Task Analysis in Action: The Role of Information Systems in Communicable Disease Reporting

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Abstract

In order to improve the design of information systems for notifiable conditions reporting, it is essential to understand the role of such systems in public health practice. Using qualitative techniques, we performed a task analysis of the activities associated with notifiable conditions reporting at a large urban health department. We identified seventeen primary tasks associated with the use of the department's information system. The results of this investigation suggest that communicable disease information management takes place in a dynamic environment where changing needs may require new solutions for system users. Additionally, our work suggests that task analysis, when applied to document the use of a legacy information system, can provide local public health agencies with valuable information about their information management needs, and can become a part of their information management decision-making strategy.

Introduction

While some studies have investigated the workflow of public health agencies [1] [2], there is currently a deficit in the documentation of the use of notifiable conditions information systems in large municipal public health agencies. These systems are employed in constantly changing environments, where work must adapt to address the most pressing health concerns of a community. In this investigation, we use task analysis to identify the tasks associated with managing the information necessary to receive and investigate reports of notifiable conditions in a large municipal public health agency. Task analysis has been used to assist in the adoption of healthcare information systems in clinical environments, providing useful information about the potential adoption of new systems [3]. The method is commonly used in evaluation exercises for information systems and computer-based interfaces [4, 5]. We selected this method for its minimal impact on daily activities in the research environment, and for the method's effectiveness in identifying and documenting tasks as they are conducted. The allocation of funds for information technology in local public health agencies is often determined by a varied group of decision-makers, including members of city council, project management groups, and financial leaders. Individuals that make decisions regarding the allocation of funds for technology spending may not work directly with the staff or managers of a group using a system that requires resources. Task analysis has the potential to provide concise documentation of a group's activities, and thereby serves to inform disparate decision-makers about the use of an information system.

Surveillance for communicable diseases and other conditions of public health significance is a core function of the public health system. The data collected during this process is used by public health departments for the assessment and long term monitoring of health trends, allocation of resources, the identification of cases and outbreaks requiring further investigation and/or disease control measures, and the prediction of potential epidemics[6]. Health care providers, health care facilities, and schools are typically required by state law to report notifiable conditions to local or state public health agencies. Local public health agencies are responsible for reporting notifiable conditions data to state public health agencies that in turn submit this data in aggregated form to federal public health agencies [7].

Electronic reporting of communicable diseases has the potential to improve the timeliness and completeness of communicable disease surveillance. Yet the adoption of electronic reporting systems by local health departments in the U.S. has been slow, in part because of a lack of interoperable standards-based electronic data management systems designed for public health [8]. There are multiple national initiatives which aim to support interoperable electronic data management systems for public health agencies throughout the country. The Public Health Information Network (PHIN) has created standards for compliancy that will assure interoperability between state and federal public health agencies [9, 10]. The National Health Information Network (NHIN) is a federal initiative that has charged several

organizations with developing use cases to demonstrate the feasibility of creating a national health information infrastructure. One component of this infrastructure will be the capacity of public health organizations to adopt electronic reporting methods [10].

Beginning in September of 2000, state public health departments throughout the U.S. began receiving federal funds to increase their notifiable conditions surveillance capacity. As of April 2005, 27 state health departments were using internet-based notifiable conditions reporting systems in some capacity. At that time, 23 other states were actively planning the design and implementation of such systems [11]. To create an optimal national framework for electronic notifiable conditions reporting, it is essential that state and local public health agencies adopt efficient notifiable conditions information management systems. In this investigation, we aim to provide useful, systematically-collected information about the current state of communicable disease information system utilization in an environment where the system has been used for many years, has been modified many times, and where no recent documentation of system utilization existed.

Background and Setting

Public Health - Seattle & King County (PHSKC) is a large local health department that serves the 1.8 million residents of King County, which includes the city of Seattle [12]. It is the largest health department in Washington State, and ranks nationally as the 10th largest county health department in terms of population served.

The Communicable Disease Epidemiology and Immunization Section (referred in the remainder of this manuscript as to as the Section) of PHSKC receives and investigates reports of notifiable conditions, and conducts epidemiologic analyses of notifiable conditions data. It responds to approximately 6,000 cases of communicable diseases a year. The Section consists of administrative staff, physicians, epidemiologists, and public health nurses. To manage the data collected for its daily activities, the Section worked with PHSKC software developers to design an information system called the Communicable Disease Database (CD-Database). The system is used by the Section for data entry and retrieval of notifiable condition reports in Seattle and King County. This database also is used extensively for analysis and reporting by the Section's epidemiologists.

The system has been periodically updated over the last decade in order to meet the business needs of the Section. The system is based on Microsoft's database platform SQL Server 2003, and a front-end designed with Visual Basic (VB). The VB front-end is used for all data entry and limited report generation. For complex queries and reports, users connect to the system using Microsoft Access, installed on each desktop computer in the Section. Datasets generated with Microsoft Access are then exported to statistical software for analysis. As a result of the system's long history with the Section, the system has evolved to reflect the changing needs of the organization. With a range of data retrieval and analysis tools available, users are able to interact with the system in many novel ways to accomplish their work goals. The purpose of this observational analysis is to describe the discrete tasks for which the current system is used. Clear documentation of how the CD-Database is used will enable the Section to more objectively compare the capabilities of candidate future systems to the current CD-Database.

