Medical Secretaries’ Care of Records: The Cooperative Work of a Non-clinical Group

Claus Bossen¹, Lotte Groth Jensen², Flemming Witt²

¹Information Studies, Aarhus University
Helsingforsgade 14, 8200 Aarhus N, Denmark
inveb@hum.au.dk

²Health Technology Assessment, Aarhus University
Oluf Palmes Alle 15, 8200 Aarhus N, Denmark
{Lotte.Groth; Flemming.Witt}@stab.rm.dk

ABSTRACT
We describe the cooperative work of medical secretaries at two hospital departments, during the implementation of an electronic health record system. Medical secretaries’ core task is to take care of patient records by ensuring that information is complete, up to date, and correctly coded. Medical secretaries also do information gatekeeping and articulation work. The EHR implementation stressed their importance to the departments’ work arrangements, coupled their work more tightly to that of other staff, and led to task drift among professions. While medical secretaries have been relatively invisible to health informatics and CSCW, this case study identifies their importance, and suggests that they and other non-clinical groups should be considered, when developing health care IT. We propose the term ‘boundary-object trimming’, to conceptualize their contributions to hospitals’ cooperative work arrangements.

Author Keywords
Electronic health records, health care, medical secretaries, invisible work, non-clinical groups.

ACM Classification Keywords
H.5.3 Group and Organization Interfaces – Computer supported cooperative work.

General Terms
Human Factors; Theory

INTRODUCTION
In this paper, we describe the work of medical secretaries, and their role in the cooperative work arrangements of hospitals. Medical secretaries are part of any larger medical practice or hospital, and schedule patients, transcribe physicians’ notes, and ensure the completeness of records. The medical secretaries’ importance became evident during the study of the implementation of a comprehensive electronic health record system (EHR) at a Danish regional hospital. Among other things, implementing the EHR slowed medical secretaries’ writing-up of physicians’ notes, with repercussions for physicians and nurses in particular, in terms of their proceeding with their work. Consequently, the implementation plan changed radically: The first scheduled upgrade consisted almost entirely of upgrades that mitigated the challenges the EHR presented to the medical secretaries.

The implementation of the EHR was part of ongoing efforts in Denmark, where, since the mid-1990s, national IT strategies have set high goals for the development and implementation of cross-professional, structured records that enhance clinical work, planning, and research. Substantial capital and high expectations have also been, and continue to be invested in EHRs and health information systems in the USA [9] and in European countries, such as the UK [15], Austria [16], and Norway [18]. Greenhalgh et al. present a comprehensive overview of EHR studies [23].

CSCW has contributed to the efforts to develop IT systems for health care, with studies of emergency departments, surgical wards, inpatient wards, and laboratories [5; 10], analyses of temporal and spatial aspects of cooperative work and awareness [4; 27], discussions of the role of representation and categorization in developing EHRs, and the challenges involved in their implementation [3; 12; 31].

Most studies focus on the cooperative work of physicians and nurses, while non-clinical staff, such as pharmacists and hospital porters, receive less attention. We argue that medical secretaries have a central role in hospital work arrangements. Along with other non-clinical groups, they are likely to become increasingly relevant to the design and implementation of health care IT, in the shift from stand-alone systems to integrated infrastructures. We suggest the term ‘boundary-object trimming’, to conceptualize their contributions to health care.

BACKGROUND
The focus on physicians and nurses in EHR-study design and implementation is understandable, considering the important and emblematic roles of these professions in health care. When browsing the ACM library portal and two medical informatics journals (Int J Med Inform; J Am Med Inform Assn), we found only one study that focused on medical secretaries: It describes the central role of the unit secretary in the information-seeking activities of a multidisciplinary team at an emergency department [40]. Medical secretaries are also mentioned in passing in other research on collaborative information-seeking [34; 37; 38].
We also found one study on patient transfers, which mentions an unspecified group of non-clinical staff [1].

Along with other non-clinical hospital staff, medical secretaries seem to be mostly invisible, a fate they share with secretaries and assistants more generally. Erickson et al. (2008) found that ‘There appear to be no studies that explicitly focus on the work of administrative assistants in the HCI or CSCW literature.’ [19: 610]. Erickson et al. describe the skills and knowledge required for administrative assistant work, and suggest the term ‘articulation workers’ for administrative assistants. One reason for the invisibility of secretaries and administrative assistants may be that their work, like that of technicians, is typically regarded as routine, unskilled, or not ‘knowledge work’ [7; 21]. Yet, as several studies in CSCW reveal, the work of telephone operators and copy machine technicians, for example, requires knowledge and skill, and is important to their organizations [11; 32; 33]. Since making work visible is pertinent to CSCW [42; 45], the apparent invisibility of clerical work is something of an enigma.

**Occupations, Cooperative Work, and Tasks**

Medical secretaries are part of hospitals’ organizational orders, which may be understood as the result of the actors’ ongoing interactions and technologies, which facilitate and stabilize complex, cooperative work arrangements [39; 43].

