours. They are on average admitted up to six times a year *"because chemotherapy cycles are usually applied six times. That means, that they come continually in monthly intervals"* (INT8, p. 2).

In the mornings there are four doctors working at the ward: the ward doctor, one assistant doctor, and two interns. All the doctors from the department meet in the morning conference. After that they move to their ward to do the ward rounds and to talk with patients and relatives. They might have meetings with other doctors during the day and trainings for the interns. Each Wednesday they have the x-ray conference at 12 o'clock. This is quite a busy day until, as one doctor says, *"at one o'clock everything breaks down here"* (PRES2, p. 4) to become calmer and less hectic in the afternoon when only two doctors are there for all four wards. The nurses do their work in two teams of two nurses each. Each of them is responsible for one side of the hallway, i.e., room 1 to 5 for one team and the other rooms for the other one. The team leader prepares the infusions and injections to be applied. The other nurse is responsible for the care tasks.

Planning and admission: Nurses keep track of planned admissions and discharges through a hand-written calendar, which is central for planning – it is used “50 times a day” (INT9, p. 2). Admissions are noted in the ward book with green and white stripes, which always lies ready in a drawer beneath the counter desk. After admission (for the procedure see the day clinic) the patient labels are printed out on A4-sheets with stickers. The labels are stuck onto a register at the counter where patient names are listed for each of the rooms at the ward. Nurses use three books for admissions: the ward book that they finish each day at midnight; a smaller booklet in which they note planned admissions (patients arriving from emergency service, with the ambulance) – this is used for counting narcotics, checking the number of clinical thermometers and the number of patients; the index book with patient labels sorted by name, which is used for organizing the medical record of patients where they only have the name.

Preparing for patients: Nurses prepare the medical record folders for all the patients in their ward book. This includes the ‘temperature curve’ (to be described later), anamnesis sheet, one sheet for the additional oncology anamnesis, an admission sheet, an informed consent sheet for patients, and a cancer announcement sheet. An intern prepares the curves, i.e., they fill in the reason for admission, diagnosis, current medication and therapies so far. They take this information from previous stays at the ward, e.g., from discharge letters or old medical records. Patients usually change between outpatient clinic and wards, so they have patient folders in the outpatient clinic, which are brought to the ward for their stay and put into the folders.



Figure Preparing materials for a new patient

All this material, together with the labeled tubes for blood tests, is ready on the counter for the new patients of the day. Later the folders are transferred onto two trolleys (one for each side of the hallway) where they remain during the stay of the patient and are taken along for the ward rounds. Old medical records for current patients are also in the trolleys as “they are always needed” (INT9, p.4).

For unexpected patients that come, e.g., during the night, this material is not available. In this case the doctor can get some information from the discharge letter of the last stay at the ward that s/he can access on the computer. S/he can also view some of the results of examinations (x-ray and blood tests) that have been done at the department. “And via a special system I can see, if s/he was admitted to some other ward at one of the hospitals of the KAV in the last years. Then I can imagine a story of why s/he was there” (INT8, p. 9).

Anamnesis and status praesens: Interns do the medical anamnesis using a detailed questionnaire. The status praesens is the state of the patient at the time of admission. It is determined by a medical examination done by the interns that is also documented on the standard anamnesis sheet. There is an additional sheet for oncology patients on which changes of the state of the patient are noted. They use a WHO-scale for the side-effects and an activity index according to Karnofsky or WHO-level. Nurses do their care anamnesis.

For example, there is a patient who is at the ward for the first time. She is going to receive a chemotherapy and will be leaving the next day. The nurse takes the patient's temperature and weighs her. Then she asks for a contact person, asks if she has a dental prosthesis or a port-a-cath, if she has pains, if she has difficulties breathing, as this is what she is observing. A conversation develops. Finally the nurse tells the patient about the daily procedures. Afterwards she completes the information that she has started to enter on the anamnesis sheet. Some things she did not ask for directly. She says that she knows them "from observation", e.g., the risk of self-endangering or the integrity of the person (OBS11, p. 7-8).

The care anamnesis is done on the same sheet as the medical one. So nurses see the information that has already been filled in by the intern and do not have to ask for some things again. However, it does not mean that doctors and nurses do the anamnesis together. The ward nurse mentions that this is often impossible: The interns prefer doing it immediately when patients arrive and the nurses would rather wait until it is calmer (INT9, p. 4).

Ward round: Once a day, the ward doctor, accompanied by two interns and a nurse, sometimes also the head physician, go from room to room, with the doctor asking the patients how they feel, if there are any problems, etc. Here the doctor makes entries into the so-called 'temperature curve' and gives orders.

"That is, at the ward round when I give an order, I write it down {into the curve} and those orders are then going to be implemented by the care personnel. They prepare the things that are then applied or done by the interns. It is different if the patient is in pain or suffers from nausea, i.e., a situation that has to be handled immediately. Then I also write it down but additionally I say it aloud and add "now". Then it is done at once" (INT8, p. 11).

The interns are responsible for ordering some of the examinations, mainly X-rays. They note them in a book and enter them into the computer after the ward round. Some of them they order immediately, as many examinations to be done at the same day have to be announced before 11 or 12 o'clock. There is another book that they take with them at the ward round where nurses note all the examinations that are to be performed in other departments. This book is for the carriers. They fetch it the day before to see which patients have to be taken where. The ward nurse says that it is *"ideal if the room number is noted and if the patient is to be transferred sitting or lying"* (INT9, p. 2).

Overall the ward round is quite a hectic procedure as there are constantly things that have to be dealt with, e.g., examinations have to be postponed or treatments in other departments have to be organized. Many of these things are done by phone. It also happens that patients from the outpatient clinic come to see 'their' doctor at the ward, people call, or patients have problems. So they have to do a lot of things in parallel, keeping them in mind while they continue the ward round. For more complicated decisions they might discuss a patient's situation together.

Preparing and carrying out examinations and treatments: After the ward round one of the interns enters the requests for X-rays into the computer at the counter. When entering the admission number for a patient, all examinations are shown with a remark about their current state, e.g., 'requested' or 'seen by a doctor'. For example, the intern enters an admission number (together with a pager-number and an abbreviation for a doctor). As 'priority' s/he enters 'E' for 'eilig' (urgent). She enters into two fields of free text: first 'anamnesis / former operations / clinical diagnosis' and second 'radiological question'. Finally s/he prints out the requests and puts it into a tray on the desk.

