Maintaining Data Quality at the hospital department level

The data work of medical secretaries

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Abstract
This article explores the collaborative work of maintaining data quality of a major health administrative database as it is carried out by medical secretaries in the role of 'registration responsible medical secretaries'. The article reports on ongoing socio-technical study of local, on-the-ground data work in 5 Danish hospital departments. We argue the medical secretaries make important and skillful contributions to data quality at department level, including identifying and correcting errors, implementing changes to the coding practice, and maintenance of data input quality at the department level requiring a high level of context sensitivity.

Keywords
Data work, medical coding, health care, medical secretaries

1 INTRODUCTION

In this paper, we explore what we call the context sensitive collaborative work of data registration and data maintenance at five hospital departments in Denmark.

We frame this data work as being socio-technical as the electronic health records (EHR) and other health informatics technologies, together with rules and regulation and staff competencies for doing data work and clinical work, is highly situated and contextual. To understand the driving forces behind the registration and quality assurance work on patient trajectories done by the medical secretaries at the department level, we first introduce some of the important parameters guiding high health data quality in Denmark.

1.1 Data-driven health care and data work

As data has risen as the new "oil' of the information economy [1], along with widespread digitalization and the growth of data-intensive resourcing in healthcare [2, 3] the focus on achieving data-driven healthcare management is increasingly evident in both academic literature [4, 5] as well as the health care strategies worldwide, as well as in the strategies of Danish health authorities [6, 7]. As ambitions for data-driven potentials are rising with advances in data-powered technologies such as artificial intelligence (AI), so is the pressure on health care professionals to deliver high-quality data. Data is not simply pumped out of the ground as the oil metaphor suggests but requires work[8]. This focus is reflected in the growing body of literature concerned with exploring the work required for sustaining the data-driven health care systems [8–13] recognizing that large-scale data is a product of the work of many people and professions [14], leads to new professions [8] and changes the task portfolio and relationship of existing professions [14, 15]. It remains pertinent to investigate the on-the-ground data work of healthcare professionals, both clinical and non-clinical such as the medical secretaries in focus of this article. We aim to contribute to this field by foregrounding some of the important and skilled data work happening backstage in Danish hospitals to maintain data quality of a major health database.

1.2 Digitalization and data-driven healthcare in the Danish context

From an international perspective, Denmark is often regarded as a frontrunner in digital health care and boasts a long history of successful national standardization efforts with numerous national health information technology strategies starting in 1995 building toward an increasingly coherent data infrastructure [16, 17]. Today this enables a wide range of data to be shared between GPs, specialists, pharmacies, municipal health services, and public hospitals, as well as with the patient through patient-facing infrastructures such as Sundhed.dk. Denmark has a well-registered population, a digitalized system of performance measurement in the health services [2], and a recent joint initiative of the Danish health authorities aim to make Denmark an international leader in the use of health data for treatment, research, public management, and innovation [7]. The aim is to further strengthen the access to and use of health data building onto, what is already referred to as the 'epidemiologists dream' [2, 17, 18] building onto '...a large network of population-based medical databases, which routinely collect high-quality data as a by-product of health care provision' [17].

In this article, the primary context of the data quality work in focus is the data quality work of medical secretaries related to data on patient hospital encounters reported into the administrative medical database The Danish National Patient Registry (DNPR).

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1.3 The Danish National Patient Registry

The DNPR which has been in place since 1977 [19] is one of the primary administrative health databases in the Danish context. DNPR collects all information on examinations and treatments in hospitals including e.g. primary and secondary discharge diagnoses, dates of contact, surgical procedures with dates from inpatient, outpatient as well as emergency encounters [17]. The Register provides data for different health registers, research, disease monitoring, and treatments [20] and is one of the most widely used registries for epidemiological research [17]. It is also a key database for performance and finance management at the hospital, regional, and state levels, as the financing model for Danish public hospitals includes both block grants, as well as activity-based subsidies (based on DRG), which utilize data reported to the DNPR for the settlements. One example of a political objective, which to a high degree shapes performance monitoring is the policy of 'extended free hospital choice' under which citizens may choose freely among all public or private hospitals if a region cannot deliver a diagnostic examination within a 30-day timeframe [17]. Creating and maintaining the necessary, correctly coded data to enable such performance measurement and fulfillment of patient rights is a key aspect of the data quality work performed by medical secretaries which is in focus in this article.