Strauss’s interactional approach to action aims to make visible the efforts involved in the actions and interactions between actors [43]. Cooperative action and work emerge as accomplishments arising from actors’ alignment of their actions with those of co-actors, task articulation, and the coordination of work trajectories with the requirements of other co-actors’ work and recursive interdependencies. The effort of alignment and articulation may be minimized by routinizing interaction, and working out standard operating procedures (SOP), which may stipulate courses of action and interaction. As cooperation becomes more complex and broader in scope, actors may work out *arrangements*: temporarily stabilized agreements that may include division of work and work roles, including, for example, descriptions of responsibilities, required skills, and accountability [43]. SOPs and arrangements are often formalized and inscribed on paper or in computers. As *coordination mechanisms*, they facilitate cooperative action, enable communication, and provide updated information on work status. Multiple coordination mechanisms may be organized into *ordering systems*: complexes of interrelated practices and artefacts. These enable cooperative, coordinated interactions of greater complexity and scope than otherwise possible [39].

The multiple actors or groups of actors involved in a cooperative effort often do not share the same work objects. The analytic advantage of keeping this in mind is evident in the case of pregnant women, who, during foetal surgery, become two work objects: To surgeons, the unborn child is the primary work object, while the mother is secondary, a practical and juridical barrier to be addressed; on the other hand, nurses regard the mother as their primary work object, and concern themselves with her survival and well-being [14]. Similarly, cooperating groups of actors may be unfamiliar with the perspectives, aims, and scope of other actors’ work. Hence, the coordination mechanisms become *boundary objects* that facilitate and stabilize cooperation between different social worlds, whose actors relate differently to, but cooperate through these [41].

From this perspective, hospitals emerge as temporarily stabilized orderings of actors and technologies, in which roles, groups, divisions of work, and so forth, are established through cooperative work arrangements, enabled and stabilized by coordination mechanisms and ordering systems. Professions such as medicine and nursing, and occupations such as medical laboratory technician, hospital porter, and medical secretary, align their tasks and actions, and cooperate through SOPs and arrangements inscribed on whiteboards, paper, and in IT systems such as EHRs. As *boundary objects*, these enable cooperation across the various social worlds of professions and departments.

Sustaining work arrangements requires ongoing effort, and they are under constant pressure for renegotiation. Since coordination mechanisms are constitutive of the complex arrangements, changes in technologies are likely to entail changes in work arrangements, including work roles, task distribution, and responsibilities. The outcome of the changes emerges from the interactional processes following the changes in technology, and may lead to the expanded or reduced role of a profession or group, with regard to responsibility, tasks, remuneration, and so on, depending, amongst other things, on the acumen and power of the various groups, including management [2; 6; 13].

**RESEARCH SETTING, CONTEXT, AND METHODS**

We conducted qualitative and quantitative studies at the endocrinology and emergency departments at Regional Hospital in Central Region, one of five regions in Denmark.

Regional Hospital has a staff of about 2000, including 300 physicians, 970 nurses, 130 medical secretaries, and 80 physiotherapists. It is one of the most effective nationally, has 360 beds, and 30,000 admissions annually, of which 85% are acute cases. Yearly, the outpatient clinics receive 110,000 patients. The endocrinology department has 167 beds, and about 12,500 admissions yearly, of which 90% are acute cases. It has a staff of 65 physicians, 169 nurses, 8 physiotherapists, and 30 medical secretaries. It consists of eight wards: stroke services, dialysis, cardiology, rheumatology, gastroenterology, diabetes, outpatient cardiac care, respiratory medicine. Its outpatient clinic receives about 15,000 patients yearly. The emergency department treats 32,000 acute cases annually, and employs 40 nurses, 12 health-care workers, and 5 medical secretaries.

**Context: Implementation of a Comprehensive EHR**

The study of the medical secretaries was conducted in the context of the implementation of a ‘comprehensive’ EHR.
The EHR comprises modules for booking, test requisitions and results, administration of medication, patient administration, and clinical documentation. The Booking, Requisition/Results, and Medication modules had already been implemented at Regional Hospital some years earlier. A previous patient administrative system (PAS) called the GREEN SYSTEM was to be replaced by a new module, which we will henceforth call ‘PAS’. The module for documenting clinical work, CLINICAL PROCESS, was entirely new, and replaced all paper-based records kept by physicians, nurses, physiotherapists, midwives, and so on. It was the first time the Central Region implemented an EHR that included such a broad and integrated range of functionalities. The EHR did not integrate the picture archiving and communication systems or the microbiology system. Thus, the region described it as ‘comprehensive’, and not ‘complete’.

