

Standardizing Clinical Pathways for Surgery Patients through ICT

Bente Christensen and Gunnar Ellingsen

Telemedicine and e-Health Research Group, University of Tromsø, Norway
bente.christensen@telemet.no,gunnar.ellingsen@hn-ikt.no

Abstract. Modern Electronic Patient Record systems (EPRs) can standardize the surgery planning process in order to improve utilization of the hospitals' resources. However, we argue that empirical insight into the practical planning process is crucial for both standardization and the design of EPRs. We look into the work of planning surgery for cancer patients bound for surgery at a university hospital. Information both about clinical status and resources is generated through the process, step by step, ending in a plan for performance of surgery.

Keywords Surgery planning, clinical pathways, standardization

1 Introduction

In hospitals, a well-working utilization of surgery facilities – due to the implicated costs of planning and performing surgeries – is crucial. However, many hospitals do not exploit their resources due to unforeseen cancellations. For instance, the proportion of elective surgeries cancelled on the day of surgery ranges from 10% to 17% across Norway, the United States, New Zealand, Great Britain and South Africa [1]. A Danish study showed that 67% of pre-scheduled operations were changed on the day of surgery [2].

Not surprisingly, modern Electronic Patient Records (EPRs) are supposed to improve the surgery performance [3,4], also through specialized modules for surgery planning. The EPR is expected to support and promote efficient standardized patient pathways in the surgery planning process, amongst others through built-in decision support and structured information (medications and observational data, etc). This is supposed to ensure more predictability, efficient utilization of resources as well as provide the patients with treatment according to best practice guidelines.

Yet, the road toward more standardization through ICT in healthcare is a thorny one [5,6] and the effort to standardize the planning of surgeries has proven difficult [7]. In this paper, we argue that the work related to planning for surgeries is not sufficiently understood, particularly the way it is distributed, negotiated and proceeding. Accordingly, we analyze how surgery planning is actually conducted in practice. We pinpoint the stakeholders involved, state what they do, and identify critical issues for ensuring successful streamlined surgery planning with the EPR.

Copyright © 2013 by the paper's authors. Copying permitted for private and academic purposes.

In: H. Gilstad, L. Melby, M. G. Jaatun (eds.): Proceedings of the European Workshop on Practical Aspects of Health Informatics (PAHI 2013), Edinburgh, Scotland, UK, 11-MAR-2013, published at <http://ceur-ws.org>

Empirically our study is based on an interpretive field study of surgery planning at the Department for Gastroenterological Surgery, University Hospital of Northern Norway. The first author has conducted in depth interviews with two coordinating nurses, two surgeons and one secretary. She has also spent a day in the outpatient clinic and followed a coordination nurse through the planning process. Informal talks with personnel in the outpatient clinic have also contributed to the understanding of the process.

We also draw upon a large EPR development project run by the North Norwegian Health Authority where a new surgery-planning module is essential. After a prolonged bid for tendering process, the Northern Norway Regional Health Authority in 2011 decided to invest in new clinical ICT systems from BigVendor for all the 11 hospitals in North Norway. The BigInvestment project was established and is amounting to 106 million EURO for the period of 2012-2016. The development of a new EPR is at the core of the investment where concrete goals are related to standardization within the following areas: a) patient pathways, b) templates for given diagnosis, c) coding and configuration, d) information content (i.e., more structure) and e) registration practice. The new software is supposed to be developed in close collaboration between the users and the vendor. More than 300 users from different healthcare professions and geographical locations are recruited to participate with BigVendor in development and standardization activities. Due to prevalent wasted resources in the hospitals' surgery performance, a new modernized surgery planning module is prioritized and a concrete aim is to be able to "lock" the program at an early stage in order to ensure a predictable and standardized planning process.

2 Case

In the following we present the clinical pathway for ventricular cancer patients at the Department of Gastroenterological Surgery at the University Hospital of North Norway. According to national guidelines for cancer treatment, a patient who is diagnosed with suspected cancer in the upper or lower level of the gastrointestinal tract at a local hospital is referred to a university hospital for further treatment. This represents a highly standardized and specialized service per se.