The nurses order blood tests. They are usually not urgent, so that they can order them collectively. For the daily blood tests they have a dedicated sheet with patient names, admission numbers, and the blood tests to be done. *"This is easier to do on the computer than having to look through 27 medical records"* (INT9, p. 5). The nurses enter the planned blood tests on night duty the day before. All others are done during the day. For all those examinations that cannot be ordered by computer the nurses prepare the standard forms, i.e., they put on patient labels and hand them over to the interns. There are two folders where the requests are stored: one for finished examinations and the other one for all those that are still open.

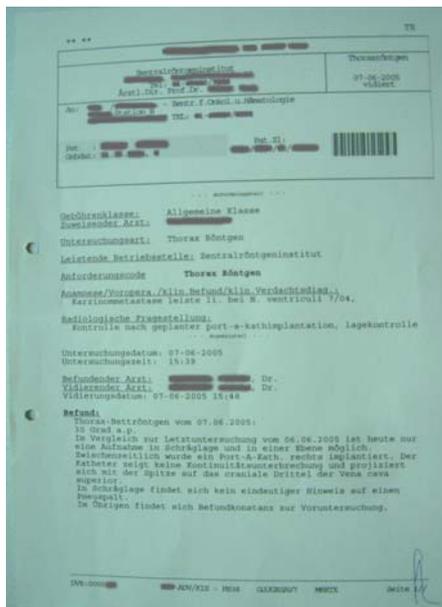


Figure Examination result from radiology

All examination results (x-ray, blood tests, and others) are printed out or they are sent on paper anyway. They have to be seen by a doctor who signs them. Then they are put into one folder for current patients. From there nurses or interns put the results into the medical records. If the results arrive when the patient has already left the ward they are put into another folder. This folder is brought to the secretary who also puts the sheets into the medical records.

Chemotherapies are ordered in the same way as in the day clinic (see above). Nurses prepare all the treatments. They order them, stick patient labels, e.g., onto the infusions and prepare everything for the interns to apply them. The nurses on night duty do this the day before for planned treatments. They use two trolleys to arrange whatever is needed, like needles, tubes, bottles, etc. The next day they go through the rooms together with one intern for each side of the

hallway and tell them what is to be done. Urgent therapies are prepared and applied immediately.



Figure Trolley where treatments are prepared

Care and care documentation: While one of the nurses in each team does all the preparations of examinations and treatments, the other one is responsible for the care tasks, i.e., s/he works at the patient bed providing patients with the support they need (eating, washing, wound treatment, etc.) Student nurses and aides help out. They do the care anamnesis and enter temperature, blood pressure, and weight into the curve. The temperature is taken once a day, when they go through the rooms after lunch at about 1 o'clock. For patients with a fever they do it more often.

The care documentation is an extensive procedure: For each patient the nurses have to set up a care plan that has to be evaluated. And they have to do the care report that is updated each day filling it in by hand. They use different schemes to classify patients according to their need for care. For chronic wounds ('decubitus') they have to do a wound documentation with photos of the wounds. The main aim of the care documentation is to make their actions accountable and not to support nurses' workflow. Nurses mainly use the care documentation to, for example, check the medication to use for the treatment of a wound. Another reason for looking into the care documentation is that nurses often cannot find the medical record when they need it and then it is good to have their own documentation ready at hand. On principle the care documentation is of interest to the doctors, since "*nurses often document much better than doctors, especially those 'soft facts'. [... These are] things that are quite useful to judge the course of a disease*" (INT8, p. 20-21). However, since the care documentation is kept in different folders, it is no longer as easily accessible to doctors as it used to be.

Discharge and final letter: The medical record is completed with the discharge letter, which is produced at the last day of a patient's stay or rather the day before. It summarizes the results of examinations and treatments, describes the course of the disease, and gives a therapy recommendation. While some parts have to be dictated, others consist of data that are inserted automatically (e.g., results of blood tests). The letter is given to the patient, who is supposed to hand it over to his/her family doctor.

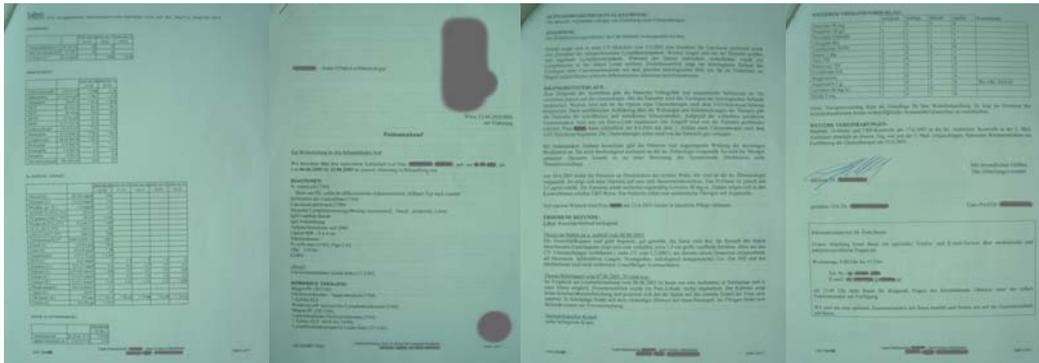


Figure First four pages of a discharge letter

Documentation of services and medical record: Finally the ward doctor has to enter the services provided to each patient into the computer system. This is necessary for accounting. To do this s/he needs all the documents generated during the stay at the ward, the patient folder from the outpatient clinic, and old medical records. One doctor says, *“That means, there can be a delay of two days. And it is possible that at the outpatient clinic they already search for this patient folder. So this is sometimes a little difficult”* (INT1, p. 8). Then s/he has to finish the medical record for the stay at the ward. S/he checks if all the documents are there and completed. Finally s/he adds a cover sheet on which s/he fills in the diagnosis and signs it. The medical records are stored and brought to the ward again for each future admission of the patient.

