Adapting Microsoft CRM 4.0 to the Needs of a Public Health Service: A Case Study in the Importance of 'Context'

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Abstract

Public health informatics is a growing area of practice and interest, related to but distinct from medical informatics. A case study is presented of the design and build phase of a project to adapt Microsoft CRM 4.0 to the needs of a busy public health service. The unique context of public health practice, including medicolegal requirements, played an important role in defining system needs. Differences in understanding of terminology and requirements for data integrity/ security presented communication challenges for both public health and vendor staff, reiterating the importance of developing shared language and understanding as part of project development. In striving to maintain evidence-based practice and effectively use developing information systems tools, public health practice is constantly evolving. Consequently it was essential that control over solution development and maintenance was able to be undertaken in the future by the service. Examples are shared of the need to balance making the best use of system capability with actual user functionality. A number of quality improvement processes were seeded from the systems thinking applied in this project, highlighting the contribution that information systems development can make to overall business development.

1. Introduction

Public health practice is characterised by a unique combination of strategic, population level imperatives and daily operational work that includes elements of personal health care service provision. Similar to other health areas, the effective use of timely and accurate information from a wide variety of sources is key to public health practice. Although a hybrid state exists, electronic information systems are playing an increasing role in the day-to-day activities of public health practitioners of all disciplines. There is pressure for greater utility, adoption and integration of these systems to support more effective and efficient operational outcomes.

It has been suggested that public health informatics is related to but distinct from medical informatics, with its own specific principles and challenges [1]. These principles include the need to focus on applications that consider populations rather than just individuals, prevention at multiple points on the causal chain rather than just treatment, and the importance of the governmental context of public health work [1]. The public health sector operates largely in the absence of a national guiding framework specific to its information needs which traditionally have been broader and more intersectoral than the personal health orientated areas of the health sector.

This article describes important observations through the project design and build phases of an information system for both business continuity and clinical needs specific to the public health environment. The focus is the opportunities and challenges when modifying a commercially available product versus a bespoke acquisition. It identifies the importance of the operational and legislative context of public health practice in defining system needs, and the challenge of implementing systems into a continually changing environment.

2. Context and Current Processes Overview

Auckland Regional Public Health Service (ARPHS) provides public health services for a population of approximately 1.4 million people, across three District Health Boards (DHBs), Auckland, Waitemata and Counties Manukau. This brings challenges in terms of work volumes and diversity of the population served that differentiate it from other public health units (PHUs). ARPHS is by far the largest of 12 PHUs across Aotearoa, New Zealand, and manages approximately a third of all notified conditions. Under 'business as usual' structures at ARPHS, communicable conditions and food safety issues are managed by a Population Protection Group, environmental health issues by the Healthy Environments Team and health promotion and aspects of compliance with tobacco and alcohol legislation by the Health Outcomes Team. A Public Health Intelligence and Infrastructure team provides support that spans across the activities of these other teams.

Provision of public health services includes the investigation and management of conditions notifiable under the Health Act 1956 and the Tuberculosis Act 1948. At the time of planning of this project there were 49 such conditions[1]. The majority of these are infectious diseases (e.g. diarrhoeal conditions, pertussis or whooping cough, Hepatitis B, tuberculosis). Also included are some conditions related to environmental health (e.g. elevated blood lead levels, chemical poisoning from environmental contamination such as dioxin). Investigating and managing notifiable conditions is a complex process which involves identification of the causative agent, tracing and screening contacts and organising control measures to prevent the spread of the infection or further contamination in the community [2]. This may include public health nurses providing preventative medication or immunisation to contacts. ARPHS has a range of protocols which guide the investigation and management of notifiable conditions; these are reviewed biannually to ensure practice continues to be evidence based.

Timeliness of information sharing between the multidisciplinary team members, primary health care practitioners and the Auckland DHBs can be critical. ARPHS does not currently have integrated information systems that are adequate for these requirements. With the shift to devolution of population based funding to DHBs, the need for district and regionally focused analysis has also achieved prominence. This is complex in the Auckland region due to the existence of three large DHBs and the multitude of local government bodies.