Fig. 1. The Actors and the Artifacts

2.1 Receiving referrals at the Department of Gastroenterological Surgery

Like in the rest of Northern Norway, more than 90% of the referrals to the Department of Gastroenterological Surgery at the University Hospital North Norway are received electronically. Referrals emerge in the EPR whereupon a secretary prints them out and puts them in one of the head surgeons' mailboxes. All the doctors' mailboxes are located on a shelf in a room where several secretaries have their workplace, and it occupies most of one wall in the room. The evaluation of referrals is part of the head surgeons' regular work plan and one surgeon has this task for one week at a time. While the EPR allows the referral to be distributed electronically to the surgeon responsible for the evaluation, the department has not established routines for this. A nurse explained:

We feel safer in a way when we print it out and put it on the shelf, cause then it is easier to ensure that it will be processed ... maybe the surgeon is away and doesn't pick it up or something. Then you can actually see that it is lying in the in-box. If this is part of an electronic workflow, it is not that easy to check if it is "hanging" somewhere and you must actually look for it.

The referral contains an anamnesis, resulting from blood tests and clinical findings so far. As part of the evaluation of the referral, the surgeon frequently enters the radiology system to look at images taken at the local hospital. If tissue samples have been collected and analyzed by the Pathology laboratory at the university hospital, (s)he can enter the pathology laboratory system to check the results. As the surgeon has evaluated the referral, (s)he makes notes of his decisions on a flow-chart (i.e., a structured paper form), listing what is to be done; for instance, if the decision is that the patient must undergo further examinations to determine diagnosis and treatment.

PASIENTFLYTSKJEMA GASTROKIRURGISK AVDELING			
Foreløpig Dx.			
PLAN V/ OVERLEGE			Dato: 25.08.11
Utredningspøl uke:	Coloncancer	Benign nedre/generell	Øvre gastrocancer
	Rectumcancer	Benign øvre	
Type kontakt:	Pasienten skal møte til undersøkelse		
	Pasientens papirer forberedes for tverrfaglig møte m/ eget notat		
Skopi / u.s. på Utslusa onsdag morgen → Operasjonsmelding må opprettes			
Gastroskopi		ERC	
Narkose		Sedasjon	
Annet:			
Belastnings EKG		Spirometri	
Ekko Cor		EUS	
Ekstra lab? (CgA, CA 19-9, CEA, PSA etc)			
Meldes tverrfaglig møte samme uke			
Gastro kreftmøte onsdag		Fredag (rtg-demo, benign)	
Operasjonsstue for ekspl. Laparotomi i uke:		→ Operasjonsmelding må opprettes	
Kommentar:			
Radiologisk problemstilling:			
Nye bilder rekvireres ved UNN-Tromsø	Undersøkelse:		
Innhente og vurdere	undersøkelse, fra	sykehus, fra dato	
Booking			
Oversykepleier Gastrokirurgisk avdeling			
Utslusa opr dato:	Innslusa opr. dato:	Innlegges dato:	
Koordinerende sykepleier Poliklinikk			
Brev	Hotell	EKG	
Lab	Histologi	Anestesi	
Utslusa	Gastrolab	Rtg demo onsdag	
Preopr. fysioterapeut	Tømmelapp	Bestilt røntgen	
MÅ VÆRE AVDELINGSSYKEPLEIER GASTROKIRURGISK AVDELING I HENDE SENEST KL 12.00 6 DØGN FØR POLIKLINIKK HVIS PASIENTEN SKAL MØTE FYSISK			

Fig. 2. The flow-chart for cancer patients

The flow-chart “follows the patient” through all the steps onto surgery. To ensure that all steps are carried out, they are subsequently documented in this flow-chart.

Having done this, the surgeon puts the paper referral and the flow-chart in a folder which he places in his outbox where the secretary will pick it up again. The secretary then registers the patient as “evaluated” and enters him in the waiting list in the Patient Administrative System ((PAS), within the EPR), according to the treatment deadline that the surgeon has set. This must also conform with the Patients’ Rights Act, which states that Cancer patients have a right to treatment within four weeks after being diagnosed. The secretary then gives the flow chart with the surgeon’s notes to the coordinating nurse who will book an appointment for the patient in the outpatient clinic.

2.2 The patient visiting the outpatient clinic

Prior to the patient’s visit at the Outpatient clinic several preparatory steps need to be taken. For travelling patients, the coordinating nurse books a room for 3-4 nights at the hospital’s hotel. This is done electronically in the hospital hotel booking system. Knowing that resources are available for diagnosing suspected cancer in the upper gastrointestinal tract on Monday and Tuesday, she must find timeslots in the outpatient clinic on one of those days. This is how the department organizes the fixed pathway, given patients on given days. This makes it possible for the surgeons to know which day they are going to be in the outpatient clinic, according to their expertise. The coordinating nurse must hence know about the different surgeons’ skills for the surgery planning later on. She also electronically books timeslots for MR and CT examinations at the radiology department. The radiology department has reserved time slots for the gastroenterology outpatient clinic so that they can book appointments for the patients aligned with the other tests that are required.