Methods

Qualitative methods including semi-structured interviews, participatory observation, and focus groups were used for data collection and for the task analysis. The focus of the investigation was to evaluate the use of the CD-Database. Therefore, the task analysis emphasized the tasks involved with using the CD-Database within the context of workflow related to actual communicable disease reporting activities.

The task analysis took place onsite, at the Section's office in downtown Seattle, WA over a nine month period. Our observations took place during regular office hours within the cubicles of the participants we observed. The participants included 11 employees within the Section involved in the collection, management, reporting, and analysis of notifiable conditions data. Each observation session lasted approximately two hours. Participants were selected based on their job role and use of the CD-Database. We observed individuals with job roles that routinely interact with the CD-Database. These roles include: Epidemiologists, Administrative Staff, Case Investigators, Public Health Nurses, and an Epidemiologic Response Coordinator. Participants were recruited to the study through email invitations. The University of Washington Human Subjects Division approved the study protocol. Participation in the study was voluntary and informed consent was

obtained from all participants for interviews, observations, and focus groups.

Participants were observed using the CD-Database for regular work activities. The primary investigator recorded trigger notes on a tablet-style password protected computer. Information relevant to participants' tasks, including the methods used to accomplish such tasks, was noted. While additional data was collected through discussions between the primary investigator and participants during the observations, the primary form of data collection was participatory observation. This method of data collection has been described by Hackos [5].

When data saturation was reached, 11 participants had been observed using the CD-Database in their daily work, yielding a total of 82 pages of trigger notes. The trigger notes consisted of descriptions of the users' actions and their associated goals. The purpose of our task analysis was to systematically document the work that is completed using the CD-Database, therefore our content analysis strategy aimed to identify manifest content as described by Berg [13]. The primary investigator reviewed the trigger notes after each observation to identify tasks. Each task identified in the field notes was recorded in a task list as described by Hackos [5]. As the field notes were reviewed, tasks which were identified in multiple observations were expressed as a representative task in the final task list.

The results of our observations represent an interpretation of observed work. In order to assure that our observations were complete, and that they accurately reflected staff's view of their work, five participants provided feedback on the accuracy and completeness of our analysis during a focus group session. Focus group attendees included two epidemiologists, a public health nurse, a case investigator, and a member of the administrative staff. Participants' feedback was incorporated into our analysis.

During the focus group, participants outlined the "life" of a notifiable conditions case, from the time it is reported through the time that the case is closed. This yielded a flowchart diagram (Figure 1) describing the notifiable conditions reporting process. Participants were asked to map each task identified during observation to a stage of the notifiable conditions reporting process they outlined.

Results

Analysis of the observation data revealed 17 primary tasks associated with use of the CD-Database. Table 1 displays the seventeen primary tasks we identified, based on the collection and analysis of data collected during observation.

Focus group participants did not identify additional tasks to add to our task list. The tasks that were suggested were already documented in the form of subtasks. Focus group participants were able to identify members of the Section that would complete each of the tasks. They were also able to place each task within a specific area of the task flow diagram that they created during the meeting.

The task flow diagram in Figure 1 was created during the focus group meeting with participants of our investigation. "Task References" refer to participants' feedback regarding where specific tasks (identified during observation) belong in the notifiable conditions information management process. See Table 1 for task names.

1. Create new electronic records
2. Assign a case to a staff member
3. Assess case status
4. Maintain\update electronic records
5. Maintain paper records
6. Identify a case in the electronic record
7. Harmonize paper records with electronic records
8. Use the electronic record during patient contact and data collection
9. Data cleaning
10. On-the-fly analysis of disease or trend
11. Review comments to determine potential causes of disease
12. Create queries
13. Re-use a pre-made query/report
14. Edit a pre-made query/report
15. Export data for analysis with a statistical program
16. Fill out State Reporting Forms
17. Create new data repositories for disease-specific investigation

Table 1. Tasks Associated with Use of the CD-Database

Discussion

The CD-Database at PHSKC is based on a platform that affords users the freedom to use the system in different ways depending on the task that must be accomplished. The inherent flexibility of the system, while providing a useful platform for the work described in our results, also made it necessary to document the work that the system is being used to complete. The Section's needs and work processes have evolved over time. Many of the tasks that the Section's staff currently performs are not functions that the original designers of the system anticipated, and resulted from progressively evolving workflow requirements. In response, system users engage in a series of "work around" adaptations to meet current work needs. As we found in Task 17, users are required to regularly create separate auxiliary data