ARPHS notifiable disease work feeds data into a national surveillance system, EpiSurv[2], which collects data about case demographics, clinical features and risk factors so as to inform national public health action. Currently ARPHS's manual investigation and data collection processes are supported by forms printed off from EpiSurv (primarily in tick box format), supplemented by relatively unstructured records of additional investigation information, related clinical decisions and activities. A subset of surveillance information is then copied back into the EpiSurv database by Surveillance Support Officers, after which the whole paper record is stored. Information is also faxed between staff members and there are multiple, unlinked Excel and Access databases into which information is entered about investigations undertaken, such as for food premises, early childhood centres and swimming pools implicated in disease outbreaks.

PHUs are also involved in emergency management activities,(e.g. major power outage, pandemic influenza). These require public health units to quickly put in place and operate emergency response structures, in collaboration with other emergency services and local government civil defence responses. In such circumstances it is imperative that PHUs such as ARPHS are quickly able to access inventories and mobilise resources and staff with a variety of skills to assist in emergency management. The complexity of such a response is magnified in Auckland by virtue of it being the site of New Zealand's largest international airport (a key national and south pacific hub) and sea port.

3. The Project

The project described was established to design, build and implement an information system to support business continuity, including emergency response capacity, for ARPHS - known as BCS (Business Continuity System) - and the service's management of notifiable conditions – known as NDCMS (Notifiable Disease Contact Management System). This article focuses primarily on the NDCMS part of the project. The 18 most commonly reported notifiable conditions, which account for over 80% of notifications to ARPHS, were prioritised for the initial implementation of the NDCMS component.

The project team comprised of a small core group of seconded and specifically employed staff from ARPHS itself, the Auckland District Health Board who provide infrastructure support for ARPHS (on behalf of the three DHBs serviced), and staff from the vendor software company. During the course of the project, additional staff members from ARPHS were involved to assist with specification ascertainment and user acceptance testing. People will be using the software

[1] see http://www.arphs.govt.nz/notifiable/downloads/NotifiableDiseaseList.pdf
[2] see http://www.surv.esr.cri.nz/episurv/index.php

in both the centralised setting of ARPHS' two primary offices and also by remote access using laptops in the community.

4. The Product

After a relevant tendering process, a vendor company was chosen to adapt a Microsoft CRM (customer relationship management) 4.0 package-based application to the needs of ARPHS. Standard entities within Microsoft Dynamics CRM were to be included in both unmodified and modified forms to meet the requirements of the business. Modifications consisting of new fields, label changes, some minor form of JavaScript and reports. In addition custom entities were to be designed for specific ARPHS needs for both the BCS and NDCMS parts of the project. One of the reasons for choosing this system is the ability for ARPHS support staff to be trained to modify the system so that future components and changes can be designed and built by an internal project team (enabling a very quick response time), and therefore having control over future development and data within the service itself. The Microsoft CRM portal through either web access or Outlook also enabled a familiar interface for end users, an important element in user adoption [3].

In addition to the CRM package, a third party audit tool was purchased to ensure legal and privacy auditing requirements could be fulfilled.

The BCS part of the project was recognised to be a relatively straightforward system build, mostly recording information about staff and other resources, with some internal linkages and external interfaces. For this part of the system, mainly out-of-the-box functionality was used. Some label names were amended, forms changed and fields added, but the structure of CRM and how it conceptualises dealing with a Person/Assets in an environment and resource scheduling was mainly kept as it was. The BCS is also envisaged to be less likely to impact actual workflow and processes than the disease section of the system.

The NDCMS part of the project was much more challenging, with the need for multiple internal linkages and relationships. This also involved exploration of the feasibility of interfaces with several other information system environments, such as the national EpiSurv, GeoStan[3], and NHI[4] databases. Both the surveillance data and the protocol driven operational and quality processes were to be captured and integrated by the system. Few out of the box entities were used for the NDCMS side of the project, and the core components (the case and the disease) were custom built. However, even though few custom entities are used, the actual CRM product is not modified in a significant way. It has been possible to customise the software within the recommended guidelines, and no additional unsupported code and very few add-ons had to be used to accommodate the needs of ARPHS. Because of this, future software updates should be straightforward, support through the vendor and/or Microsoft should be possible for all issues, and handover from vendor to ARPHS and training within ARPHS, relatively simple.