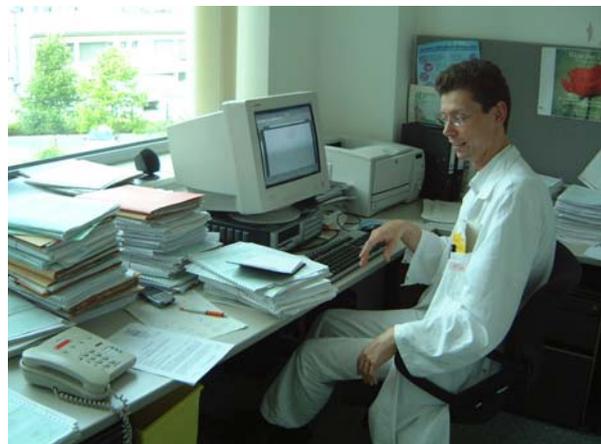


Figure left: final medical record for a stay at the ward; right: doctor in his room working through medical records

Medical and care documentation

Two systems of medical documentation are used at ONC1: At the outpatient and day clinic *“the documentation is a little archaic”* (INT3, p. 4). The physicians dictate a ‘Dekurs’ for each visit of a patient. They use sheets of paper, on which they note the date and place the patient's labels, in the right order *“for the secretary who has to type the whole thing: I only put the patient data on a sheet using the labels one after the other so that she sees, [...] under which file she has to*

store it in the computer" (INT3, p. 4). The medical report is held rather short, so as to allow a quick overview. There is a brief description of the condition of the patient, the problem discussed, and the decisions taken. For each patient there is one single document in the computer, which is constantly updated. Doctors can consult it online and also email it to other departments and colleagues. If not arranged otherwise, it takes some days until the medical documentation is ready. The page with the new text is printed out and replaces the last page of the old documentation in the patient folder. The most recent 'Dekurs' is placed on top of all the documents in the patient folders.

The wards have their own and much more detailed medical documentation system. While a patient is at the ward, all relevant data are entered into the 'temperature curve' (see below) that is stored together with examination results and other documents in the trolley to be taken along at ward rounds. The documentation is finalized with the discharge letter when patients leave the ward. The two documentation systems pose problems as many patients visit the outpatient clinic and the ward as well so that they *"constantly have problems to get these documentations together and keep them congruent"* (INT1, p. 3). Their solution is on the one hand to put discharge letters from the wards in the patient folders at the outpatient and day clinic. On the other hand when patients are at the ward they fetch the patient folder from the archive in the outpatient clinic.

The care documentation is largely separated from the medical documentation. They only use a common sheet for the anemnesis. While at the ward the care documentation is regulated by law, at the outpatient and day clinic there are no detailed guidelines how to document.

KEY ARTIFACTS AND WORK PRACTICES

As we have seen, the workflow in the clinic is supported by a variety of physical artifacts that are designed to fulfill the specific needs of the day clinic, outpatient clinic, and wards, respectively. These are paper documents of various kinds, most of them of standard format, folders, and booklets. A lot of work goes into producing, updating, filing, and retrieving these artifacts. In parallel, data are entered into and looked up at the computer. The following section describes some of the key artifacts.

Admission - identifying patients

As we have seen in the outpatient clinic, each patient gets a unique ID. In addition, an admission number is issued each time a patient visits the day clinic or is admitted to one of the wards. The admission is done by the care personnel. For readmissions this takes only a minute. The nurse will call admission, mention the patient's old admission number from the last stay, and get the new one, which is a serial number for all admissions at HOS1. This number is written by hand into the ward book. On a form, sex and class for each patient are filled in. This is done for admission and discharge. When no more patients are expected, the ward book for that day can be completed. The nurse will add up women and men and enter the total number, separated for discharge or transfer (e.g., it can happen that patients are admitted to a ward directly from the day clinic). In the day clinic the new score is always 0. The ward book (with the sheets for admission with green and white stripes) is stored in a drawer beneath the desk so that it is always easily accessible. After the admission the patient labels can be printed out on A4-sheets with stickers. The labels have a barcode, the patient name, and the admission number. During night duty nurses often have to do an "emergency admission", as from midnight to six o'clock no

regular admissions can be done. Then they receive a number that they use temporarily until admission is done in the morning. *“It is important that blood can be taken as this is the precondition to do a therapy”* (INT9, p. 1).

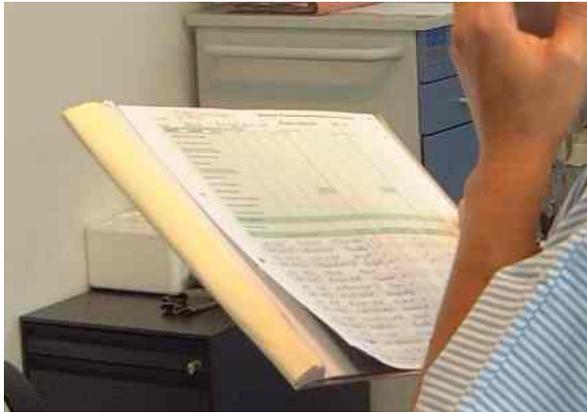


Figure Ward book in the day clinic

Patient folders – the archive

The main source of information about a patient in the outpatient or day clinic is the patient folder. It should contain all the information available that is relevant for taking care of the patient. To ensure this, and to be held up to date, all the folders have to be steadily replenished with different kinds of reports. Doctors and nurses constantly use the folders. Those of present patients travel between places where they usually are arranged in piles. The amount of folders in a pile gives a good estimate of the number of patients for that day. All the reports generated as a result of the patients' visits (medical documentation, lab and other results) are collected in the patient folder. If a patient has been to one of the wards, the discharge letter travels to the folder in the outpatient clinic.

A folder has a barcode label with the patient's number. 'Yellow' stands for a 'solid' tumor, 'red' for a 'hematology' one, a traditional distinction, which is still thought of as being useful 'at first sight'. Folders are ordered by date of birth (day/month), which is visible on the label on the back; as in this example of a patient who was born on the March 3 and whose surname starts with a K.



Figure Folder archive and outside of folder

The folders of all patients who have visited the outpatient clinic in the current or preceding year are stored in the archive located in a small room behind the counter. Older folders can be found in the archive in the basement.

Locating folders is one of the main tasks for the nurses in the outpatient clinic. For each patient who comes to the clinic or requests information from the doctor by phone, they have to provide the corresponding folder. As folders travel, they have introduced “out-folders”, i.e., an empty folder that indicates when and by whom the corresponding folder was taken away. But still *“this does not always work”* (OBS2, p. 2). In this case they may ask the other nurses if they know about the location of the folder, or they can look up the patient in the computer system, trying to find out when he or she had recently been to the outpatient clinic, or go and look in the basement.

Another task is updating – collecting all the new data (e.g., test results signed off by a physician or discharge letters coming from one of the wards) that have been generated. For this nurses use an *intermediary folder*, which is black and organized by date of birth, from where these items are transferred to the patient folders later. Results for patients whose folder is missing are filed into another folder that the nurses look through occasionally. However, it may happen that results are missing in a folder when the doctor needs them. Again, some of the results, e.g., x-ray results and blood tests, but also discharge letters from the wards, may be in the computer.

Care sheets

In the outpatient and the day clinic nurses mainly do administrative work, and few care interventions take place. Still, they produce what they call ‘care sheets’ for each patient. These sheets are easily identifiable as they are blue (in contrast to all other documents in the folders). They are central for the organization of the workflow.

