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Impact of Nursing Information Systems on residential care provision in an aged care provider

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Abstract

The challenge of an ageing population has placed a great pressure on the Australian aged care sector in the coming decades. Technology-enabled solutions such as health information systems (HIS) can be seen as a way to improve care quality, safety and process efficiency. Compared to the overall healthcare sector, the adoption of HIS in the aged care sector has been slower. One reason for this is that aged care providers are not well informed therefore not yet convinced of the positive impacts of technology solutions on their service provision. This paper reports findings from an evaluation of the impact of HIS adoption at an aged care provider in Victoria. The evaluation was conducted in two distinct areas, residential aged care and residential disability services. Overall, the findings show positive impacts of the system on individual work of the care staff and on service provision of the organisation as well as suggesting opportunities for improvement in later implementation stages. The evaluation will also inform other aged care and disability service providers of the benefits of HIS and useful lessons in adoption of technology solutions.

Keywords:

Nursing information systems, technology adoption, impact evaluation, aged care, disability services

ADOPTION OF ELECTRONIC NURSING DOCUMENTATION IN AGED CARE

Health Information Systems (HIS) refer to a range of information systems (IS) that are designed for use in different healthcare settings, such as hospitals, clinics, pharmacies, or aged care and community care providers. In Australia, especially with the current e-Health implementation coordinated by National E-Health Transition Authority (NEHTA), HIS are increasingly introduced for different purposes, for example patient administration, patient electronic health records, pathology and radiology, clinical decision support, and medication management. Such systems are expected to have positive impacts on healthcare service provision. The impacts are often expected to include improved productivity and efficiency, reduced hospital stays and medication errors, better patients' outcome and safety, and care staff satisfaction (Ayres et al. 2006). While predictive analyses support such expectations of HIS impact, research-based empirical evidence is rather limited (Shekelle et al. 2006). This paper reports an empirical evaluation of the impact that a health information system has on service provision at an aged care provider in Victoria. The evaluation was conducted in two of their service areas, residential aged care and residential disability support.

The evaluation was motivated by the need to assess the system's impact as experienced and perceived by the care staff in adopting an electronic nursing documentation system in their nursing practice. Such an impact evaluation will provide evidence of the value of the adopted system and insights for future technology projects in the adopting organisation as well as for other future adopters (Kirkley and Rewick 2003). The evaluation is especially important to the aged care sector because, compared to the overall healthcare sector, the aged care has been found to be slower to take up technology-enabled solutions (Hegney et al. 2007; Yu and Comensoli 2004).

The paper is structured as follows. Section two will discuss key concepts from the literature that lead to the selection of an appropriate framework for the evaluation and how it was tailored to fit the context of residential aged care and disability service provision. Section three will present the research approach consisting of a questionnaire and a series of individual interviews. Section four will present findings based on both quantitative and qualitative analyses of the collected data. Section five will provide a conclusion and outline future research directions.

EVALUATING IMPACTS OF HEALTH INFORMATION SYSTEMS IN HEALTHCARE AND AGED CARE

Impacts of HIS implementation on the overall healthcare sector

Potential benefits of HIS in the hospital acute care setting and emergency departments have been well promoted. They are often described as including streamlined workflows, increased efficiency, improved patient safety and care outcome, and staff satisfaction (Kirkley and Rewick 2003). Evidence reported in previous empirical evaluations shows a range of benefits received by the users as well as implementation issues. Meijden and colleagues (2003) conducted a comprehensive search in the English and Dutch literature on evaluations of inpatient clinical information systems during 1991 and 2001 and selected 35 papers for a complete rigorous review. Nursing documentation systems, patient health records, computerised physical order entry (CPOE), intensive care unit (ICU) systems were amongst the typical systems in their review. Shekelle and colleagues (2006) conducted a comprehensive search in publications between 1995 to January 2004 on the evaluation of benefits and costs of a range of systems, such as computerised physician order entry (CPOE), clinical decision support systems (CDSS) and electronic health records (EHR). They selected a larger range of 256 papers for a complete and rigorous review. Common benefits were found to include improved work processes and enhanced patient care outcome, better support for decision making, improved data capture and access, and improved safety (Meijden et al. 2003; Shekelle et al. 2006). In addition, high information quality such as completeness, accuracy and legibility, systems' ease of use and response time, and improved communication and collaboration were found in the review by Meijden and colleagues (2003). However as asserted in these reviews, empirically researched evidence of the benefits is insufficient and difficult to draw generalisable knowledge about the impact of different systems. Specific contextual factors, such as the setting, organisational aspects, implementation attributes, staff and patient demographics may greatly influence HIS use and value.