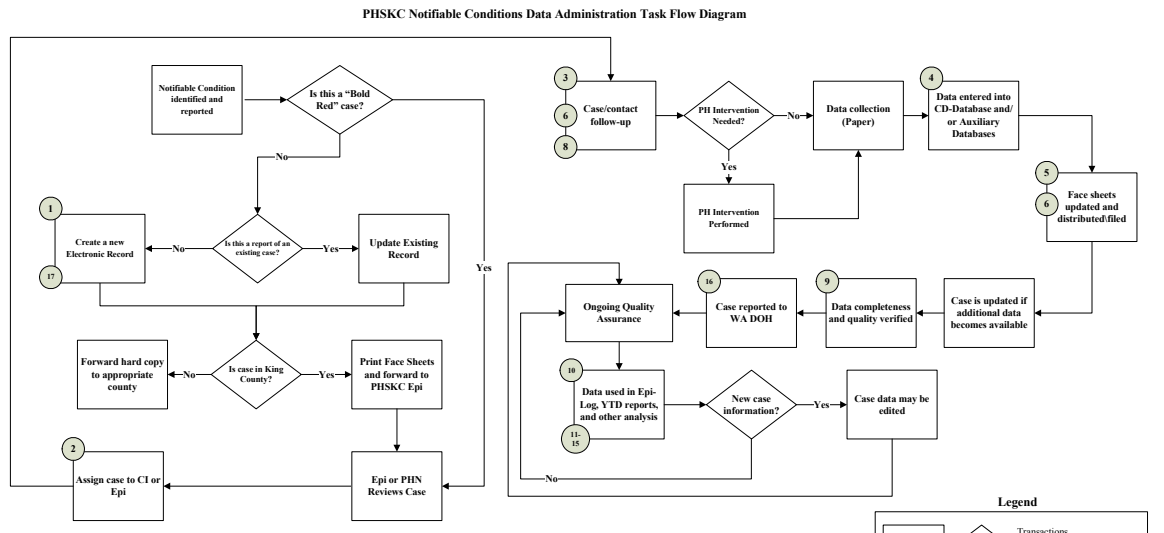

Figure 1. Task flow diagram of notifiable conditions data administration

repositories to accommodate the collection and management of new data elements related to outbreaks of disease. This is necessary because users cannot alter the data entry interface on their own. Similarly, staff must take part in extensive data cleaning efforts, manually identifying and editing contraindicating data. This process is necessary because users are unable to create data entry rules which would limit or eliminate some forms of data entry error. It is likely that an updated information system design would improve the efficiency of tasks performed by system users. The identification of these work-around practices suggests that further investigation of the Section's workflow is warranted. By documenting the work of the group using task analysis, the Section's decision-makers can now make clear and decisive statements about the Section's use of its information system.

The value of task analysis in this context is demonstrated by reviewing the instances where the results from this investigation have been used to support the Section's decision-making. Initially, the primary tasks list was used to assess the feasibility of adopting an online reporting system available to the Section. The task list from this investigation allowed the Section to assess whether the new system would support their current work. The results have also been an integral component of a related assessment of the Section's information management needs, and were used in an evaluation of several commercially available software products that the Section was reviewing. In this evaluation, the task list was modified to create a list of heuristics used for comparing multiple systems. Finally, the task list was used to communicate information needs between the Section and the Washington State Department of Health, fostering a deeper understanding of the unique needs of PHSKC as the largest municipal public health agency in Washington State. Specifically, these findings were presented to the State public Health Department in both a report and an oral presentation.

The recurrent use of the results of this investigation suggest that task analysis, while labor-intensive, provides valuable feedback for environments with rich information management needs. Although further investigation is necessary to validate the use of task analysis in environments like the Section of PHSKC, this technique should be considered prior to purchasing or developing an information system in complex information environments. In a local public health context, conducting task analysis can provide system stakeholders with an opportunity to deeply consider the enacted work of a group at the present state, as systematically observed and analyzed by a non-involved party. As national efforts to standardize notifiable conditions reporting processes move forward, public health agencies will need to begin using online reporting tools. To facilitate the adoption of such tools, task analysis as described here may be a useful tool to provide local public health agencies with the knowledge and documentation to describe their current information management practices.

Limitations

This investigation took place at a single, local public health department over a nine month period. Further research is required to determine the extent to which the identified tasks are generalizable in other local public health agencies. The task analysis was associated with the CD-database, and the tasks identified in this study may differ according to the system under study. The CD-database may also be a constraint on daily work. It is possible that the Section omitted certain tasks from the workflow because the CD-database has historically not been able to accommodate those tasks. Observing another group using an information system with a different set of capabilities might have identified a different set of tasks. Observations were performed by a single researcher which provided consistency, but may have introduced observer bias. We attempted to minimize bias through triangulation of our observation data by soliciting feedback on our results from investigation participants.

Conclusion

Using qualitative techniques, we successfully completed a task analysis of the activities associated with notifiable conditions reporting at a large urban health department. We identified seventeen primary tasks associated with the use of the CD-database. These seventeen primary tasks were confirmed as accurate and complete using member checking with staff who were involved in notifiable conditions reporting. We believe these tasks to be a sufficient summary of the use of the notifiable conditions information management system in the Section. It may be valuable for future research to evaluate these findings in the context of other local public health agencies. Our investigation suggests that communicable disease information management takes place in a dynamic environment where new information management demands may require new solutions for system users. Furthermore, our work suggests that task analysis can provide local public health agencies with valuable information about their information management system usage, and can become a part of their information management decision-making strategy.

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