When a patient arrives, the nurse responsible for data entry into the computer system notes on the care sheet what is planned for the patient, e.g., a blood test. In the left column the current date is entered with a stamp. In the main column (“blood, other, examinations/appointments”) the planned interventions are documented. The last column is used to initial the entry.

The care sheet serves multiple functions. First, the specific information of what is to be done (e.g., the kind of blood test) is noted on the care sheet. This is needed by the nurse at the ‘blood workplace’ who has to enter the request to the laboratory and prepare labeled tubes. Second, nurses also document on the care sheet the condition of a patient or special incidents. Most importantly, they see the care sheet as providing them with an overview, which would otherwise not be available:

“To make it better manageable for us what is done, what we have done and what we need, especially which results – this is the reason why we document there {on the care sheet} once again for us. Because in the physician’s documentation it is not always included in the way we want it or these documents are not always available when we need them.” (INT4, p. 8).

Occasionally the doctors use the care sheet. A doctor may decide during a consultation that the patient needs another blood test. S/he will note this on the care sheet for nurses to know, hand over the folder to the patient, and tell him/her to go back to the counter where the nurses take care of it. Finally the care sheet is sometimes the only means to document the visit of a patient. The head nurse comments: *“Often in the outpatient clinic patients come only to have blood taken without being seen by a doctor. That’s why I think it is important that the care personnel documents, because otherwise the visits of these patients and what has been done would not really be traceable”* (INT7, p. 3).

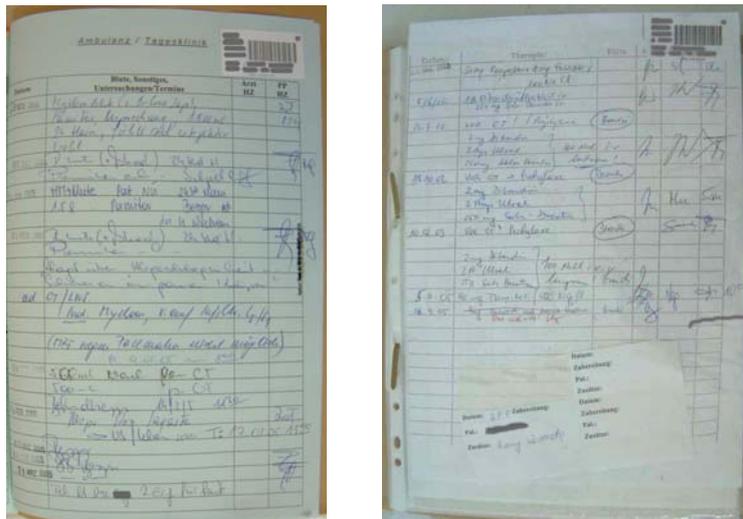


Figure Care sheet (left) and Therapy sheet (right)

Therapy sheets

Another key artifact is the so-called therapy sheet, which is used to document all therapies other than chemotherapies. It was developed by the head nurse at the day clinic to facilitate work.

“For chemotherapies there have always been special forms. For all other therapies, like, for example, bisphosphonate or blood bottles, there were none. We had a documentation in the patient folder. The problem was that the doctor, who gave the therapy to the patient, could not see who gave the order. As in the day clinic, we often have 40 or 45 admissions, and to prepare therapies with 40 or 45 patient folders was difficult, just possible. And so the therapy sheet was developed. From this sheet you can see what the patient has received continuously. You can take it with you to the patient. And the actual order becomes traceable” (INT7, p. 5).

The therapy sheet has a patient label on it. In the left column the date is entered, then the therapy and the blood tests to be done. In the remaining columns there are the signs of the doctor who ordered the therapy, the nurse who prepared it, and the intern who gave it to the patient. A clear plastic folder covers the sheet so that the doctors and nurses can use it without carrying the whole patient folder with them.

The ‘schedule for the next day’

Another example of key coordinative artifacts we want to discuss here is the ‘schedule for the next day’ (an A3 sheet lying on the desk at the counter), which is the central artifact for organizing work in the day clinic. This schedule, together with the patient folders, is usually prepared one week in advance. The names of all patients expected for therapy for the day are filled into the sheet and the nurse takes it to retrieve all folders from the archive in the outpatient clinic. The folders contain the patient labels that are then put onto the schedule (covering the names of the patients that they have just filled in). In addition, nurses fill in the diagnosis, blood tests, and planned therapy.



Figure The schedule

When patients arrive they hand over their patient's diary to the nurse at the counter, who highlights their name on the schedule with a marker. That indicates that admission for this patient can be processed. Throughout the stay of the patient the schedule is used to document the current status. For example, when a blood test (which has to be done immediately before therapy) does not meet the criteria necessary for the chemotherapy the nurses note a "?" behind the patients name and send him/her to the physician, who has to decide if the chemotherapy can be done anyway. So the schedule always gives an overview of the work progress for a day. It is a good indicator of how many patients are to be expected. It is kept for future reference.

The 'temperature curve'

The so-called 'temperature curve' is a big sheet of paper (about 3 times A4, folded to A4-format). During the stay of the patient it is kept with all the other documents that together make up the medical record in one of the two trolleys that are used for the ward rounds.

The 'temperature curve' describes the "daily course" (INT1, p. 3) of actions and the condition of the patient on a high level of detail. That is, each time they see a patient at the ward round or in between, doctors document their observations and note orders of medication, therapies, examinations, and nursing interventions. There is space for additional remarks in a section 'below', i.e., at the end of the front page with lines for free text.

"In the curve the doctors also document a 'Dekurs', i.e. what they find for a patient, that cannot immediately be seen from the curve: bases for decisions. For example: The patient does not feel well today. He complains about nausea mainly in the late afternoon. And from this you can conclude, that on this day a new medication was ordered. Or I document a talk with relatives there" (INT1, p. 4).

The 'Dekurs' provides explanations for decisions so that they are comprehensible for doctors who later on try to reconstruct the medical history of a patient. Another example is: *"Patient has a temperature today, but as the antibiotic was changed yesterday, we do not again change it today. We still wait"* (INT8, p. 14).

Results from examinations are usually not entered in the 'temperature curve' but added as printouts to the medical record. But sometimes they are also noted in the 'Dekurs' section or written down as an additional diagnosis. Also, the care personnel make their daily entries in the 'Dekurs' section: temperature, blood pressure, and excretion. Different colors, signs, and abbreviations are used to enhance overview at one sight. For example, a rise in temperature is signaled by a thick red line (in the upper right). It resulted in an extended stay of the patient

(originally the discharge was planned for the June 10 and readmission for June 22, which is also noted on the curve). The figures 1 to 5 denote the number of days the port-a-cath (a small device under the skin to give chemotherapy and take blood) has been installed. This is important, as the needle has to be changed after 10 days.