Of special interest to this study is the PAS, since one of the core tasks of medical secretaries is patient administration. In the PAS, patient data (name, social security number, address, relatives, etc.) are registered along with admissions to, and discharges from departments at Regional Hospital, as are transfers to other hospitals. Of interest is also CLINICAL PROCESS, in which clinicians were to document treatment and care in a structured manner, using a wide range of menus and fields shaped by staff at Regional Hospital. Where appropriate, codes for documenting treatment and care are linked to the menus and text fields. For example, the new EHR automatically reports codes for Diagnosis Related Groups (DRG) – used for reimbursing the hospital for its activities – to the National Board of Health. Registration and reporting of DRG codes was, and to some extent remains a core task of medical secretaries.

The EHR was implemented in three phases in the spring of 2010. The first and major phase involved the endocrinology and emergency departments, discussed here.

Data Collection and Analysis
This paper builds on data generated during a larger study conducted in the first half of 2010. It was commissioned by the region, and aimed to evaluate the clinical applicability of the EHR and changes in work practices at the endocrinology and emergency departments at Regional Hospital. Because the region urgently needed to decide whether or not to implement the EHR at other hospitals, the study was conducted during the shakedown phase, just before and after implementation. It may take up to a year before an organization stabilizes, since further changes evolve, as work practices and arrangements are recursively aligned. However, evaluation studies during the shakedown phase are important, and may provide valuable insights [26].

The larger study was devised as a mixed-methods case study [47], and focused on four professions (physicians, nurses, physiotherapists, and medical secretaries). It combined qualitative interviews, ethnographic observation, and a quantitative survey. Observations of the four professional groups were mainly conducted before implementation, to learn about their work practices and organization (in all, 64 hrs; 42 hrs before, 22 hrs after implementation). Also included was observation of expert-user meetings (10), and implementation management meetings (14), following implementation. Observation notes were written up as extended text immediately afterwards. This data also informed interview guides and the design of the survey. All interviews were conducted after implementation, to obtain the staff’s evaluation of the EHR: 13 individual interviews were conducted before the survey, and were also used to inform its design; 7 group interviews were conducted after the survey, and also used to validate survey results.

The project was approved by the hospital directors and department heads, and presented at staff meetings, noting that participation was voluntary. Permission to observe and interview was obtained verbally, as research advanced. All interviews were transcribed and analysed by two of the authors. The quantitative survey was conducted six weeks after implementation (n=225, 58% response rate), and analysed for significant patterns. Nurses, therapists, physicians, and medical secretaries were generally satisfied with the EHR, though there was room, and at some points a need for improvements. The latter two groups were most critical. Not all data from the survey (40+ questions) is relevant to this paper, and is only included where medical secretaries deviated from the general trend.

The analysis of the medical secretaries’ responses draws on data generated by the larger study, as well as the data specifically concerning medical secretaries. This includes three individual interviews (lasting between 54 and 67 min.) and one group interview (lasting 80 min.; 4 participants), eleven hours of observation, and the survey data (n=6 medical secretaries, response rate 87%). The latter sample is very small, and would be unreliable on its own. However, the medical secretaries’ relatively critical stance in the survey is supported by the interviews and observations of the expert-user and implementation management meetings, where they were very vocal. When possible, their concerns led to immediate software upgrades, as well as to a radical rescheduling of the first planned upgrade, three months after implementation. The generated data have been read and reanalysed, in order to understand the work of medical secretaries, their cooperation with other professions, use of various artefacts, and the changes the EHRs involved.

MEDICAL SECRETARIES’ WORK PRECEDING THE EHR
To become a medical secretary in Denmark, one must have a high school degree, followed by a certified, two-year vocational education that includes courses in medical terminology, office software, transcribing and information technology. In this section, we describe their work at Regional Hospital, prior to the implementation of the EHR.

Maintaining Accurate Records
Ruth arrives at her office in the Gastroenterology Department at 7.00, and starts her computer. From a letter tray on her desk, she
takes printed discharge summaries for patients discharged the previous day. She transcribed the summaries yesterday, but could not enter them into the record until the nurse had finalized her notes, and left the record on Ruth’s desk. The discharge summary is filed under the appropriate tabs, first in the record, but also in the file for physicians’ ongoing notes, of which the summary is also part. She writes the discharge date on a table on the front page of the record, and places the record on one of two shelves. One shelf is for records with summaries dictated by junior physicians, which must be checked by a senior physician before an internal messenger takes them to the record archive. Another shelf is for records with summaries dictated by senior physicians, which the messenger may take directly to the archive. Ruth then turns to her computer, finds the data file for a given patient by entering her or his social security number, enters the discharge date, and closes the patient’s admission record.

Medical secretaries participate in the cooperative work surrounding patients. Although they are only infrequently in contact with patients, they contribute to the maintenance of patient records, and do so in a way that is aligned with departmental work arrangements. In the case of discharged patients, the medical secretaries ‘tidy’ the records before they go into the archives. ‘Tidying’ includes a number of tasks: Medical secretaries ensure that all transcribed physicians’ notes and examination results are in the record folder. They enter the physicians’ final diagnoses into the GREEN SYSTEM as DRG codes, based on the discharge summaries. The system accumulates codes, and, on a monthly basis, reports them to the National Board of Health, which uses them to reimburse the hospital, thus, entering the codes in the GREEN SYSTEM is one of the medical secretaries’ crucial tasks, as far as the hospital administration is concerned. Tidying records also includes entering the status of a discharged patient in a table at the front of the paper-based record, and in the GREEN SYSTEM. Furthermore, records are sorted into two stacks, to facilitate a quality-control procedure between junior and senior physicians: Discharge summaries written by the former are read and evaluated by the latter. All records are kept in Ruth’s office for a week following discharge, in case test results arrive, and have to be added to the record. Ruth and her colleagues are also in charge of communication between her department and the archive, and of requesting and returning records on behalf of nurses and physicians.