Data for the DNPR derives from registration in the patient administrative systems utilizing an integrated classification system, which combines entirely Danish classification systems based on international standards such as versions of the WHOs International Classification of Diseases ICD-10 and the Nordic operation classification systems (NCSP) [20, 21].

In 2019 a major upgrade (DNPR3) to the database was carried out implementing a shift to trajectory-oriented registration, bundling contacts, diagnoses, procedure, and result registration in relation to a clinical disease trajectory for each patient. Hence is possible for patients to have 2 or more ongoing trajectories at the same time, which is needed among patients with co-morbidity.

Data for monitoring interventions and outcomes as recommended in national clinical guidelines is an important objective for a comprehensive national data structure. Moving from the level of political intentions to the organizational level, as well as the concrete registration, and quality assurance of health care data, four levels and entities are of significance.

Organizational structure	Data registration body
National	Danish Health Data Authority
Regional	Business intelligence and/ central IT departments
Hospital	Registration unit and consultants
Hospital Department	Registration responsible Physicians and Medical secretaries/health administrative coordinators

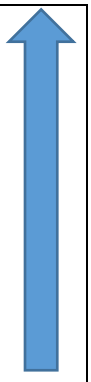

Figure 1. Health data registration organization levels: National, regional, hospital, and department

At the hospital department level, a registration responsible physician and a registration responsible medical secretary (RRMS) is appointed by department management to make sure data work is done according to the national guidelines. At the hospital level, a registration responsible unit and registration responsible consultants are monitoring the aggregated data work and data compilation. At the regional level data from all departments and hospitals are managed, quality assessed, and used by the regional politicians and managers to monitor regional health-related activities, but also forwarded to the Danish Health Data Authority (DHDA) where health data from all 5 regions are quality assessed, aggregated, used for research, and visualized.

The specific responsibilities and guidelines for the execution of the RRMS role in relation to the wider registration organization are formalized in a region-wide role description for the RRMS. There are no formal certification requirements connected with the role of the RRMS beyond those required for medical secretaries in general and the specific organization of the role is decided locally depending on the department context.

1.4 Data work of medical secretaries

The study, from which this article emanates, particularly seeks to make visible the *data work* of medical secretaries in Danish hospitals (see [15]). Medical secretaries in Danish hospitals undertake a broad array of patient-oriented and health-administrative tasks as well as support to clinicians' work [22, 23]. The profession of medical secretaries is actively working to acquire new tasks and remain relevant in modern digitalized health care and has been taking on new tasks following from an increasingly digitalized work setting [14, 24, 25]; one example being the work of data quality assurance of patient data registration as in focus here. In 2021 the education for medical secretary has been replaced with a one of 'Health Administrative Coordinator' placing a higher emphasis on their role in the administration of a more complex, digitalized healthcare setting.

Since the profession began gaining in numbers in the Danish hospital context in the 1950s medical secretaries were closely tied to the doctors and thus the clinical context. They have still today maintained a decentral department distribution where they physically and organizationally are located close to clinical practice. Several studies emphasize this as a key factor, which enables them to "often act as the organizational 'glue' or connecting thread between other professional groups at the hospital' [26] and that "secretaries are deeply involved in diagnostic work through the eligible administration of patients in the collaborative electronic information systems' [27] and thus are positioned at the intersection of clinical and administrative work (ibid).