5. Challenges and Lessons Learned

5.1. Unique features of the public health environment

As noted previously, informatics in the public health environment raises some unique challenges related to the population level of public health practice. These include the need for greater 'connectedness' (data relationships) within the information system. For instance the ability to map people exposed (known as exposed contacts) to 'groups' simultaneously with mapping those exposed contacts to 'locations of interest', e.g. a swimming pool, are important features to allow analysis of infection spread. In other instances such as food borne illness, ARPHS staff may be investigating the source of infection, which is a food, not a person. These considerations require greater degrees of relationships and linkages between system components than typical medical information systems in primary and secondary care, where the focus is primarily on the 'linear medical record' of an individual. These linkages were both facilitated and constrained in different ways by the customisation available in CRM.

To effectively use information from a variety of sources, public health practice also needs integration of information systems. Several aspects of this project was reliant on national work proceeding on sending and receiving laboratory results, the feasibility of an interface with EpiSurv, as well as regional issues related to community laboratory contract negotiations. Being dependant on external parties' progress impacted on what could be realistically built for in NDCMS. Having good technical and domain specific expertise in this area is crucial.

[3] see: http://www.moh.govt.nz/nir
[4] See: http://www.geocoding.co.nz/

The various physical contexts in which ARPHS staff undertake their work also influenced system needs. Some functions are very much office based, where with the use of headsets for phone interviews much of the data required could be entered directly into an electronic system. However other functions involve visiting people in their homes, along with visits to implicated food premises and education settings.

The social context of the work of ARPHS public health nurses can make laptops impractical and potentially dangerous in some home visit situations. This means management of some notifiable conditions will be a hybrid situation, using paper forms in the community with transfer back into the electronic system. This also means that the various screens of the electronic system need to be easily printed off for recording information manually. Public health nurses have some experience typing progress notes into an electronic database for the management of tuberculosis, but for other conditions are used to working with paper-based notes. Training will need to encourage people to think about the most effective ways to use time to transfer information into NDCMS e.g. is finding a private corner to work in the local library a feasible option (so they can plug their laptop into a power source giving them better lighting on the screen and more ergonomic posture for data entry).

5.2. Information system implementation as a business improvement process

Information technology is recognised as having a key role in facilitating quality improvement processes in healthcare services [4] and that has certainly been our experience to date. It has also been suggested that implementation of information systems is 'a thoroughly social process in which both technology and practice are transformed'[5]. The systems thinking required to analyse and document current work processes as a basis for building a new information system draws attention to unnecessary variation in current processes which can be addressed as part of quality improvement. In this project such analysis led to a number of significant quality initiatives, including a total review and major rewrite of eight interrelated protocols dealing with enteric infections (diarrhoeal infections), review and redesign of the quality checklists associated with each infectious disease protocol, review of template letters and instigation of improved communication with primary care practitioners.

In addition, many issues were identified with staff where ARPHS could improve current processes with better training and documentation as well as implementation of the various features in the new system. Staff demonstrated significant insight into reasons for 'the way things are done around here' and commendable preparedness to consider alternative options to improve quality. Asking 'which decisions do we need to record' and how much of the decision-making process' led to rethinking ways to record clinical decision-making which will be a significant improvement and new way of working.

The integration of protocol steps into predetermined tasks/activities for each notifiable condition which could then be audited was one area of CRM functionality which was explored extensively. In the ARPHS environment, which includes on-call afterhours work, workflow parameters need to 'enable not dictate', so that if a part of a protocol has not been completed within the time frame suggested, , it should not keep staff from completing subsequent tasks and returning to the previous part of the workflow at a later stage. For example, there may be a need to generate a letter from the system, without having the fields for earlier tasks completed in the electronic system because a paper file has been used for some process steps in the community on a weekend in the middle of an outbreak. The information for those earlier steps will be entered into NDCMS but at a later time, so the system workflow needs to allow for that while still giving the capacity for quality audit including time to response.