Ruth accomplishes her work by using several ordering systems. One comprises paper-based records, and consists of folders, drawers, binders, and trolleys sized for A4 paper. Another consists of digital systems, such as the GREEN SYSTEM, the database in which patients’ personal data, and admissions and diagnosis codes are registered. Whereas paper-based records are primarily used by clinicians when treating and caring for patients, the GREEN SYSTEM is mainly used by medical secretaries, to track patient admissions, discharges, and bookings, and store transcribed physicians’ notes. However, nurses may also use it, when the medical secretaries are busy.

Locating Patient Records
Continuing to go through the records, Ruth stops at one particular record. She enters the GREEN SYSTEM, and writes a message to the records archive, headed ‘Write on the bag’: ‘Hey archive girls! I’m sending this record to the outpatient clinic’.

‘The bag’ is a record’s folder in the archives, whose staff Ruth addresses jocularly as ‘archive girls’. Her message is intended to remind the archive staff to write the record’s destined location on the folder. It is quicker, and less work to send the record directly to the other department, instead of via the archive, which does, however, need to know the record’s location, should someone else need it. Locating patient records is often a challenge. Patients move between departments, and may have multiple admissions, and the location of the record is not always noted on ‘the bag’. According to Ruth, there are generally two ways to locate a record whose location is unknown: look it up in the GREEN SYSTEM to see whether the patient has admissions or bookings at other departments, or contact the department to which the patient was last admitted.

Transcribing Physicians’ Notes
Having taken care of the records of discharged patients, Ruth returns to her computer, and enters the SPEECH DICTATE SYSTEM, to see whether there are physicians’ notes that have not yet been transcribed. There are three sets. She listens to the first seconds of the first note, for the patient’s social security number, and enters the number in the GREEN SYSTEM, to find the patient’s file in the system. In the patient’s file, she clicks on a link to start the digital NOTE EDITOR, and begins writing. She puts on headphones, and starts and stops the SPEECH DICTATE SYSTEM by pressing a pedal. Having finished the first dictation, she clicks on a button in the NOTE EDITOR, which sends the written text to the GREEN SYSTEM, from which Ruth prints it. She picks up the notes from the printer in the nurses’ office, and puts it into the patient’s record, in a letter tray on a shelf in the nurses’ office.

One of the medical secretaries’ core tasks is writing out physicians’ notes. This is achieved by switching between three digital systems. The SPEECH DICTATE SYSTEM stores sound files of physicians’ dictation, using recorders kept in the nurses’ office, where the patient records are kept, and rounds planned and finalized. The sound files are stored centrally in a common database, though sorted according to priority and by department. Hence, medical secretaries can take care of their own department’s dictation, and also help colleagues at other departments if they fall behind, and they have spare time. Hence, transcribing is shared among medical secretaries at different departments. On the recorder, physicians must enter numerical codes, to identify the kind of note they have made. In order of priority, these are: ‘11’ for new or acute patients, ‘12’ for ward round dictation, ‘22’ for outpatients, and ‘14’ for discharge summaries. The codes show up in the SPEECH DICTATE SYSTEM, and allow medical secretaries to prioritize transcribing, though they also consider the work pressure on their own ward.
**Transcribing is a Skilled Activity**

In her office at the haematology department, Karen repeatedly listens to the same sound bite. The physician states a treatment, but Karen can only distinguish the last part: ‘...[incomprehensible] manoeuvre’. She phones a colleague at another ward, who is better acquainted with the terminology of this medical specialty, and plays the sound bite into the receiver. However, the colleague cannot make out the term either, so Karen transcribes the rest of the note, prints it, marks the problematic term in red, and sends it by internal mail to the physician who dictated the note.

Situations such as this abound, when medical secretaries transcribe. They have to check terms in medical dictionaries, or consult colleagues with more expertise in a particular medical area. Accuracy is crucial, since slight differences may completely alter a diagnosis. For example, as one physician explained: ‘encephalitis’ is an inflammation of the brain, whereas ‘(hepatic) encephalopathy’ is caused by liver dysfunction, and the two diagnoses entail entirely different treatment. Hearing the difference between terms may be difficult, and requires a trained ear. As is typing in general [22], transcribing notes is a skilled activity: Secretaries switch between digital systems, and simultaneously listen, type, and use the pedal, while differentiating between similar, sometimes unintelligible medical terms.