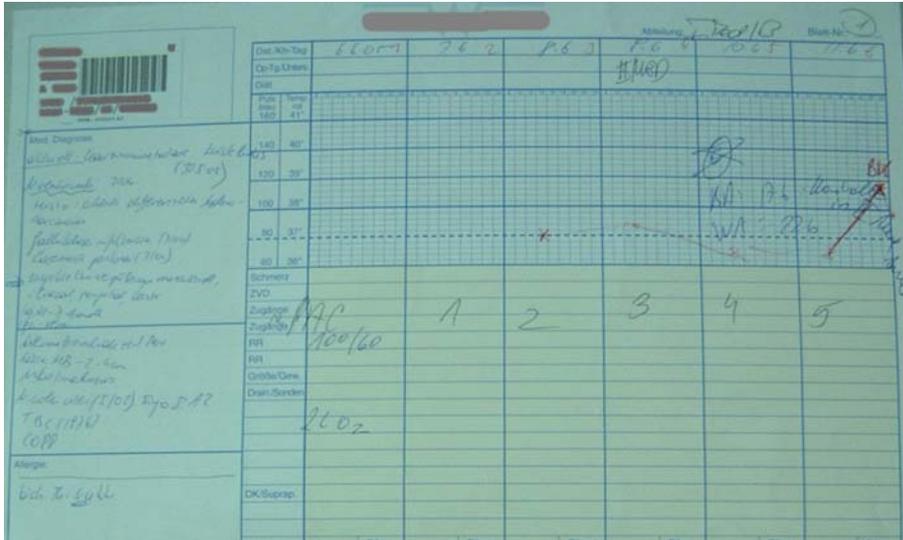


Figure Section of 'temperature curve'

The 'temperature curve,' on the one hand, documents the current state of the patient and work in progress:

"It is the central sheet. The medical record is the central sheet, that's where we look for results for example. If one is missing, I can see {on the curve} if the examination has been done, if there is something from it, if I can expect something from it or not. And we experience time and again that there are examinations noted, but the date is missing. Then you think that it has already been done. So this is really a central sheet. If it is not maintained correctly, then nothing works any longer" (INT8, p. 22).

Especially in the afternoon it is important that the physician on duty documents his/her decisions *"so that the one, who comes the next day and carries on with the patient, knows, why I did certain things, why the therapy of a patient was changed, what has turned out especially"* (INT8, p. 24).

On the other hand, the 'temperature curve' is the artifact through which physicians' orders are communicated to nurses. One nurse explains how she 'reads' the curve. She finds the medication for the patient on the front side in the left column for different kinds of application (enteral/oral, parenteral, perfusion). Below that is the medication they may give the patient when needed, e.g., for pain. There is a note if blood pressure and weight have to be measured daily. Next she looks at the 'Dekurs' below on the front side. She says that it is *"quite interesting, but mostly indecipherable"* (INT9, p. 6). Then she looks for examinations and punctures. They are noted on the backside of the curve, with sections for blood tests, other examinations (diagnostic imaging like x-rays or computer tomography), etc. The doctor who gave the order notes the date of the order with a sign. Ointments and the like are to be found under what is called 'jointly responsible area of activity,' where all the actions are noted that have to be done by care personnel in their own responsibility. In a column on the right, the blood tests to be ordered are listed. Chemotherapies are documented on the special sheets that have already been described

for the day clinic. On the curve, chemotherapies are marked with a cross on the days of application. On the backside of the curve, in the free area at the end of the sheet, there is place for sticking the yellow labels from chemotherapies or other substances with batch control. Each action has to be confirmed with a signature.

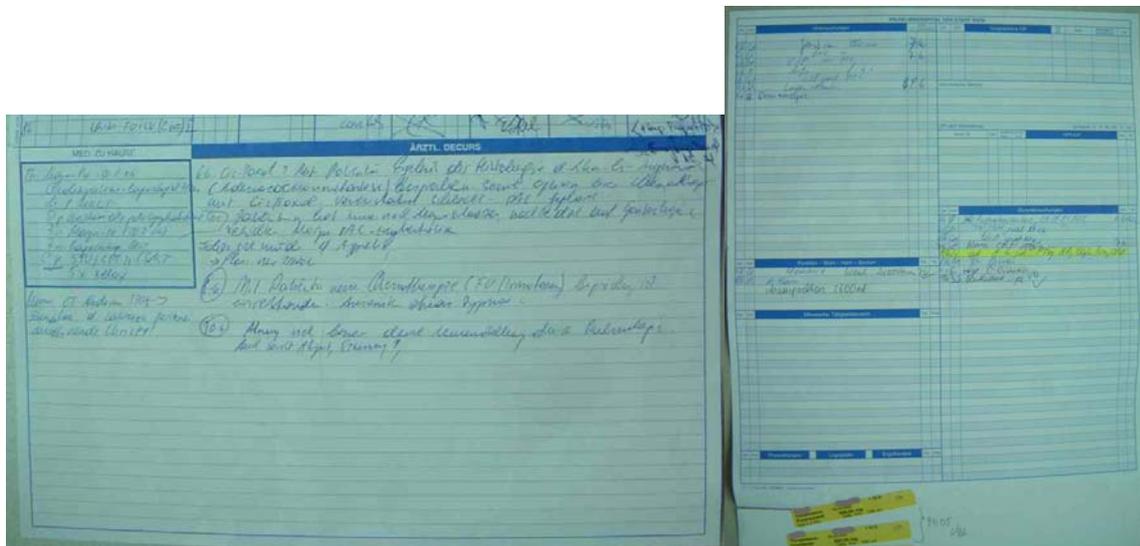


Figure How a nurse 'reads' the 'temperature curve'

Usually the nurses go through the curve after the ward round. All those things that have to be done immediately are either done by the nurse who accompanies the ward round, or if there is none, they use an orange sign that is attached to each medical record: if it is visible it means that they have to take a look into it (INT9, p. 5).

Coding

Documenting the services per patient is a tedious task and is done by a doctor. This is mainly done for internal accounting. Each service values a certain number of points, and at the end of the month services and costs are compared. The clinic's resources largely depend on their ability to document their activities on a high level of detail. Coding is not well supported though. The responsible doctor has lists with the relevant codes, which s/he has to consult for all those codes that s/he does not know by heart. As part of this activity, the doctor has to control if the documentation is correct and complete (INT2, p. 2).