5.3. Public health data standards

Discussions have occurred as to whether a single electronic national notifiable disease management system could meet the very different operational needs of the twelve disparate public health units. Compounding this, the purposes of local and national data collection differ. One area for development is improving the interoperability of public health information systems; for this comprehensive data standards are the key. The Centre for Disease Control in the USA [6] has defined what it sees as architecture and standards for a public health information network, which are integration between hospital and clinic encounters, the surveillance system, laboratories and other health alert networks. However it also acknowledges the achievement of this is limited by agreement on a common coding system.

In the wider healthcare sector in New Zealand, HL7 messaging standards have commonly been adapted for exchanging data between medical information systems. However, in the public health domain, the usage of HL7 messaging only began recently with the direct laboratory notification process and at present is limited to that process. There are no other agreed data exchanging standards in public health information systems, and HL7 messaging standards for communicable disease records is still an untouched area.

Ethnicity data collection is an area where across sectors the Ethnicity Collection and Storage protocols 2004 defined by the Ministry of Health [7] differ from Statistics New Zealand Ethnicity Classification 2005 [8]. While inconsistencies in the way that ethnicity data is captured and stored among national and local healthcare information systems has lessened, there are still disparate ethnicity data formats between systems requiring mapping and validating when exchanging data. There are also concerns of data loss during the mapping process. For ARPHS, the unique population constructs in the Auckland region determine the need for more detailed ethnicity data within certain ethnic groups (e.g. different groups within Pacific peoples) than may be required in other areas, to support our regional operation and surveillance.

5.4. A shared language is necessary

The importance of shared language has been previously acknowledged as a key component of successful implementation of information systems in health environments [9].

Early in the design phase it was recognised that a number of terms were being used by both the ARPHS team and the vendor team but with different meaning ascribed. For instance ARPHS staff refer to people exposed to an infectious disease as 'contacts', while vendor staff were using the term to refer to a system entity for recording information (as in Microsoft Outlook 'contacts') . Some of those terms were less obvious, and only after a while was it discovered that ARPHS staff referred to a patient as a 'case', whereas the vendor and non clinical staff considered the 'case' to be the system equivalent to a paper file, i.e. the instance of a disease in the system. Hence the 'lifetime of a case' meant anything between birth and death of a patient for some, and creation and completion/deletion of a database record for others. Discussion at team meetings and email dialogue was used to construct a table of key terms where there needed to be one common understanding across both teams. In some cases terminology was changed to make the situation clearer for all those involved; for example ARPHS staff learned to use the term 'exposed contact' to refer to those they would previously have simply called contacts.

As vendor staff showed commendable skill in adopting the terms in common usage for public health, ARPHS staff also had to rapidly upskill in information system terminology. The perception for many ARPHS staff is that gaining competence and confidence in this area has been valued and is perceived as integral to professional functioning in today's healthcare environment.

5.5. Communication

From the beginning the project was communicated not as an "IT" project, but rather part of an ongoing project to support the business needs and people working for ARPHS. The importance of stakeholder engagement and a strong communication strategy have been recognised as key to effective information systems implementation [10]. The clinical leaders recognised the relevance of the mantra 'If you want to go fast, go alone; if you want to go far, take others with you'.

It was recognised that despite very tight timelines, engagement with various groups of staff was a valid meeting outcome, even if sometimes the actual content of the design specifications changed materially very little as a result of the discussion. On other occasions meetings which could have been perceived as unlikely to contribute significantly to the design process proved to be very useful and important. The input of less 'IT savvy' staff, to make sure what was built worked for them, was actively sought.

Previous implementation of information systems in hospitals setting in DHBs in the Auckland area highlighted the concerns that clinicians had about the lack of understanding of IS team members of the workings of the setting in which their system was to function – the hospital environment in that case [11]. This project attempted to pre-empt this situation by having two team members in particular who had experience in the day-to-day work to be impacted by the new system, a clinician and a business analyst. They played a key intermediary/interpretative role for communication between vendor staff responsible for the design and build and ARPHS clinical and surveillance staff. The need to 'state the obvious' and be very clear about what function was needed when documenting design/build requirements, especially because when perhaps the vendor has not a great deal of experience in the health sector, was an ongoing learning for ARPHS staff.