**Booking**

At about 9.00, Ruth starts to book patients for enteroscopy. She goes through the small stack of requisitions on her desk, checks that each enteroscopy requisition is registered in the **Green System**, searches for a time slot in the **Booking Module**, and books the examination. Then she puts the requisitions into binders on one of the shelves in her office.

Because Ruth is working on a ward that also has an outpatient clinic, one of her tasks is to book examinations. After booking an examination, she prints a patient notification letter, and sends it, together with informational folders about the examination, and dietary and fasting requirements, by ordinary post. Later, patients may phone to inquire about examinations, rescheduling, or cancellations.

**Information Gatekeepers**

During her transcribing of physicians’ notes, Karen is interrupted several times by phone calls. In one instance, a relative wants to hear more about what occurred when a now-discharged patient was on the ward. Karen puts the relative on hold, phones the nurses’ office, and is fortunate to be answered by a nurse who cared for that patient. She connects the relative and the nurse, and terminates the call at her end. In another instance, the local suicide prevention centre would like to see the summary for a newly discharged patient. Luckily, the record is still on a shelf in her office, and she can take the summary from the record, and fax it to the suicide prevention centre.

Medical secretaries handle numerous inquiries by clinicians and other staff at the department, other departments, relatives, and other entities, external to the hospital. They are contacted about matters that concern the location of patient records, non-clinical data (addresses, DRG codes, etc.), bookings, or more generally, connecting people with questions to people with answers. Thus, being information gatekeepers is one of their central tasks [40].

**Miscellaneous Tasks**

Medical secretaries also take care of a range of other tasks, such as ordering and returning office equipment, or special mattresses for patients with bedsores, and guiding relatives and taxi-drivers bringing flowers to the patients’ rooms.

**The Cooperative Work of Medical Secretaries**

Medical secretaries may be said to handle the non-clinical aspects of patient treatment trajectories and patient records. They record and coordinate admissions, bookings, and discharges, register and report DRG codes to the National Board of Health, request and retrieve records from the archives, locate records, or pass them along to other staff. They transcribe physicians’ notes, act as intermediaries between relatives, patients, and staff, and carry out various other tasks. Their work is not mere routine, but requires skill and applied knowledge. They are information gatekeepers, as well as articulation workers [19; 40].

Since the 1980s, medical secretaries’ work has been undergoing computerization, to which the **Green System**, **Speech Dictate System**, and **Note Editor** testify. Though not integrated with the patient records, these systems are parts of the department’s ordering system. The secretaries’ primary work arrangement is that of the department and its physicians and nurses, with whom they align and coordinate their work. But they are also part of a cooperative arrangement of other medical secretaries, whom they help with transcribing and the handling of records.

While patient records form an ordering system shared by medical secretaries, nurses, and physicians, their stance on it is different. The primary work object of physicians and nurses is the patient: The patient record, its information channels and formal aspects, merely document and record patient care. To medical secretaries, the records and the information channels themselves are the primary work objects, whose completeness, integrity, and formal aspects they take care of. Whereas clinicians are patient caretakers, medical secretaries are record caretakers.

**The New Work of Medical Secretaries**

The most apparent and immediate change for the medical secretaries was the replacement of the **Green System** with the new PAS that was integrated into the EHR. The **Green System** had been used at most hospitals in Denmark, including Regional Hospital, since the late 1980s. Thus, medical secretaries were very proficient in its use, and could manoeuvre about in it with optimal speed. Therefore, the implementation group and the secretaries themselves anticipated that deploying the EHR would cause frustration, since it was expected that it would take some time for the medical secretaries to recover their previous proficiency.
The implementation strategy was based on minimal instruction in the new system prior to implementation, with extensive local support during the first 14 days of use. Nevertheless, the medical secretaries received more training than any other group, because their learning curve was expected to be steeper. As it turned out, that prediction was correct, and, along with the physicians, the secretaries were the most critical group in the survey. Their difficulties had repercussions for the other groups, and included shifts in tasks and responsibilities, some being abolished, new ones emerging, and others shifting between occupations.

Transcribing Becomes More Cumbersome
One immediate effect of the new EHR was that transcribing notes took longer. Statistics from NOTE EDITOR reveal that during the first 12 weeks following implementation, the transcription ratio (min. of writing/min. physician dictation) rose from an average of 6, preceding the implementation of the EHR, to 9 during the first week of use, then settled near an average of 7, during weeks 5 to 12 after implementation (Table 1). The total number of untranscribed notes grew steadily to 813 during the first 12 weeks following implementation, compared to about 50 to 60 unwritten notes previously. Since the statistics from NOTE EDITOR also show that neither the number nor the length of notes grew (Table 2), the increase in untranscribed notes must be attributed to the rise in the transcription ratio caused by the PAS module. Hospital management initially asked the medical secretaries to work overtime, but later had to hire outside help.