Like that of other clerical workers, the work of medical secretaries has often been relegated to the background [23], [28], regarded as mere routine work rather than knowledge work and thus targeted for automation [29, 30]. This article seeks to contribute to the growing body of literature foregrounding the work behind the high-quality data powering the 'epidemiologists' dream' and AI, described above, by investigating the work of medical secretaries in

Danish hospital departments as they work to maintain the quality of data for a major patient trajectory database, the DNPR.

Entering into this, we ask the following research question:

Which practices and skills are employed by registration responsible medical secretaries for maintaining the quality of patient trajectory registration data at the department level?

2 METHODS

This paper reports insights from ethnographic fieldwork carried out by the first author from February to March 2022, at five different hospital departments in the region of Northern Jutland in Denmark. The region spans from small, local hospitals to a major university hospital. This study includes departments in both regional and the central university hospital, and departments ranging from 7 to 30 secretaries. The departments included were chosen based on prior knowledge from an ongoing study of the data work of medical secretaries in Danish hospitals (see [15]) as well as snowballing to identify RRMSs deemed highly skilled by their peers. Hence, the medical secretaries who were interviewed are all experienced in the use of the ICT systems, which was a crucial element when enquiring into their skills and competencies as professionals.

Five RRMS were interviewed for each 30-60 minutes after which a focused shadowing was carried out by engaging in a form of apprenticeship peer training session. This was carried out by instructing the RRMS to introduce the tasks, main systems, etc to the observer, the first author as if he was a new apprentice creating a space for both the RRMC to present their expertise in context and for the interviewer to enquire into specific elements of practice. The shadowing happened at the desk of the RRMC being a natural workplace connected with the role. Three of the sessions lasted 2 hours, two lasted 6 hours split over two days.

In addition, one interview (45 minutes) was made with a member of the Registration Unit as well as one interview (60 minutes) with a head of medical secretaries in one of the departments.

All interviews were transcribed in full. During observation, handwritten notes were jotted down and written into full notes immediately after supported by focused transcription of the sound recording from the observation sequence.

Analysis of the data largely followed the process of Grounded Theory [31] constructing themes by shifting between open, horizontal coding, and vertical, consolidating coding and subsequent focused coding. The presentation of data and insights in this paper is the product of the discussions between the two authors.

3 ANALYSIS

In the following, we present characteristics of the work of quality assurance in the work of the RRMS as they emerged through the fieldwork and subsequential analysis. Initially, we touch on the necessary competencies or mindset required for the role as RRMS (3.1) after which we outline the process and tools related to the work on error lists. Finally, we outline two strategies applied in the work on error lists, namely 'detective work' (3.3) and 'data quality educator' (3.4), and show how these rely on a context sensitivity based on the intertwined situated skill and knowledge from both the administrative, clinical, and organizational context of the department.

3.1 The registration mindset – being RRMS

As mentioned earlier, there are no formal requirements or certifications tied to the role of the RRMS. Two of the RRMS in this study had taken specific courses oriented toward health data registration (e.g. data processing and controlling), but obtaining the role as RRMS rather seems to be based on experience and a certain type of mindset. As described by a head medical secretary:

*"To be a registration responsible really is demanding. It simply requires a huge insight into the hospital, and it also requires a lot of experience. *RRMS* is really - she is mega experienced. And likewise - the thing about going in-depth, wondering and the thing about things simply having to be right - you have to have a lot of... a pride, a professional pride about it. So, she's very good at it. You need to have someone like her in the departments. Also, because it gets… complicated sometimes.' (Head of medical secretaries)*

When talking about the skills needed for performing the work, it was unanimously agreed that it took a certain type of personality. One secretary refers to herself as having a 'registration brain' (RRMS 5), while others jokingly suggested having 'a bit of OCD' and finding joy in cleaning up and 'getting things completely right'. During the in-situ interviews the RRMMs would at times enthusiastically celebrate upon opening a list, which was empty or had fewer errors than previous or expected such as the quote below, in which an RRMS opened an error list which she had been particularly attentive to for a period, but had not checked for several days:

"Wow, now have look! It's empty. Oh my God, this is the first time in a long time – that is amazing!' (RRMS 2)

While most of the RRMS explained how they got the role somewhat coincidentally rather than as a deliberate career choice, they stress the particular attitudes – or the 'registration brain' – as a key characteristic to thrive in the role.