In the outpatient clinic they use a different system. They receive the same amount of money for each patient per quarter. The coding they perform is mainly a performance record for information to the KAV. However, not all services are covered by the codes in use: *"It is incomplete. This is only a partial information, I would say, of what is really done"* (INT4, p.1). For example, bone marrow punctures are not included - *"this is an extensive diagnostic examination that is not covered"* (INT7, p. 2).

Searching for study patients

To take part in clinical studies physicians have to know how many patients they have at ONC1 with a certain diagnosis. At the moment they can only estimate this number for each request. The doctors in the outpatient clinic play an important role in this. One of them calls it "filtering":

As he sees most of the patients at ONC1, he takes a note whenever a patient could be fitting for a study and later on checks if s/he fulfills the criteria of inclusion. To support this he has sheets of information about current studies on the pinboard over his desk (OBS4, p.8).

The role of computer-based information

The patient information system KIS, still in use, dates back to the 70's. It contains general patient data and several interfaces for requesting examinations and results and for documenting services. There are only a few PCs installed on the wards and they are used for many things, including nurses sending out requests of meals.

The system, which will be replaced at some point, has grown over time and is partial and fragmented. It supports requesting results from nuclear medicine, radiology, and the laboratory as well as checking their status. While requests for medication are processed through the system, paper forms are used for requests for chemotherapies. Only laboratory results of tests done at ONC1 can be viewed. Radiology results can be viewed for all departments at HOS1 but only after a patient has been admitted to ONC1. Radiology uses RIS and a system digitizing x-rays with the option to e-mail images and diagnosis to others. More recently health professionals at HOS1 have access to their own patients' health history, namely test results and discharge letters, produced in any hospital organized within KAV.

What is seen as particularly helpful is that in the case of patients arriving during the night, personnel can see all the discharge letters from wards at ONC1 and reports from the outpatient and day clinic. This allows them to see if and why a patient had been hospitalized recently.

In sum, the main source of information about patients is the paper-based record. The computer is used for some of the requests to other departments and to check their status. In case the paper-based record is not available, discharge letters can be seen to get a first idea about what to do.

STARTING TO UNDERSTAND ORDERING SYSTEMS IN A HOSPITAL ENVIRONMENT

We have seen that the patient folder is central to the work in the clinic. The patient folder (and, to some degree, its electronic equivalent) contains physician orders and examination results, the medical documentation, care sheets, therapy sheets, and many more documents.

Here we summarize the most relevant features of the patient folder:

- Each patient folder has a unique identifier – the patient ID (in the form of a barcode), the date of birth (day/month) and the first letter of the patient's name.
- All components (sheets) have a standardized format (see, for example, the order form for chemotherapies below). All entries carry a date and are authorized (signed).

VINOURELBIN (Teilbestellung)

1999

Größe: cm
Gewicht: kg
KOF: m²
Zyklus: ④
o Tag 1 Tag 8 o Tag 15

Dosisreduktion
Vinorelbin (-) %

► Tag 1 = 2/10/04

HZ PP HZ Arzt

1	Prophylaxe gegen Übelkeit:	1 Amp Nauseo 2x 1144							
NR	Substanz	mg/m ²	absolut	Träger	Menge (ml)	Ort	Dauer		
2	Vinorelbin ^{*)}	30	60	NaCl 0.9%	250	i. v.	30 min		

*) Achtung: Neigt der Patient zu Venenentzündung? o Ja Nein Falls Ja, 25 ml 20% Humanalbumin in die zubereitete Chemotherapie zumischen!

Unterschrift des Arztes: *[Signature]*

wsp 1me.onko.vinorelbin (teilbestellung).v2002.doc/MED, Code 8737/vinorelbin = navetbinell

i.H. Arzt
Vinorelbin: 60,00 mg/5,00 ml
NaCl 0.9% Ges.Vol.: 250 ml

Figure Order form for chemotherapies

- The patient folder in its physical form consists of a collection of loose sheets, with color and texture standing for different types of documents. As one physician explains: “... I know from the type of paper, from the way documents are assembled, where I have to look, how the head of a particular document looks like, and so forth” (INT1, p. 14).
- Patient folders in use are physically arranged in significant places, with their positioning indicating sequential order (of the patients to be seen), workload, specific task, and so forth. Some of them may carry indicators of special arrangements.

The folder system is organized in a way that guarantees, in most of the cases, (near to) completeness and availability where it is needed. Availability is crucial for the patient folders: They have to be accessible ad-hoc, as patients come without fixed appointments. We can also see that places, as well as the physicality of the arrangement, have a large role in this. Everyone’s work is organized in piles of patient folders, with piles on desks, in boxes underneath a table or on the couch, and everyone knows who is responsible for processing them and what the tasks are. For example, some patients may call to learn about the results of a recent examination because they live far away or have difficulties walking. The responsible nurses places these folders in a pile on the couch in the physician’s room, with a yellow Post-it note attached to it with a symbol of a phone and “pat. calls” on it. Sometimes they write the time and date of the call on this Post-it. There are other Post-its for other types of recurrent activities.



Figure Piles of folders in the day clinic

Each unit has its own medical documentation. In the outpatient clinic and day clinic this is a continuously updated Word document, each new version being printed out replacing the older version in the patient folder. The key artifact in the wards is the ‘temperature curve’. This is a

detailed record of all examinations and interventions performed and their results. It has what in CSCW has been termed a *standardized format* (Harper et al., 1989, pp. 15f). For others to be able to easily identify a document and make sense of, its form must be standardized according to certain criteria. The spatial arrangement that can be seen in ‘temperature curve’ does not reflect a systematical grammar. However, it is organized so as to represent patient's trajectory (with columns allowing daily entries). Moreover, it rather loosely reflects a certain order of examinations to be carried out, such as at the top the daily measurements of the body temperature (a procedure which has given its name to the whole document). One may say that it embodies a rather general clinical protocol to be observed without indicating a specific sequence or mandatory entries. Particular places have been reserved for particular professions as well as for special entries, such as the physician's ‘Dekurs’, medication to take when back home. As we saw, nurses have established a certain routine in reading the ‘temperature curve’ so as to be able to carry out physician orders.