During our interviews, and in the reports to the hospital's implementation group, the medical secretaries identified a combination of HCI issues and slow functionality as the causes of their predicament. For example, when writing discharge summaries, they first had to enter the current date and the physician's name in fields at the very bottom of the screen, and then write the actual note in a field at the very top of the screen. This meant scrolling up and down when writing each summary. They also complained of too many mouse-clicks, and a lack of keyboard short cuts.

The new PAS also made some tasks more rigid. Previously, medical secretaries just wrote the name of a physician or a diagnosis code in a discharge summary, but they now had to upload these through a browser from a database. However, both the diagnosis and the physician identification browsers were frustratingly slow: 'I start the browser, then I go to the shelves for records while I wait', Karen stated.

The untranscribed notes were a major problem for physicians and nurses, since the notes are the primary means of communication about patients among staff and across shifts. Without notes, they lacked access to previous diagnoses, plans, and prescriptions, unless they could contact the physician responsible for these. Proceeding with treatment and care became difficult, a serious situation with critically ill patients. As the problem of untranscribed notes was not resolved, despite investing more resources and hours in transcribing, the implementation group and the system supplier renegotiated the next upgrade of the EHR, scheduled for a few months later, and designed functionality that addressed medical secretaries’ highest priorities, a move that stresses the importance of their work to the department.

Tighter Coupling to Other Professions
The new EHR combined the GREEN SYSTEM and the paper-based physicians’ and nurses’ records into one integrated system. Medical secretaries, nurses, and physicians now shared the same artefact, and could respond immediately to updates. This also meant that their work practices became more tightly coordinated and interdependent. For example, previously, medical secretaries discharged patients via the GREEN SYSTEM, after having written up the physician’s discharge summary, while nurses finalized their documentation in parallel to, and independently of that. The new, cross-professional record integrated nurses’ and physicians’ notes in CLINICAL PROCESS. Physicians often dictated their discharge summary before the nurses had completed their documentation of a patient’s care, and while the secretaries could write the summary, they could not send it until the nurses had finished their documentation, and the patient was registered in the PAS as discharged. Hence, they had to check patient records occasionally, to see whether this had occurred, which entailed a bit more work for them.

This tighter coupling also affected physicians’ notes more generally. When dictating, physicians at the department
usually followed a recommended structure for going through diagnosis, treatment, prescriptions, and so on. In the EHR, the elements of this structure appear as separate fields, in order to structure data on patients, diagnoses, treatment, and so forth. For example, a note of a physician’s round must have the following structure: Record for <patient name>, <patient social security number>, by <physician name>, Objective observations, Conclusion (e.g. diagnosis), Plan, and Prescriptions. If physicians follow this structure, transcribing is no more complicated than previously, since they can ‘jump’ down the screen in the same order as that in the dictated notes. If physicians do not follow the template, transcribing takes significantly longer, since medical secretaries have to scroll up and down to enter the information in the correct fields. Physicians may not follow the template, either out of habit or because they think it leads to notes of lesser quality: For patients with multiple diagnoses, the template requires that these be listed separately from the prescriptions (diagnoses in one field, prescriptions in another), which means that the reasoning behind prescriptions is listed separately, and must be inferred, instead of being explicated in the case narrative.

Medical secretaries’ and nurses’ tasks also became more tightly coupled. For example, nurses are responsible for initiating the plans to which care, examinations, and treatment are linked, and which are basic elements of the EHR. Since nurses are often busy, they do not always register activities in the EHR in real time. To nurses, this makes little difference, since they seldom document in real time. However, for the medical secretaries this means that they cannot register the actual time of admission when transcribing admission notes. They have to either use the start time indicated in the EHR, which may be three hours late, or correct the time of admission in the EHR. The former is incorrect; the latter requires more effort and time.

Organizing Records

…as a medical secretary, you’ve been taught that your work must be in order. Times must be exact. It is really important. When a patient dies, you register the exact time that it happens. Now it happens that nurses do not have time to register a death until sometime during the night. Then we register a death at 23.00, even though the patient died at 19.00. It is not right. It is frustrating, when you have been taught to register when things happen. (Head medical secretary)

The implementation of the EHR imposed changes that affected the work ethic of the medical secretaries, as described in the statement above. They regarded the maintenance of orderly and accurate records as one of their core tasks. Not registering data at the correct time was one challenge to this ethic, while finishing records following discharge was another. As mentioned, the EHR makes use of plans that health care staff activate on admission, and when commencing new treatment or care activities. These plans must be closed once completed, but, particularly when patients are discharged, this is not always done. Medical secretaries tried to close them, and tidy the records as part of the process of writing the discharge summary, as they had done previously with the paper-based records. However, this was not always possible, because some plans were ongoing, and might be part of a patient’s visits to the outpatient clinic, for example. Only physicians and nurses have the clinical insight to judge whether or not plans should be closed, and therefore the medical secretaries could not tidy the records as accurately as they wished.