3.2 The work on error lists

The main part of the work of the RRMS is centered around quality and error lists, which are "a tool for medical secretaries to perform ongoing quality assurance of registrations' [32].

The error lists, which are uniform across all hospitals in the region, are automated data extracts supplied by the regional Business Intelligence Unit containing logical errors from the clinical registration of patient trajectories. New extracts are published once every 24 hours and accessible through a folder in a shared drive in the form of lists in PDF and Excel files. The error lists are sorted in thematic subfolders and the files are separated by error type (eg 'Potentially missing clinical decision').

Though, most of the lists are accessible through different avenues (eg. the patient-administrative system, a business intelligence solution, and websites from the national health data authority) the lists are accessed through a folder in a shared drive, referred to as the 'department folder'.

Most of the lists are permanent, while others are in place to enable specific events; in the case of this fieldwork one of these events was preparation for migration to a new EHR.

The role description, see [32], specifies the frequency to which each list should be reviewed, however in practice these are not followed. Rather the pace of the routine relies on the size of the department, concrete registration deadlines related to certain lists, and the overall activity in the department.

In the observed departments, the time spent on the role varies depending on the size and context of the department. In one large department with a coordinating role for other departments in a regional hospital, the role was managed by two persons as the primary function. In a small department, the role was assigned to the head medical secretary, who assessed that she spent a few hours per week on the work on error lists specifically.

A central aspect of the work on monitoring and clearing errors off the error lists requires the RRMS to maintain an overview of the status of the lists over time. Due to the system of lists being updated daily (around midnight), there is a delay in the feedback as to whether the corrections made to the trajectory data results are correct, as this will only be visible on the next day's error list. Additionally, one registration issue often shows up on several error lists, meaning that the correction of one issue will often solve issues figuring on multiple lists. Analyzing these connections requires insights both into the logic of the registration system as well as the intricacies of the patient administrative systems in general. Failing to foresee the connections can lead to the RRMS 'searching for an error, which isn't there anymore' (RRMS 4).

3.3 Data detective work – investigating and correcting errors

A majority of the errors on the lists are, despite being time-consuming due to being many, simple in the sense that they require little analysis and are often uniform and easily corrected, eg by adding or changing a single code. At the level of the individual complex error, several of the RR secretaries in this study refer to this as being 'detective work' or as taking a 'Sherlock Holmes' approach. This is to describe the process of going from the decontextualized error on the error list, eg 'Missing A-Diagnosis', to investigating through the available patient data across different systems (eg booking system, EHR, patient-administrative system, physician task lists) and different types of data (eg medical notes such as s or admission and discharge letters, test answers, bookings) and to identify the cause of the error and what needs to be done by whom to correct it.

'It's a lot about tracing down what has been going on' (RRMS 1)

The 'detective work' description illustrates the ability to identify the cause of the errors on the list by combining a deep contextual understanding of the IT systems in use, the registration regime, the role of registration in department/hospital administration and the organization and medical specialty.

As described above, the work on errors often spans a period and involves awaiting other people or processes to contribute:

'RRMS is working on a case on the error list of cases in which inquiries have outrun the 30-day period. The RRMS is 'trying to chase down the clinical decision', she says, to establish whether a clinical decision has been made by meticulously browsing through the relevant systems. In the notes module, she identifies a medical note (a sound file) pending transcription, which fits the timespan to potentially contain a clinical decision made within the 30-day period. Hence, not able to assign the correct code, the RRMS adds a 'priority' mark to accelerate the transcription process. In the patient-administrative system, she notes down 'Note #date#' as an indication for herself, that transcription is awaiting. The error remains on the list and will appear again after 24 hours until solved.' [Field notes]