Moreover, and typical of coordinative artifacts (see Schmidt and Wagner 2005), the ‘temperature curve’ supports:

- *Practices of identification* – from the patient information in the upper left corner (which consists of the patient ID in the form of a barcode and admission number, a code for the medical unit) a potential user will know ‘what’ and ‘which’ the document is.
- *Practices of validation* – for each entry there is a date and a signature pointing to a person who has validated it. The names of certain exams and the spaces for examination results (values) indicate particular procedures of assessing a patient's health and the implications of certain interventions. All this taken together allows potential users to assess the relevance, validity, veracity, etc. of entries.

Care sheet and therapy sheet resemble the ‘temperature curve’ in that they mirror what has actually been done and is to be done with a particular patient. Their purpose is to document the current work progress, i.e., finished as well as outstanding tasks. But their use is more local and their organization simpler. The care sheet lists all patient-related activities in the outpatient clinic in chronological order. It:

- Documents in detail what is done, when, by whom and contains specific information about the patient's state – this is important in case the interventions deviate from the standard protocol;
- Gives up-to-date information about future tasks, including additional physician orders;
- Guarantees the complete documentation of all interactions with the patient, even if he/she was not seen by a doctor.

Finally, the ‘schedule for the next day’ helps staff organize the up to 45 therapies that are administered daily in the day clinic. Contrary to the outpatient clinic, the patients for the day clinic are known in advance so that their folders, as well as the schedule, can be prepared the day before. The schedule thereby provides an overview of patients to be treated that is stable throughout the day regarding the total number of patients but constantly updating the current status for each of the patients. It is an example of how temporal order is maintained in the clinic. There are several temporal dimensions to be taken care of: sequencing of tasks, time allocation, and managing a patient's overall trajectory. The ‘schedule for the next day’ regulates:

- staff preparing for blood tests, ordering chemotherapies, blood bottles, and other drugs;

- setting time apart for patients with different therapies, anticipating workload.

In addition, there are numerous 'books' in use in the clinic. One example is the 'ward book' in use in the day clinic – nurses have to call admission to get an admission number for each patient. For this admission she needs the patient's name and old admission number she finds on the 'schedule for the day'. Then she gets the new number, which is a serial number for all the admissions at the hospital, which she writes down by hand into the ward book. When there are no more patients to come, they can complete the ward book for that day. They add up women and men and enter the total number, separated for discharge or transfer, e.g., it can happen that patients are admitted to a ward directly from the day clinic. The ward book is stored in a drawer beneath the desk so that it is always easily accessible. There is a similar book on each ward. But they have two additional booklets in use for admission and two more for the ward rounds. These books are used for

- keeping track of events, such as admissions,
- noting activities (such as orders) that have to be processed later and also entered into the computer,
- communicating orders to others (e.g. the people who have to transport patients to other places for examinations).

There are additional coordinative artifacts in use in the clinic; among them:

- the patient diary, which mirrors parts of the patient's trajectory but is incomplete (patients often forget to bring it along),
- folders with the most frequently used diagnostic-related codes (which the physicians need for the reporting of all diagnoses and interventions),
- checklists and guidelines, as well as templates for all kinds of orders.

EXPECTATIONS TOWARDS THE COMPUTER-BASED DOCUMENTATION SYSTEM

As already mentioned, users, in particular physicians, participated in the formulation of requirements. They can be summed up as follows:

- The system supports the wards at the departments as well as outpatient and day clinic.
- The data to be recorded are relevant for administrative as well as medical issues. They comprise basic information, such as the reason for admittance, clinical results, diagnosis, services, and so forth. Furthermore, the system should support the automatic coding of services.
- The system includes the option to enter data at the bedside through mobile computing with notebooks or tablet PCs. However, there is no plan to use mobile devices in the short term.
- The system provides interfaces to administration and management, to other medical departments in the hospitals (laboratory, pharmacy, X-ray, pathology, ...) as well as to external resources (laboratories, family doctors).
- It provides different views: on the patient, on the stay at the hospital, on the case.

- It allows for statistical evaluation of patient trajectories at both the department level and and the KAV as a whole. This is, e.g., to facilitate the search for patients to be included in clinical studies.
- The system is embedded in the KAV's overall electronic documentation and archiving system.

During our observations and talks with the personnel at ONC1 we have come across a diversity of expectations concerning the system. A prominent one is that it supports overview: *"We expect that it is possible to immediately or nearly always see the complete patient information. This is most important for us, that we really have all examination results together and can retrieve them quickly"* (INT1, p.9). What is crucial about the way how information should be displayed is that it is possible to see the whole trajectory of examination results, preferably in relation to the therapies applied. *"We have patients who come six or seven times a year on average, i.e., they come frequently for their chemotherapy cycles and the like. And it would be favourable for us to see the trajectory from the beginning to the end in one piece"* (INT1, p. 11). The correlation between applied therapies and examination results, e.g., tumor markers, should be displayed graphically.

Another expectation concerns the integration of patient information from the outpatient/day clinic and the wards - *"that all the information [from those two domains] is centrally available from one pool of information"* (INT3, p. 8). Currently, a lot of effort has to be put into the duplication of information, i.e., bringing the folders from the outpatient clinic to the wards when patients are admitted and after their stay putting the discharge letters into the folders to have the information from the ward accessible in the outpatient clinic. Especially at the outpatient clinic the nurses would expect from a computer system that they can easily and unambiguously see from one single source what is planned for a patient. As the head nurse puts it: *"This is a source of error, especially in stressful times: When you have five different sheets to see what is to be done with the patient, [there is a risk] that you overlook one"* (INT7, p. 12). Furthermore, the computer system could help to make actions trackable and enhance accountability: *"I do expect, that information becomes more comprehensible because problems of handwriting are solved and that it is clear who entered the information and who is responsible for it"* (INT3, p.8).

An expectation that is expressed with caution is that results from examinations should be accessible, even if they have been ordered by other departments or hospitals. This could, in the long run, diminish the number of examinations done twice. However, not all hospitals would easily allow access to their data.

DISCUSSION

The coordinative practices and artifacts in the clinic are used in conjunction with each other, and together they are instrumental in ensuring and maintaining a workable degree of order. They

- keep track of and provide access to the vast collection of documents for thousands of patients,
- assist in identifying and validating individual artifacts and versions of artifacts,
- assist in maintaining a practical degree of consistency across the local activities as constituted by division of labor and specialization, over time,
- provide an overview of related activities, the evolution of particular parameters over time,

- document that actors meet agreed-to or statutory standards of care and deadlines,
- ensure that all services are accounted for and reported to the administration,
- and so on...

The artifacts have evolved over time. While most of them reflect more general documentation practices, others, such as the care sheets, were created in response to perceived local needs. Much work goes into maintaining this order, into updating documents, filing them in the right place, retrieving them in time and placing them where they are needed, checking their correctness and completeness, and so forth. A strict discipline in maintaining this order is required, in particular from nurses.