Task Drift among Professions

The problems related to initiating and closing plans are linked to task drift, that is, tasks originally performed by one group being executed by another group. Usually, the trend is for routine tasks to move down the hierarchy. With the EHR, PAS functionality is no longer a separate system like the GREEN SYSTEM, but integrated with other functionalities. Hence, these functionalities are more easily accessible to others, as well as to secretaries. For example, nurses can now access the functionality for discharging patients, which poses the question of whether nurses should register discharges, which would make sense if real-time registration is pursued, or whether the secretaries should continue to do this, which might mean that they are not be registered until the next morning, when they write the discharge summary. Similar examples of task drift are physicians themselves writing (short) notes or registering diagnosis codes in the EHR, and nurses printing labels.

Discarding Old Tasks and Acquiring New Ones

A funny incident occurred the other day. We have medical secretaries who work at home. This raised the question: Who is going to tidy, take transcriptions from the printer, and put them into record binders? And I said: ‘But there is nothing coming out of the printer’. (Head medical secretary)

An important effect of the EHR, almost overlooked in the interviews, is that medical secretaries no longer have to print and distribute notes into the (paper-based) records anymore: Transcriptions go directly into the EHR. Similarly, they do not have to spend as much time locating records as previously, though this still requires some of their attention, since paper records are still relevant for some patients. Another obsolete task is the registration of certain services by therapists and nurses, for which they previously had to register the codes, in order for the hospital to be reimbursed by the National Board of Health. Before, physiotherapists would document their work with patients in their own records, and leave a note in the nurses’ office. The medical secretary would pick it up, and register the service codes in the GREEN SYSTEM. Now, the therapists’ records are part of the EHR, and the codes are automatically reported.

As already mentioned, nurses did some of the same administrative tasks as medical secretaries, and still do. Nurses now transfer patients between departments at the hospital, or to other hospitals, and discharge them from the hospital. However, this creates more work for the secretaries: Nurses sometimes transfer patients incorrectly, and since only the receiving department can correct the
error, medical secretaries have to wait for that to happen. Therefore, they maintain lists of incorrectly transferred or discharged patients, so that they can complete the administrative work on a patient, when the error has been corrected (e.g. send a discharge summary to the general practitioner). Tidying has become more complicated, since the work arrangement surrounding it is more complex, and tasks and responsibilities drift between professions.

Whether medical secretaries now have fewer or more tasks, and less or more work is difficult to assess, since the gains of not having to print, distribute print-outs, locate records, and request records and return them to the archives are currently overshadowed by the extra work needed for transcribing. As the only group surveyed, they did not think that EHR had reduced their work load.

The New Cooperative Work Arrangement
The problem of physicians’ untranscribed notes made clear the importance of the medical secretaries’ work to all at the two departments and to management, as evidenced by the revision of the first scheduled upgrade of the EHR.

The EHR involved a systemic integration of medical secretaries’ work with that of physicians and nurses. The previous division of work had been partly effected and supported by the media used for patient administration. In the integrated, comprehensive EHR, the GREEN SYSTEM was replaced by the PAS, and physicians’ and nurses’ records were replaced by CLINICAL PROCESS, which was accessible to all groups. This more tightly coupled tasks, which became more dependent on one another, with regard to accuracy and timeliness. Also, some tasks, such as registering discharges, entering diagnosis codes, and assuming responsibility for initiating the closing of plans in the EHR, tended to drift among groups of staff. While a major benefit of the EHR for the medical secretaries was that they no longer had to print and distribute physicians’ notes, or request, return, and locate patient records, they also acquired new tasks, such as keeping records of patient files that were not yet in order. The tighter coupling, task drift, and new tasks meant that they could no longer tidy records as thoroughly as before, which challenged their work ethic.

The formal distinctions among occupations and professions remain, but the new work arrangements that had to be established created possibilities for desirable and undesirable expansion and reduction of roles. For example, some physicians regarded the option of writing notes themselves as a yet another effort on the part of management to delegate more tasks to them. Nurses did not reject the tasks of admitting and discharging patients in the PAS, because it integrates with the writing of care summaries. Medical secretaries, however, were more anxious during this process, since some of their tasks were now automated (e.g. DRG coding) or partly assumed by other groups (e.g. note writing, admission, and discharge), and the extent of their new tasks was not entirely clear. The results remain to be seen, as the outcomes of implementing new technology are not given [2; 6]. At the time of our study, shortly after implementation, a new arrangement had not yet stabilized.

DISCUSSION
Computerization of medical secretaries’ work has been ongoing since the late 1980s, though unnoticed by CSCW, CHI, and medical informatics. Yet, as efforts to develop health care IT move from stand-alone systems to integrated infrastructures such as EHRs, medical secretaries’ work may become more demanding. Moreover, as the information infrastructures in health care incorporate more groups, other non-clinical staff may also become increasingly relevant.

The invisibility of medical secretaries to CSCW and related fields may have several explanations: Until recently, private and public efforts to digitize health care have focused on physicians and nurses, and research may have reflected that focus; medical secretaries may appear to work alone in their offices, cut off from the hum of other staff activity by headphones (Figure 1); or, they may have been perceived as holdovers from the field of Office Automation, which faded in the mid-1980s, when the field of CSCW emerged [24].