In another example an error concerns a referral, which has been simultaneously canceled/closed and referred to inquiry and therefore conflicts with the need to assign the start date of a patient's 30-day inquiry period:

'To solve the issue, she has to 'dig through earlier referrals', which she opens in Clinical (EHR), where she – as opposed to the patient administrative system – can read through the visitation information; who did what when in the visitation history. By reading through history, she can conclude that the cancellation must have been added by mistake by another department. She sends the case to the department with a note on suggested processing.' (Field notes)

In this case, the RRMS show a high level of interactional expertise in the clinical field they are in in addition to a deep knowledge of the related coding regime, which is required to be able to effectively navigate complex patient trajectories and construct these in the form of correct registration. This combination of knowledge has been particularly necessary after the introduction of the DNPR3 and the related trajectory-oriented coding regime as many physicians and regular medical secretaries still tend to fall into using the former activity-oriented coding regime.

The coding expertise is also visible in how, the RRMSs engage in *refining* the coding of trajectories:

*'*RRMS* is showing the workflow of correcting an error on the 'Missing A-Diagnosis' list. She points out that most (non-RR) secretaries would probably just see that 'this is ambulant' and see that it is a control visit after an emergency room visit. She, however, likes to go back in the patient history (in the patient administrative system) to see earlier activities in the trajectories of the patient to be able to connect the diagnosis to the correct place in the trajectory as well as add the right fracture diagnosis as a 'plus-diagnosis'' (From field notes)*

This speaks to the 'professional pride' or urge to 'get things right' mentioned earlier.

A considerable number of errors, the RRMSs agree, stem from poor integrations between the booking system and the patient-administrative system, where registrations do not properly synchronize between the systems. An example of this is that it is possible to create a booking in the booking

system without the contact being registered to the patient trajectory (in the PAS), which prompts an error. To identify how to fix the error the RRMS has 'to go hunting', as one secretary put it, in patient data (physicians' notes, discharge letters, etc.) across different systems to establish what kind of contact, if any, took place. One example is identifying in the free text of a note from the physician that the patient will be contacted by a nurse.

'That is a really, I mean, that's really annoying work to clean up, because you have to rewind the whole thing to see if 'is this one supposed to be there or is it not and if not, when and to which contact is it supposed to be assigned?'' (RRMS, 1)

In sum, the RRMSs – as Sherlock Holmes in a crime scene – navigate the complex contexts of patient trajectory data from the points of single, decontextualized logical errors in the registration as they appear on error lists through a range of skills and knowledge situated in both clinical, administrative and organizational aspects of the department context.

3.4 Data quality educator

In the observation and interviews of this study, the focus on supporting the ability of the medical secretaries in the department to deliver high-quality registrations unsurprisingly comes out very clearly as a key concern for all the RRMS.

The work of building the registration capacity of the department's secretaries covers aspects of identifying and correcting patterns of error in the registration at the group and individual levels as well as contextualizing and communicating changes to the registration practice.

One of the formalized responsibilities of the RRMS is to *"Ensure that news regarding registration is known and manageable by medical secretaries"* [32]. Through the Registration Unit, the RRMSs regularly receive notifications (mostly by e-mail) of changes to the registration practice. The RRMS then decides the necessary steps to roll out the new practice and whether it necessitates any changes to registration workflows. Depending on the type and complexity of the change, the size and organization of the department, and other contextual factors, the RRMS produces, initiates, and monitors the implementation of these changes at the department level. An example of a complex shift is the upgrade from DNPR2 to DNPR3, mentioned earlier, which constituted a major shift in the registration logic for secretaries and clinicians alike. Though this upgrade was rolled out in 2019, the RRMS often mention dealing with residue from the former activity-oriented registration logic (eg. Examinations that are logged without connection to an active trajectory).