An anesthesiologist must be present in the outpatient clinic these given days to make the preoperative assessment of heart and lung functions, and if needed, further tests like echo cardiography and spirometry (heart and lung tests) can be performed by an internal medicine specialist. By aligning the bookings this way, they can ensure that all the necessary activities are placed within one or two days, and that all the clinical information needed for the final decision about surgery is present for the further process. The assessment in the outpatient clinic includes an array of blood tests. These range from tumor markers to parameters telling about nourishment status. A number of relevant tests are predefined into a “package,” which can be easily adjusted by ticking on/off the tests. An Order Form listing the tests to be taken is printed and sent to the patient together with a Letter Of Appointment in the outpatient clinic, informing the patient to first stop at the laboratory to give blood samples when arriving at the hospital.

When the patient appears for his consultation, the results of the blood tests are available in the EPR. When the patient has reported his arrival to a secretary, she registers his arrival electronically and establishes a “contact” (this is the term that describes the start of a treatment period in the EPR) that all the documentation must be connected to. This way, it can be retrieved in the EPR by searching the date for this hospital visit. She also ticks off his name on a paper list of all the patients expected on this day. This list is brought to the nurse who puts a folder with the patient’s papers

on a shelf by the examination room. This is the sign that the patient has shown up and can be called from the waiting area. In the folder there is a paper form with suggested diagnosis- and procedure codes the surgeon must tick off in order for the hospital to get its reimbursement, together with the flow-chart. When the patient is leaving, this paper is given to the secretary who punches the diagnosis and intervention codes into PAS. After the consultation, the surgeon dictates a note of the findings. At this point, it is verified whether the patient has cancer and will need surgery. So the note is addressed to the coordinating nurse, and serves as a referral for hospitalization and surgery. In this note (s)he usually writes various messages about the patient, like if he must stop medical treatment prior to surgery, or must do certain exercises. Therefore, this is a very important document for the coordinating nurse as she goes on to plan the surgery. The dictate is transcribed and put in the Waiting List For Admissions in PAS by a secretary, so that the coordinating nurse may find it. In her daily routine, the coordinating nurse opens the waiting list to see if there are new patients and what is their deadline for treatment. The surgeon also notes his(her) decisions in the flow-chart that is put in the coordinating nurse's mail box. Sometimes, the surgeon starts filling in the Surgery Order Form on the screen during the outpatient consultation. This is a display in the surgery planning module within the EPR that gives some clinical information both from the surgeon and the anesthesiologist. Logistic data, like booking the surgery team and operating room, date and duration must also be registered in order for the booking to show up in the surgery plan. This will be done at a later stage by the coordinating nurse, as the information has not yet been created. At this stage, the surgeon only fills in the available clinical data.

Fig. 3. The surgery order form

The surgery order form must be connected to the correct contact, so if the surgery order-form was established at the outpatient clinic, it must be moved to the admission contact at a later stage. If not, it will not show up in the surgery plan and all the secondary use of data will be incorrect:

“It is not easy to use the system (...) sometimes when the surgeons have been on their own, I spend half a day correcting things. If they have connected the surgery order form to the wrong “contact” and the patient has had the surgery, all the information and codes must be deleted and re-entered ... lots of work for me. (Secretary)

2.3 Deciding on surgery

After the consultation but while the patient is still in the hotel, the coordinating nurse receives the flow-chart of the patient trajectory, to schedule the patient for admittance and surgery. She checks that all the tests noted in the flow-chart have been performed. Missing tests might postpone the whole trajectory. If some tests are missing, she must check on why and if they will be performed before scheduling surgery. If, for some reason, there are to be deviations from the fixed schedule, this has to be clearly noted, or else the surgery might be cancelled on the actual day, noted as “patient not sufficiently prepared”. The coordinating nurse brings the flow-chart to a multidisciplinary meeting where the surgeons and an oncologist, radiologist, pathologist, and a special trained nurse participate. In this meeting, all the patient’s assessments and tests are evaluated, ensuring every point of view is considered. For instance, what kind of tumor it is, what treatment it is most likely to respond to and what will be the best incision to access it. Given the patient’s prognosis, it is important that the right treatment is chosen. Finally it is decided if the patient is to undergo surgery, chemotherapy or radiation therapy. Sometimes, patients have to go through chemotherapy or radiation therapy prior to surgery to make the tumor operable. If so, they have to go through the loop once again six weeks later.