There are several concepts that help explain some of the features of ordering systems. The concept of *mobility work* introduced by Bardram and Bossen (2005) helps understand the need of “the achievement of the right configuration of people, resources, knowledge and place” (p. 137). As a consequence of the specialization of medical knowledge that is incorporated into diverse technologies of examination and treatment, patients have to move between the locally distributed devices, and information has to be exchanged between the departments.

In the outpatient and day clinic especially the nurses are constantly engaged in keeping track of the examinations and treatments that their patients receive within their own as well as in other specialized departments. This enables them to provide the physicians with up-to-date information about the patient. As the paper-based record in the patient folder exists in one copy, ‘just’ getting access to it is crucial and not always easy. A computer-based record might help. However, Bardram and Bossen (2005) describe that this can pose new challenges. “The medical record has in a strange sense become less mobile, because it can only be moved to specific places, namely the fixed PCs” (p. 156). This underlines the importance of mobile artifacts, such as the therapy sheet in the day clinic that can easily be taken to the patient bed where it is used for administering treatments or the trolleys.

Ordering practices are also connected to *physical space, place, and form*. Examples are:

- the Kardex Lextriever as a place and particular physical arrangement
- places for patient folders: desks, couch, wooden box underneath table, blood workplace, etc.
- different folders for filing in-between, out-folders – the role of physical markers (colours, Post-its, etc.)

Another clue to understanding the clinic’s ordering system is the notion of *redundancy*. Tjora (2004) suggests that redundancy often increases the “ability of an organization to suppress error and generate alternative action strategies”, and may be an important source of reliability. In the outpatient clinic we have seen that there are several sources for nurses to see what is to be done with a patient. Though this may cause problems if the information they provide is contradictory, it also ensures that alternate sources of information in cases of uncertainty or missing information are available. Another example of supportive redundancy is the computer as an additional source of information in case the paper-based documentation is not available.

Other ‘productive’ examples of redundant data became visible at the ward where interns fill in the diagnosis and past development into the ‘temperature curve’ to provide visibility at one glance. The nurses in the outpatient and day clinic use the care sheet to write down the

information on future tasks in the way they need it. In both examples we can see that providing information in a specific form may be supportive of a specific function. Moreover, as Cabitza et al. (2005) describe, the process of writing down may contribute to organizing relevant information in the writer's mind. For example, nurses have to produce a report before the handing over conference. The mere act of writing down past events makes them aware of the context and helps them to focus on the most important changes when they actually hand over their tasks to other nurses.

Cabitza et al. (2005) also point to the *redundancy of functions* as important means to ensure what could be called the "smooth flow of work" (compare Bowers et al., 1995): "Redundancy of functions allows different people in an organization to complete the same task so that it is flexibly substituted or exchanged as seamlessly as possible according to the current needs" (p. 159). In ONC1 we have seen that redundancy of functions is supported by the piles of folders in different places indicating tasks. This allows for anybody coming by to take over these tasks. Through the piles of folders and their mutual awareness within physical space, nurses and interns share a common knowledge about the current work progress.

The concept of *overview* is relevant not only for managing the workflow but also in terms of judging the development of a disease as basis for decisions on treatments. This refers to ways of ordering documents and/or data so as to identify relationships between activities, such as the evolution of a parameter over time, or critical points within a patient's trajectory. We have also seen how the spatial organization of information in the 'temperature curve' provides one kind of overview. But as the overriding documentation principle is maintaining the chronology of events, other kinds of overview are not well supported in the present system. In the words of one of the physicians:

"This patient ... her first diagnosis was October 2000. At the moment we document this diagnosis step-by-step. And this is repeated each and every time, we indicate in the curve what happened with her. For example, here she had a new diagnosis, here chemotherapy, here bone metastases were detected, and then she received something else. Then the therapy was changed and so on. We have patients where this goes on for pages" (INT1, p. 11).

What physicians do now is to extract the tumor markers manually for a couple of months, adding information about the therapy, so as to "get a feeling" for the evolution of the disease.

CONCLUDING REMARK

We see our analysis of documentation practices at the clinic as pointing out relevant positive aspects of present paper-based practices that need to be observed so as to make an electronic system successful, either emulating them and/or supplementing them with additional relevant functionalities. As the decision for a vendor and system has already been made, our observations and analysis can, in the next step, the implementation level, be used for evaluating the system.

We are currently observing documentation practices within the outpatient and day clinic of ONC2, which are quite different from those identified at ONC1. This gives us reasons to believe that users' expectations concerning the customizability of the system will be high, and first reactions to the KAV's implementation plan have confirmed this. ONC2 already decided to implement the system on one computer only, and this in small steps, so as to be able to preserve

their current 'good practices'. We also have the opportunity to observe documentation practices within a third clinic, ONC3, which already has a well-functioning system in place (which KAV plans to be supported by the new 'unified' system in the long run). This will give us the possibility of making comparisons across clinics with different work practices and ordering systems as well as across systems.

MATERIAL

	date	interview partner	place	remark
INT1	25.2.2005	doctor	ward	
INT2	21.3.2005	doctor	ward	part of OBS1
INT3	1.4.2005	doctor	outpatient clinic	
INT4	13.4.2005	nurse	outpatient clinic	
INT5	17.5.2005	doctor	ward	
INT6	19.5.2005	nurse	outpatient and day clinic	talk
INT7	2.6.2005	nurse	outpatient and day clinic	
INT8	15.6.2005	doctor	ward	
INT9	16.6.2005	nurse	ward	
INT10	6.7.2005	nurse	outpatient and day clinic	talk

	date	observed persons	place
OBS1	21.3.2005	doctor	ward
OBS2	6.4.2005	nurses	outpatient clinic
OBS3	13.4.2005	nurses	outpatient clinic
OBS4	18.4.2005	doctor	outpatient clinic
OBS5	21.4.2005	doctor	outpatient clinic
OBS6	22.4.2005	nurses	day clinic
OBS7	27.4.2005	nurses	day clinic
OBS8	3.5.2005	doctor	day clinic
OBS9	4.5.2005	doctor	day clinic
OBS10	8.6.2005	doctors	ward
OBS11	1.7.2005	nurse	ward

	date	participants
PRES1	9.3.2005	doctors at morning conference, head nurses
PRES2	16.3.2005	nurses at outpatient and day clinic
PRES3	17.3.2005	nurses at ward
PRES4	31.3.2005	nurses at ward
PRES5	6.4.2005	nurses at wards

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