The RRMSs in this study emphasize the identification and acting on patterns of error in the registration of the department is an integral part of managing data quality at the department level. The RRMSs describe how their choice of action regarding an error – whether to fix the error or send it back to the secretary who made the error – is a balancing of when to step into the role of the educator vs simply correcting the error. This balancing is based on whether the error is systematic and part of a pattern either with the individual secretary or the group, as well as an assessment of the cause of the error; e.g. whether it is due to a wrongful understanding of the correct registration practice, based on the registration systems (such as issues from poor integrations) or organizational (eg delays in transcription, illness or lack of personnel in own or other departments, etc).

They stress how considerations of upholding relations with other secretaries and physicians are central to their decision of when to choose the educator role. In a recent paper, Jensen [33] point out how diplomacy skills, ie "creat(ing) and uphold(ing) good relations (…) is a fundamental and under-recognized aspect of transplant data practices" (p 9). This echoes the considerations of the RRMS as they balance their strategies between educating the department and knowing that what they are asking often is often regarded as annoying.

Thus, to enforce the continuously changing registration practice and maintain department registration quality, the RMMSs apply a deep contextual knowledge of organizational as well as administrative domains. In doing so a key ability of the RRMS is to identify patterns in registration errors at the department level and successfully use this in building the registration capacity of secretaries and clinicians in the department while balancing their relations in the collaboration with their colleagues whose registration they are correcting.

4 DISCUSSION

As with most other clerical functions, a major part of the work of medical secretaries happens 'backstage', in the back office behind a desk, looking at a screen, while physicians and nurses are much more visible. As discussed in several classical texts within Computer-Supported Cooperative Work (CSCW) and related fields [28, 30] the invisibility of clerical workers and considering their work as routine work tends to lead to ambitions to automate them away.

As Holten-Møller [25] foresees, while many discussions of automation are ongoing in the context of data and registration in health care, "the future of AI and automation in hospitals seems to have little or no place for clerical work' (ibid). What we are seeing might be that "data work may simply be shifting hands' (ibid).

In Denmark, we recently saw with the implementation of the EPIC EHR system in two Danish regions in 2017, how the business case of the new EHR systems were been partly financed through a planned redundancy of medical secretaries [34]. Here the ambitions followed the general trend of realizing a double aim of cutting costs and achieving real-time data by authorizing physicians to the coding of patient trajectories at the bedside [4]. The regions in question, however, ended up re-hiring most of the medical secretaries to work on correcting error lists to maintain data quality as the quality of registrations plummeted and frustrations of the physicians grew [34]. The work didn't disappear – it merely shifted hands and took a new form.

The role of the RRMS discussed in this article illustrate data work needed to maintain data quality and how a group of non-clinical health care professionals does this work by applying situational knowledge and skills from the clinical, administrative, and organizational context of a hospital

department. As a potential future role in a context of increasing automation of coding work as new generation EHRs are being implemented, shedding light on the qualities of on-the-ground data quality work becomes crucial in understanding how non-clinical workers in health care with a deep knowledge of the departmental context contribute to realizing the increasing ambitions of data-driven health care.

5 CONCLUSION

This paper has highlighted how medical secretaries as non-clinical workers in Danish hospitals, contribute to data quality of an major national health database by correcting data registration errors made by clinicians, fellow medical secretaries, and/or EHR systems at the hospital departments. Their work requires highly situated skills and competencies within data registration practices, on-the-ground knowledge, and an interest in close follow-up and implementation of new data registration guidelines for the health care organization.

We have shown how the work of identifying and correcting errors, implementing changes to the coding practice, and maintenance of data input quality at the department level is carried out with a high level of context sensitivity through strategies as 'detectives' (analysing and correcting errors) and 'educators' (identifying and acting on error patterns in department coding practice) while simultaneously balancing the diplomacy of correcting the errors of colleagues to uphold a good working relationship.

As a profession, medical secretaries contribute at regional and national levels to quality health care data and thus to meet the goals in the national strategies for data-informed patient trajectory, treatment, research, public management, and innovation.

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