If surgery is determined, the patient is called so that he can talk to the surgeon (and the oncologist) about how the treatment will proceed. The department aims at doing surgery the week after the multidisciplinary meeting, but many factors influence progress. This is the puzzle that the coordinating nurse works with to bring everything together.

2.4 Closing in on the day of surgery

If the surgery is scheduled immediately after the multidisciplinary meeting, factors about the patient will be brought to bear. If planned for later, ensuring that the patient is set for surgery will be amongst the coordinating nurse’s work. Cancer surgeries are large interventions that are rather stressful, and the pre-conditions must be as optimal as possible. So, at the outpatient clinic, the patient’s nutritional status is checked and if necessary must be improved before surgery. The time needed for this must be planned for as well. There might also be some other diagnoses that must be brought

under control beforehand. In planning, the referral that the surgeon made in the outpatient consultation is very important. The coordinating nurse enters this in the EPR:

“Very often it is me who intercepts messages in the referral, like if the patient is treated with anti-coagulant and needs to stop this treatment prior to surgery, or if they should do some special exercises before they show up here – and then I call the patient to tell them this. Sometimes the referrals say something about logistics – whether the patient must have special transportation, needs a companion, or if surgery must be performed when a patient’s daughter can stay with the patient afterwards. We are talking about heavy surgery that puts the patient out of play sometimes for quite a long time after the operation, and surgery must be planned when things are best set for the patient. Sometimes it might even depend on special competence in the municipality home care service. All these are important issues that you need to know of before the date of surgery is set, or else the patient may not be able to attend and you will have to do the work all over again. There are lots of considerations to be made.”
(Coordinating nurse)

In addition to ensuring the single patient’s needs, the coordinating nurse must also coordinate the in-house resources for surgery. One of the factors is the surgeons. Being part of a university hospital, the surgeons are trained in sub-specialities within their discipline. Thus, in scheduling surgery, knowledge of each surgeon’s skills and education plan is necessary. Planning for the right surgeon is actually easiest for the most specialized surgery. These surgeons have fixed days in the operating room (like in the outpatient clinic) and the operation may be scheduled on these days. It is more complicated for the patients not requiring a specific surgeon:

“If we had a plan where days of surgery, outpatient clinic, teaching and so on for each doctor was plotted, this job would be a dream! In real life, this might shift in half an hour.”
(Coordinating nurse)

Now, the coordinating nurse accesses the booking of operating rooms, operating teams, the waiting list and the patients’ lab results from the electronic patient record. The referral from the outpatient clinic is printed from the patient record to accompany the flow chart in the patient trajectory paper sheet. If the surgery order form in the EPR was constituted in the outpatient clinic, she picks this up and enters the logistic data, such as date of surgery, operating room, team, name of surgeon, ranking and admittance date, so that the patient can be notified of admittance and treatment, and the operation becomes visible in the surgery planning module. The process must be completed by clicking “give timeslot” for the planned operation to turn visible in the planning module for the personnel in the operating theatres.

The plan is confirmed in a meeting with the operating personnel, the surgeon and the management of the different units involved the week before performance. The final confirmation is about allocating the surgeon and checking that other personnel and capacity in the surgery team and in recovery is available. It is frequently a problem that illness among staff in the operating department leads to less capacity for

operations, as they are already understaffed. At this point, the coordinating nurse also makes a final check that the standard preparations are completed, and that the surgery order form holds all the necessary information.

The planning of the different departments and units is now converging. Personnel like nurses working in the wards and in the operating rooms, anaesthetic nurses, nurses working in recovery, surgeons, anaesthetic doctors, assistants for cleaning and for the sterilizing unit - all of these groups are planned for in the different shift plans of their respective units. Then there are schedules for the operating theatres and bed capacity both in wards and in recovery. Stock of medical equipment and surgery tools must also be planned for. Hence, the different steps of the planning are performed by different personnel responsible for their part of the overall pathway. This goes all the way until the performance of surgery. This implies an interaction with a patchwork of different information sources (systems, calendars, paper forms, Excel sheets and oral input) in order to bring the patient's trajectory in line with the clinical pathway standard. There is no total overview of the aligning resources to be seen early in the process:

“I don't know – if I could look into the other units' planning – what should I look for? I think it might just be confusing. On the other hand, we are all dependent on each other's planning. If one of us does a bad job, it all falls apart. It's like domino bricks falling.”
(Coordinating nurse)

From now on, the plan changes from being “in process” to being a plan for performance, and to be the tool for the operating department to start planning in detail how to perform the surgery. For the operating department, it is frustrating that this comes together so late in the process, as it gives them little time for their own planning of details. The surgery nurses will start checking their personnel resources, if the right competence for the team is present, if there are sickness leaves or other factors that might hinder the performance. Then they order the necessary pack of tools (standardized tool packages for the given intervention) from the sterilizing unit. On their hand, they have to check that the package is sterilized or must be prepared. The anaesthetic nurses also check on their personnel resources. The anaesthetic doctors look at the surgery order form to ensure that clinical data to assess the patient pre operatively is present. At this point it is very resource-demanding to change the plan, but it happens and causes much frustration.

3 Concluding discussion

Given our case, it is not surprising that the BigInvestment project seeks to standardize the surgery planning process including the wish of “locking” the program in the early stages of the planning phase to avoid “ad hoc” coordinating at the last minute. Changes to the plan in the “performance phase” are very frustrating as they cause extra work and coordination of many involved persons and resources. Simultaneously it is clear that surgery planning work is highly uncertain and heterogeneous. This makes managing clinical pathways a lot of articulation work [8]. The practice of planning does not

take place through the filling out and subsequent ‘use’ of one artefact – the electronic surgery plan. Rather, planning unfolds (i) distributed across a network of material/technological and human resources and (ii) continuously through ongoing and negotiated additions, deletions and changes. The official plan is in this sense merely a node in a network of interconnected, mutually dependent nodes of material arrangements, practices and different professionals [9]. Clinical pathways as templates may seem “simple” and easy to follow, but applying the templates in practice means lots of considerations. The resources to be planned are part of different units and are planned for more or less independently. For instance, the surgeons that actually are (the) most important resources, are very difficult to allocate for a fixed time slot. At some point the different plans converge into a schedule for surgery. Clinical information as well as resources are gathered along the process, deciding the actions of the next step. The process of planning itself in a way generates the information that is needed for surgery. It is not just booking fixed resources. So a clinical pathway may be seen as steps of gathering information as well as actions within treatment.

As an overall goal of the BigInvestment project is to standardize the clinical pathways, outlining the actual patient trajectories is important to show the work involved, and the different personnel involved to set the workflow correctly. Based on our description of the surgery planning process, transparency of the process and the possibility to make changes to a plan seems crucial in a new EPR system.

References

1. Aaserud, M., Trommald, M., Boynton, J.: Elective surgery – cancellations, ring fencing and efficiency, Tidsskr. Nor.Laegeforening 121 September 2516-2519 (2001).
2. Bardram, J.E.: Plans as situated action: an activity theory approach to workflow systems. In: Proceedings of the Fifth European Conference on Computer Supported Cooperative Work, p 17-32 (1997).
3. Berg, M.: Patient care information systems and health care work: a sociotechnical approach, Int. J. Med. Inform. 55 (August) p 87-101(1999).
4. Ren, Y.Q., Kiesler, S. and Fussell, S.R.: Multiple group coordination in complex and dynamic task environments: interruptions, coping mechanisms, and technology recommendations, J. Manage. Inform. Syst. 25 (Summer 2008).
5. Ellingsen, G.: Tightrope walking: Standardization meets local Work-practice in a hospital. Journal of IT Standards & Standardization Research, 2(1), 1-22, Jan-June (2004).
6. Timmermans, S. and Berg, M.: Standardization in action: Achieving universalism and localization through medical protocols, Social Studies of Science, 27, 111-34 (1997).
7. Bardram, J.: Temporal coordination – on time and coordination of collaborative activities at a surgical department. In Computer Supported Cooperative Work (CSCW), vol. 9, 2000 p. 157-187. (2000).
8. Holten Møller, N. and P. Bjørn.: “Layers in Sorting Practices: Sorting out Patients with Potential Cancer.” *Computer Supported Cooperative Work (CSCW)*: 123-153 (2011).
9. Munkvold, G., Ellingsen G., and Monteiro E.: “From plans to planning: the case of nursing plans.” *Proceedings of the 2007 international ACM conference on Conference on supporting group work - GROUP '07*: 21-30 (2007).