Supporting Community Knowledge Brokers: Information System Challenges in Breast Screening Service Delivery

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Abstract

This study aimed to understand the complexity of community knowledge brokering through a case study of the work practices and information management processes of a community recruitment and education officer within Breast Screen Tasmania (BST). More specifically, this research aimed to produce a set of design principles and guidelines for the development of mobile information technologies to support and enhance the practices and processes involved in brokering knowledge into a community. Critically, attention was paid to usually unacknowledged second-order effects of existing technologies within the environment as these technologies might add complexity to information management rather than reducing complexity.

Background and Literature Review: Within public and community health services the provision of up-to-date, accurate and tailored health information is critical. Ensuring that clients (and potential clients) understand, and can be pro-active in taking some responsibility for their health is a powerful method in preventing or reducing the incidence of particular public health issues. The concept of *brokering*: "connections provided by people who can introduce elements of one practice to another" (Wenger 1998, p. 105) is adaptable to this work. The role of community education and recruitment officers can be described as a kind of knowledge brokering into communities outside the health service per se. For community health workers challenges in brokering this health knowledge arise in its acquisition and provision to a diverse range of users and in the assessment of the impact of the information (both form & content) on behaviour change. Information systems would appear to offer a solution to these challenges but designing systems that can accommodate the complexity and dynamism of interactions between brokers, their information sources and clients/potential clients has proven problematic.

Qualitative approaches are currently accepted and used in both academic and business domains for eliciting information for the design, development and implementation of information systems that take into account human factors and

the social context of work (Grudin 1990; Kujala 2003). These approaches have been proven to improve technology adoption and use by variously influencing design in a way that increases users' satisfaction, trust and ease of use with particular technologies/systems (Singh, Burke et al. 2003). It is linked to broader perspectives of universal design and participatory design (Astbrink and Beekhuyzen 2003; Beekhuyzen, von Hellens et al. 2003). However, a concern has been expressed that these approaches have an underlying technology-bias which affects the process of translation from the rich insights generated to the systems that are finally built (Gasson 2003; Kelder and Turner 2005).

Methods: This paper is based on a 12 month ethnographic case study deploying a human-centred design approach for data collection and the user centred design (UCD) techniques of persona and scenario development (Jenson 2002) to analyse data. The technique of critical reflection (identifying and challenging assumptions) was also adopted to minimize technology bias in translation from user to researcher to technologist (Kelder and Turner 2006).

Data collection involved following the community recruitment & education officer in Breast Screen Tasmania (BST), observing and questioning their daily work practices and information management processes. From an outside perspective the work of community education had two primary 'modes': 1) in the office and 2) in the community. Data collection for the office work practices and information systems consisted of observation of a community recruitment & education officer called "Katherine" in the remainder of this paper, at work in the BST head quarters (at her desk, in meetings and general conversations) and documenting the activities as well as the artefacts she used to support and record her activities. Because Katherine worked four days per week and the bulk of her work is conducted away from the office, these observations were done opportunistically over several months. Two extended interviews were conducted. See Table 1.

Data Type	Collection Technique	Comments
At her desk	Multiple observations of 15 - 30 min duration; one observation of hour duration; observation activity included recording answers to researcher clarification and explanation questions	Desk work constantly interrupted and done 'in between' meetings and discussions – not possible to organise an observation beforehand
In BST meetings	Meeting minutes plus researcher notes	Information source on linkages between community education and recruitment work and other BST activities
In the Community	1 day – Agfest stall (Agfest is a local community event); ½ day focus group; ½ day consumer reference group;	Community work involves travel away from home for days at time; many opportunities arise at short notice – not possible to observe all activities and personal interactions
Artefacts	Document artefacts used in information-related activities and purpose	Focus on cognitive function of artefact and distribution of information across artefacts
Semi –structured Interview; structured	Extended semi-structured interview of 90 minutes drew on observations	Semi-structured interview questions focused on her role and identifying information

interview	and focused on information collection, use, and storage; Structured interview validate analysis (one hour)	related activities and issues/problems faced. Structured interview questions were focused on using the persona and scenario analysis document and asking for comments and validation.

