

Socio-technical Infrastructures for Healthcare Automation in NHS Primary Care

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Abstract. Automation and computerisation technologies are poised to impact some 47 percent of the U.S. labour market. While automation is typically seen as a threat to workers in many economic sectors, it is an opportunity in the current state of NHS England primary care and general practice services. The early findings reported here are from a recently approved research program that employs ethnography to understand the socio-technical interactions of all primary care staff. With a keen eye on the occupational roles, the tasks those occupations perform, and the tasks technologies perform. The concept of junction work is used to discuss opportunities for automation across different task workflows and occupational roles connecting to the infrastructure at each primary care research site. The project aims to better understand questions surrounding the social dynamics of adopting new technologies, detail the existence of current infrastructures, and identify the key features that may resist automation or support the implementation of automative technologies into existing infrastructures. Early findings are from two health centres, one rural and one urban.

Introduction

Computerisation and automation are typically seen as a threat to workers in most industries because automation leads to reduced wages or layoffs. While automation may target vulnerable workers in many economic sectors, healthcare is one of the few areas in which automation is viewed as an opportunity; specifically, an opportunity in NHS England primary care system. Primary care

faces numerous pressures including staff shortages, increased workloads, increased demand, reduced budget, skill shortages, and decreased time for patient consultations (Baird, Charles, Honeyman, Maguire, & Das, 2016; Hopson, 2016; Martin, Davies, & Gershlick, 2016). While automation may address these pressures in primary care, it will also reconfigure the work of all staff roles and change the patients' relationships with their general practitioners.

The pharmacist is one example of a health occupation reconfigured through decades of automation and computerisation technologies. Prior to 1970, the majority of a pharmacist's time was spent on distribution – counting and packaging pills. Between 1967 and 1970, the first portable, digital tablet counting device was developed by John and Frank Kirby in Manchester, England. Since 1970, the ability to automate pharmacists' tasks has expanded to measuring, mixing, handling, packaging, distributing, drug interaction alerts, and allergy warnings. This change has increased a pharmacist's scope of work to include more patient consultations, as well as consultations with primary care physicians, so that a pharmacist now requires greater technical skill. In fact, the Pharm. D. has become the required prerequisite for a career as a pharmacist (Angelo, Christensen, & Ferreri, 2005; "Pharmacist Scope of Practice," 2002). This example provides a clear perspective on the history of how a medical profession has responded to, and been shaped by, automation. The next important question is to identify how automation and additional digital technologies will reconfigure other professions in primary care and how automation will shape technical and social infrastructures within healthcare.

Using Junction Work to Understand Automation

Given the potential benefit automation technologies can bring to a troubled NHS England primary care service, I report on early fieldwork from a project that looks at opportunities and challenges to automation in primary care. The research design is organized into two phases. The first phase is collection of qualitative data by observation of all health centre employees – including during clinician and patient consultations – and assembly of these empirical data to richly describe general practice occupations, the tasks performed in these occupations, the skills required to accomplish occupation tasks, and the features of each task. The second phase of the project involves translational work to convert these qualitative data into quantitative expressions to ultimately understand the probability of automating each specific task. Both phases are intended to provide insights into the challenges and opportunities of automation in primary care, with a particular emphasis on the effect of automation on primary care staff work, and the potential changes to the patient-provider relationship.

I employ a socio-technical perspective in conducting ethnographic fieldwork to understand the work practices of staff and clinicians. Specifically, the objective is

to identify tasks of work susceptible to automation and also the reconfiguration of staff work. Primary care health centres in England can choose to purchase one of four modern electronic medical records to help manage the overall practice and patient information. In addition to electronic medical records are a host of medical devices, sensors, and measurement tools to facilitate the diagnosis and treatment of patients. A better understanding of these technical infrastructures is key to effective automation support of primary care. To this end I employ the concept of junction work articulated by scholars Piras and Zanutto (2016). Junction work is the work that is performed to share data across systems that are not integrated or interoperable (Piras & Zanutto, 2016). The concept of junction work has been integral to understanding staff work because several occupational roles (receptionist, secretary) are almost entirely junction work related roles. Those two occupations consistently work across multiple systems moving data from one system to another. Another example of junction work in these occupational roles is using a clinical letter as a way to identify all the required information requested by a medical professional, and then assembling that information from multiple sources into a new letter. Many challenges remain in how these systems can or cannot be interoperable, what staff members use what technologies, and how the installed base of the primary care system may hinder new automation technologies (Star, 1999).