Several key points of tension during the project, with significant implications for project timelines and budgets, related to ARPHS staff only being able to achieve limited conceptualisation of some of the functional aspects of the system, sometimes because 'you can't know what you haven't been told'. Because of time delays in deploying the early testing environment, in some cases the results only became apparent at the time of user acceptance testing (UAT) and required major rebuild of aspects of the system (e.g. protocol driven task workflows) to make it functional for ARPHS staff.

5.6. Medicolegal issues

Health care has been acknowledged as a highly complex "Invironment" [9] in which to implement information systems, including a wider social and technical environment, and a medicolegal framework. During this project, some challenges arose related to the vendor company being experienced in producing generic software but being less aware of the uniqueness of the medical environment, where the requirements for data integrity and security are particularly rigorous. For example automatic checkbox defaulting as negative may be perfectly reasonable in a marketing environment but has very significant implications medicolegally. If a question has not been asked, then it is important no answer is recorded; a default answer implies the question has been asked. Similarly the importance of privacy and accuracy of information calls for the ability to audit fields and even tell if a record has been viewed. The latter ability not necessarily required in non-medical settings.

5.7. When implementing systems into a constantly changing environment

During the time of planning this project the process by which ARPHS is notified of notifiable conditions changed from practitioner notification to mandatory laboratory notification for the majority of conditions. The introduction of laboratory notification has resulted in significant changes in the process for managing a number of conditions, changes which evolved throughout the procurement, design and build phases of this project. While ARPHS staff will be trained to modify the system once it is built, the design of the overall structure and linkages needed to anticipate and account for these evolutionary changes as much as possible. As in many other environments, there were also major restructures of work teams within ARPHS over the course of this project, with implications for NDCMS workflow design.

At the time of writing this article, ARPHS is in the throes of dealing with the Influenza A (H1N1) outbreak. This situation is highlighting the need for integrated information systems to support the organisation's pandemic emergency response and has illuminated many process and data requirements that hadn't previously been fully elucidated. Consequently the specifications for some parts of the NDCMS project will again require change to better serve the needs identified. One of the perceived key advantages of CRM is the flexibility and how quickly modifications can be instituted when necessary. Finally, these changes in the 'Invironment' of this project serve to reinforce the value of systems thinking as an anchor for organising people and resources to achieve the outcomes desired in times of change.

5.8. System capability versus user functionality

Technology can provide many features that seem beneficial and time saving, but in reality, may not support the way people work. From an information system perspective, automatically assigning tasks to queues can be very useful; however understanding some of the people processes behind the task assignment in ARPHS workflows helped us understand the potential impacts of changing those processes from manual to automatic. In the case at hand, it was recognised that 'personal communication is the glue that holds the health quality and safety net in place.' So while automatic workload distribution and task assignment by the system has advantages, for ARPHS, the benefits of this were not outweighed by the benefits of case management and prioritising through personal contact operational processes. Managing those processes via personal communication was found to be more likely to ensure a timely and tailored response.

Similarly, the system is able to generate reminders and tasks to guide users through workflow. However while these may be helpful in tracking timeframes and deadlines, during UAT it was clear that having too many was unmanageable and risked being perceived as patronising to staff as they detailed step by step what to do when these were commonly accepted processes.

Another example of the need to balance making the best use of system capability with actual user functionality is that in the initial build of NDCMS considerable use was made of conditional fields and hidden tabs to reduce scrolling due to long screens when answers to questions were negative so that further details are not required. However in user acceptance testing staff found these features confusing and ended up entering information in wrong places because the right fields hadn't been unhidden yet. It thus became clear that sometimes this functionality would not be helpful at all but instead actually confuses users as to where data is best entered when they don't see an obvious recording area.

6. Conclusions

This article describes the challenges and lessons learned when adapting a commercially available product for use in the complex environment of a busy public health unit. The experiences reinforce what is known from other information systems projects about the importance of the many aspects of 'context' in defining system needs and project processes. Specifically terminology issues, data integrity, security and interface needs presented particular challenges. However

the use of a commercially available system has meant a relatively quick design and build phase, with the availability in most instances of seeing the system and proposed solutions swiftly. The key role of system users in ensuring the system built will be functional has also been reinforced by this project, along with the critical nature of quality communication in the many facets of the system design and build. A number of quality improvement processes have resulted from the systems thinking applied in this project, demonstrating the contribution that information systems development can make to overall business development.

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