Table **1** Summary Data Collection

The data was analysed using user centred design techniques of persona and scenario development (Jenson 2002) and critical reflection by the researcher. The aim of the analysis was to construct output that could be used to guide discussion with an information technology design expert on possible information technology support for the type of work captured. The assumption was that a rich description provided a context to facilitate a technology designer to 'imagine' the context of any digital artefact or system of artefacts that might be designed to support community education and recruitment work and provide information capable of exposing or challenging any assumptions a technology designer might tacitly employ in a design. The output produced involves a rich description of the work and life of the community education officer for BST from the perspective of information use. The document was systematically examined in a structured interview by the researcher and the community education and recruitment officer and validated after minor corrections. This document had several sections; each section was designed to contribute to a rich understanding the nature of Katherine's work, and how she approached information.

Results: The analysis resulted in a document with three complementary sections. The first section was a structured presentation of key information and issues identified about Katherine's work (See Table 2). The information was structured to highlight structural variables such as her age group, gender, family status, cultural background, socio-economic and education background, and information behaviours that occur during the course of her work and family life. The structural variables were key contextual indicators that the researchers identified as important variables that affect the usability and acceptance of any information technology.

A particularly interesting finding was that there was no clear way to map, in a deterministic – technical - way the information-related behaviours observed: the interactions between Katherine and multiple sources of information and between Katherine and many different numbers and types of women were highly variable and could occur any time, any place, and in any combination. This section also listed the artefacts Katherine used in the course of her work, and the key goals and issues in meeting these goals that she faced.

KEY ISSUES	KEY INFORMATION UNDERLYING THE SCENARIO
Losing information not getting it in time not processing it	If Katherine lost her diary: "I'd be dead" Katherine doesn't have daily access to all the information that comes to her by electronic and physical post • not in the office much • not time to read it and do recruitment

KEY ISSUES	KEY INFORMATION UNDERLYING THE SCENARIO
in time for action	She utilises occasional 'blocks of time' periods where she is not engaged in recruiting activities • sometimes she misses out on events because they have passed before she has a block of time available to read her emails and the newsletters announcing opportunities • issues get forgotten unless 'scribbled' in her diary • Issues noted in her diary don't get recorded for action when she is back in the office (consequence of time lag is loss of momentum for action)
Engineering and presenting information	Katherine has to engineer the information she wishes to verbally disseminate, and present it so as to optimise receptiveness • adapt to suit characteristics of different naturally occurring people groups • adjust how she dresses and how she speaks according to who she speaks to (culturally appropriate) • decide the modality of communication constrained by o location (may be no communication technologies available) o number of people communicating with o characteristics of the audience • decide what depth of information she gives them o rationale of population screening o biology of breast cancer o process of screening o process of further information gathering (assessment process) with counselling available • decide what information about herself she gives them (had breast cancer) • decide what physical 'products' carrying the information she gives them: o reminder function (key rings, shower hangers, drink bottles, frig magnets, carry bag) o ongoing advertising function (key rings, drink bottles, frig magnets, carry bag) o inform function (brochures, shower hanger)

Table **2** Segment from Key Issues and Information table

The second section of the document is a persona: a 500 word introduction to Katherine, and includes information such as, "Her job with BST requires flexibility: she has to travel all over the State, often staying away from home for days, or weeks. She is available to speak with community groups when and where is convenient for them. She has to adapt her dress, speech, the depth and scope of information she gives according to their culture, needs and abilities. When she is away, her information resources are what she knows and can remember, and whatever she has taken with her."

The third section in the document was a scenario constructed to demonstrate that Katherine used a variety of information in multiple ways and contexts. Several key issues were highlighted including: 1) that any particular segment of information Katherine acquired and used dynamically changed in importance, depending on its context of immediate use; 2) that Katherine actively accumulated information to achieve her education and recruiting purposes, drawing on and synthesising whatever materials she had available, including tacit knowledge and explicit information embedded in documents or other artefacts and 3) that Katherine engineered synthesised information (adapting both content and medium) to construct a communication event that she considered would best achieve her purpose of educating women and motivating them to register with and participate in the BreastScreen program. A 'communication event' was

defined in the document "as any interaction or set of interactions involving Katherine giving and receiving information that in her judgment related to her work at BreastScreen." This included answering a phone query, talking 1:1 at a display stall, facilitating a focus group, giving a talk to a community group, speaking at a fund raising dinner, being interviewed on the radio, participating in meetings. The information in the scenario was set out to emphasise implications for: 1) decisions on modes and channels of information that are appropriate for Katherine at different times and 2) how information constructed by Katherine for dissemination to a particular woman is transferred and retained from that woman's perspective. This was achieved by interspersing information with a 'question' addressed to a technologist reading the document for information and principles to guide designing information technology support for 'knowledge brokering' work involved in community education and recruitment or similar work. See Table 3.