Preliminary results are reported from two research sites. The first site is a larger health centre in an urban setting with a catchment (surrounding area the clinic serves) of about 10,000 people. The second site is smaller with a rural setting and a catchment of about 4,000 people. As a data check, when the field researcher had a complete list of tasks for an occupation, that occupation was presented with the task list to confirm the data is an accurate representation of that occupations work tasks. Both sites use the same brand of electronic medical record (EMR) and many other systems that are required by NHS England for primary care clinics to use for reporting data and viewing contracts. These systems enable data sharing between the individual health clinics and various NHS institutions, and systems such as the Calculating Quality Reporting Service (CQRS) web portal. This CQRS system is one of several that practice managers use to share data about their patient population and services rendered for financial reimbursement. Overall, the specific tasks and workflows of each occupation remain remarkably similar between the urban and rural sites. The most notable difference is that GPs at the rural location type many of their own letters rather than dictate. Because of this, one of the major differences is that the rural health centre did not have a secretary. The secretary at the urban location was responsible for transcribing letters dictated by the doctors.

Early findings from both research sites indicate an overwhelming amount of, what I refer to as, letter work performed by receptionists. I focus on letter work because it is an example of a widespread practice performed throughout the

primary care setting and is observed at both research sites. This letter work includes both writing letters to and receiving letters from other practices, secondary care, private parties, consultants, and other entities. The work to respond to and generate these letters is piecemeal, as it requires receptionists to scan in letters, import them into the document management system, and then assign tasks to different staff members based on the content of the letter. They also locate information across a variety of platforms including multiple locations in the electronic medical record, paper records, practice website, or intranet, and then place this information into a letter template. Receptionists are primarily responsible for letter work, but certain tasks may be delegated to other staff contingent on the actions requested in a letter.

The instances of junction work observed at both research sites are too many to describe here in detail. However, the most prominent example of junction work occurred at the urban practice where the workflow for digital letter management was the following: receive an email with a digital letter attached, print the letter out on paper, scan the letter into the digital document management system, and finally assign tasks and make the letter actionable across the EMR. In this event the receptionist is moving data (the letter PDF) from one system, to a physical format, back to digital, and then into a different information management system that would finally allow the letter to be acted upon.

Although junction work can be both disruptive to a practice or integral to specialized practices, in the case of this research the junction work observed is highly automatable from a technical perspective. The ability to automate the junction work from each field site is primarily an interoperability problem. It usually requires a staff member to exchange or share data from one system to the next. When the staff member was queried about why the letter process involved printing, scanning, and importing back into a digital format, the staff member did not know. The reason for the process was simply that the workflow had always been that way and it was how that type of work is completed. However, though the work can be automated through solving technical interoperability issues, changing the junction work will have ramifications for the occupations that once performed that work.

It is anticipated that automation technologies will reconfigure much of this junction work. One approach to automation of some of this junction work is through the use of a digital infrastructure that supports key characteristics of interoperability and integration of multiple types of heterogeneous work that occurs in the primary care setting (Ribes & Lee, 2010). It is important to note that every occupational role at both research sites used a desktop computer. While specialized technologies were used, they were only used by clinical staff. The greater the experience of the clinical occupation, the more technologies that occupation was qualified to use. The role of these technologies in a digital infrastructure is to reduce the junction work that is required to share data

generated by the medical technology and back into the clinical record system. This preliminary work shows that certain infrastructural configurations lead to greater amounts of junction work performed by primary care staff and therefore present additional opportunities for automation. Although it is not always possible or desirable to eliminate each instance of junction work, this early research establishes that the concept of junction work may be useful in the identification and separation of task workflows that may be automated from those that may not.

Discussion

I want to end with a few discussion questions in regard to the empirical cases presented here. Clearly the many challenges and constraints that NHS England faces point to the fact that something needs to change. Aside from sweeping organizational and funding changes, the ability to “work smarter not harder” is change that can be implemented and potentially have a meaningful impact. How can, or should, letter work be automated? Communication across the health system is based on receptionists and GPs writing letters to each other. The reason for this is one part to communicate results and another part to create a paper trail of treatments, therapies, exams, and the documentation of the practice of medicine. So how can work be automated when the purpose of the work being automated is to coordinate different social actors and to create an audit trail?

Clearly, some junction work is inefficient: the previous case of printing digital documents and scanning them in to get those documents into a different digital document management system. Other junction work is either impossible to automate or is useful to help staff members understand aspects of their health centres function. Case in point is the practice manager moving data from the EMR databases to the NHS CQRS system. This task requires junction work, but through this junction work the manager can discover errors in payments, changes in the centres scope of work, and other critical details that amount to financial outcomes for the health centre. Theoretically this work could be automated since it is an interoperability problem. However, doing so would remove the social actor from error checking and learning about the direction of the health centre as a business. Given these two examples, how can we identify junction work that is wasteful and junction work that serves critical functions for the health centre?

Some junction work can be institutionally inherited and the person performing the work can be doing that work the way it has been conducted for years without considering how technology and other practices have changed. Given this, how can junction work that is institutionally ingrained be revised either when that work is automated or partially performed by social actors?

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