Medical secretaries are unlikely to become obsolete. The skills of registering, transcribing medical terms, and information gatekeeping are unlikely to be fully replaceable by IT. Moreover, the emergence of infrastructures such as EHRs is part of an increasing demand for accountability to other parties, such as management and health care authorities [36]. This will demand continued effort, to ensure the accuracy, completeness, and integrity of data. Since clinicians are costly, on call, and prefer clinical tasks to administrative ones, medical secretaries’ care of records should continue to be in demand. The roles of clerical staff as intermediaries, information gatekeepers, and articulation workers should not be underestimated [17]. As studies have revealed, clerical work is rarely mere routine, but requires knowledge and skill. If this is disregarded, the development of IT may lose central functionalities. Archive staff may execute tasks important to hospitals’ work arrangements: As medical secretaries do not merely ‘transcribe notes’; archive staff may not just ‘archive records’.

There seem to be at least two ways to increase the visibility of medical secretaries and other non-clinical staff: one is to conduct studies with and of archive staff, pharmacists, porters, and so on, to describe their work, which may prove relevant to the development of health care IT; another is to pursue a research strategy of ‘following the object’, rather than following the actors [25; 28]. With patient records, this might have led researchers into the offices of the medical secretaries, and down to the cellar, to the records archives. It might also have led from the ward to hospital management, and to the National Board of Health: What kind of work relevant to the design of EHRs might be performed there?

Boundary-object Trimming
The primary work object of the medical secretaries is the EHR, to which they attend in its formal aspects. They are
not concerned with the actual diagnoses and care plans, but with whether diagnoses have been entered, care and treatment properly coded, and with the completeness of information: Has all dictation been transcribed and entered into the EHR? Are all examination and test results recorded? Have appropriate plans been initiated and terminated?

Until now, we have informally called this work ‘tidying’, and contrasted medical secretaries’ care of records with clinicians’ care of patients. In the interactional approach’s efforts to make visible the interaction and work [42; 45], we propose defining this as boundary-object trimming. Originated by Star and Griesemer [41], the concept of the boundary object has been widely used, and several studies have contributed to a nuanced understanding of it. Fujimura emphasizes the need to augment the robustness rather than the plasticity of boundary objects, when these have to travel between diverse social worlds, and suggested the term ‘standardized package’ [20]. Lee argues that not all objects that travel between social worlds are boundary objects: Non-standardized, temporary objects may be used to negotiate boundaries between groups [29; See also 35]. Finally, boundary objects should not be considered static. Lutters and Ackerman describe boundary objects that are in flux, as the work of which they are part changes. They are ‘punctuated crystallizations’ of information, interpreted in the context of their production [30]. Subrahmanian et al. describe how changes in organization threaten to make boundary objects useless, as their information becomes irrelevant, and interpretations in different social worlds diverge [44]. The two last-mentioned studies indicate the importance of the ongoing maintenance of boundary objects.

To a large extent, this is what medical secretaries do, when they ‘tidy’ medical records. In the paper record, they wrote notes and inserted these, along with examination and test results, into the record folders. They added codes, ensured the completeness of the record before sending it to the archives or another department, and kept track of its location. Though somewhat differently executed, much of this tidying work continues with the EHR: Secretaries write notes, add codes, and try to ensure the completeness of the record by closing initiated plans. They maintain the records, so that they may function effectively as boundary objects.

Strauss called actors’ reflexive monitoring of their own and other actors’ actions, and the projection of future ones, the ‘gyroscopic source’ for coordinating different courses of action for common goals [43, p37]. Boundary objects have a similar stabilizing effect on the interactional courses of cooperative work, as long as they are useful and appropriate to that work. Their structural forms and informational content must be maintained and updated, which may be accomplished during use, but may also be delegated to a group of staff. In the same way, ‘articulation work’ may be an integral part of action, but may also be the main task of some (e.g. secretaries and project managers). We suggest calling this ‘trimming’, in the aeronautical sense of levelling an airplane to ensure smooth flight, or in the nautical sense of distributing the load and adjusting the sails of a ship, to reach optimal speed and stay on course. ‘Trimming’ stresses the dynamic and directional aspects of the work, in contrast to ‘upkeep’ or ‘maintenance’, which suggest a more static extension of a given state. The concept of boundary-object trimming may be a third way of making visible the efforts of medical secretaries and other non-clinical groups.

CONCLUSION
We have described the cooperative work of medical secretaries, and their central role in the work arrangement at a hospital, based on a mixed-methods case study of the implementation of a comprehensive EHR. We propose the term ‘boundary-object trimming’ to characterize a central feature of their work; they and other non-clinical groups have been relatively invisible to CSCW and medical informatics, but may require more attention, as health care IT moves from stand-alone systems to integrated health care infrastructures, and hence incorporates more groups of health care professionals.

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REFERENCES