Katherine hadn't been into the office for nearly a week. She had travelled to Sorrell (a town in Tasmania) the previous Friday for a professional development course on Health Promotion. She hadn't checked her emails for nearly a week, and didn't have time today. She hadn't had time to read through all the material that came across her desk and via the Internet for she didn't know how long. She could check from home: she knew how to get onto the Department of Health and Human Services intranet, and sometimes used Internet cafes when on the road, but she had recently decided that her passion for promoting breast screening had to be quarantined from her home life. She had collected all her reading material and paper work and brought them into the office, and only read her emails from home on work days when she was not going into the office. ***How can you support Katherine to access information via the Internet when she isn't in the office?*** • *information she needs to find to use in the current context – in a car, a hotel, a rural town hall, a local government or community centre ...* • *information that needs to be acted on from within the current context – in a car, a hotel, a rural town hall, a local government or community centre ...* • *information that needs to be categorised for different levels of importance (which may change with time and context), and different contexts (which may be added to or disappear over time).*

Table **3** Document: Scenario Segment and related question for technologist

Once validated by Katherine, the researchers discussed the document with a technologist engaged in designing a smart personal assistant for mobile workers. The conclusion of the discussion was that the information use requirements for community education and recruitment work were so diverse, distributed and dynamic that no one digital technology in the market at that time was capable of providing a single point of information access and control.

Discussion: This paper contributes to identifying and mapping a research gap in understanding how information systems could possibly support professional educators working in public and community health services. The paper presents findings that highlight the complexity and dynamic nature of community health education: work that can be described as community knowledge brokering. More specifically the paper reveals the complexity of information acquisition, processing and access that need to be accommodated in the design of information systems if such workers are to be successfully supported.

The work identifies a number of areas that are currently under-researched in ehealth. First, it is yet unclear to what extent the information behaviour of the community knowledge broker observed in this study fits any of the "standard" information behaviour models described in the literature (eg Leckie et al. 1996; for an overview see for example Fisher et al 2006). Information behaviour studies have had a tendency to be relatively abstract, often trying to map the information needs of user groups, such as engineers or dentists, rather than individuals. Also, there is little emphasis on information behaviour being embodied interaction with the environment. Emphasising embodiment not only means that information seekers do have a physical body that need to move around but also that the body and its specific characteristics enable and constrain interaction with the environment at the same time. More recent perspectives in cognitive science question the traditional separation between mind and body, and also the separation between body and environment (eg Clark 1997). Spatial arrangements, including library layouts or desktop arrangements, have been identified as not only supporting but enabling human cognitive capabilities. Other spatial arrangements appear to help reduce task complexity and are used to "outsource" memory capacity. In Lueg and Bidwell (2005), a paper written specifically for the information science community, we highlight some of the ramifications. Challenges include the very question of feasibility: what is the appropriate level of analysis? The ethnographic research discussed in this paper, for example, is very rich but could possibly be extended to cover moment-to-moment interaction. This would come at considerable cost though as this kind of interaction is difficult to track and extremely time-consuming to analyse.

As discussed, community health education work is conducted primarily in social contexts involving focus groups, community forums and speaking engagements. It is important to note that community health education workers deal in information and that their work involves gathering, assessing and processing generic health-related information from a variety of sources, both electronic and paper-based. A second area demanding further research is therefore the issue of fragmentation of work (Mark et al 2005). The observations reported also point to the difficulties around managing information to be accessed from a number of sources. Ubiquitous computing has promised for years to solve in the near future what might be called the "information access problem" but as discussed by Oulasvirta (2008) people often just get more proficient at working around the edges. Among the reasons might be that many ubiquitous computing scenarios were based on unrealistic assumptions (Lueg 2002), thus causing applications to break down when facing reality.

Mark et al (2008) point out the incredible number of distractions people face during work. Community health knowledge brokering is clearly not atypical in this regard, but perhaps our enhanced understanding allows for more perspicacity regarding the claims made for each new application or device to hit the market. We must also be careful not to ‘build out’ in new systems the very flexibility that knowledge workers need to be able to work in such disruptive environments.

Recognising why knowledge brokering is so much more than the 'right information, to the right person at the right time', is hopefully a start in the right direction.

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