Impacts of HIS implementation on the aged care sector

In Australia, the aged care sector provides a wide range of services such as domestic assistance and personal care in the community, personal care and nursing in residential aged care (low care and high care), respite care, and palliative care. The services are provided to the people 65 years old and over in order to address their care needs associated increasing frailty, physical and cognitive disability as they get older (Productivity Commission, 2008). The aged care sector has also been known as a service provider for young people with disability. Around 6,500 young people, 60 years of age or younger, live in residential aged care facilities in Australia (Winkler et al. 2006). Compared to the overall healthcare sector, the aged care and community care sector has been slower in their adoption of technologies (Hegney et al. 2007; Ridley and Young 2005). A reason for this is that the aged care organisations have not been well informed or convinced of the benefits of technology (Yu and Comensoli 2004). Australian Nursing Federation conduced a large survey (Hegney et al. 2007) with 4401 responses returned from 10000 nurses in healthcare and aged care in all states and territories in Australia, thus making a response rate of 44%. According to their findings, a lower level of experience, confidence and use of technology was found in the aged care sector. Major contributing factors were identified to be a low rate of access to technology, lack or opportunities for training, and lack of applications that are fit for purpose. Interestingly, the availability of nursing documentation and medication management systems was found highest and administration and management systems was lowest in the aged care sector compared to the overall healthcare sector. A survey (Yu et al. 2008) with 24 (out of the 40) staff members of two aged care facilities after five weeks of using an electronic nursing documentation system revealed that improved documentation efficiency, information legibility and accessibility were found as benefits of the system. Another survey (Yu et al. 2009) was conducted in 2004 using an extended technology acceptance model (TAM2). Based on an analysis of 134 responses returned (38.3% response rate), this survey confirmed that perceived usefulness and perceived ease of user were factors that determine the acceptance of HIS by the aged care staff. In addition, computer skills and concern for professional image of care staff (for example, as a Personal Care Assistant or a Registered Nurse) were found to have a significant impact on their intention to accept technology (Yu et al. 2009).

Overall, more research-based empirical evidence is required to assist the aged care and community care sector in assessing expected benefits and selecting relevant technology solutions for their organisations (Kirkley and Rewick 2003; Ridley and Young 2005).

DeLone and McLean's Impact Evaluation Framework

There exists different frameworks to guide the evaluation of the impact of information systems (Seddon et al. 1999). They vary in dimensions and levels of granularity, for example one framework evaluates the system's impact on individual work and task performance (Torkzadeh and Doll 1999) whereas another framework (Mirani and Lederer 1998) evaluates strategic, informational and transactional impacts on the organisation. Amongst different frameworks, the one developed by DeLone and McLean (1992; 2003) has been dominating in the IS

literature for its comprehensiveness (Iivari 2005). The 2003 revised version (DeLone and McLean 2003) consists of the following six components. System quality measures technical success, for example ease-of-use, functionality, reliability, flexibility, data quality, portability, integration, and importance. Information quality measures semantic success, for example accuracy, timeliness, completeness, relevance, and consistency. Services measures success/quality of services of a single system or the Information Technology (IT) department. This component has been added in the 2003 revision. Service quality framework SERVQUAL (Parasuraman et al. 1990) was suggested to be adopted to measure the IT/IS services (Landrum et al. 2009). Intention of use and Use evaluate frequency of use, time of use, usage patent, number of accesses, and dependency are measures of use. Intention of use refers to attitudes rather than behaviours because the adoption of a system can be mandatory or voluntary in different organisations. User satisfaction refers to various levels of satisfaction with a single function or overall system, enjoyment, decision-making satisfaction that users experience. Net benefits measures two levels of individual impacts, for example job performance, quality of work and decision making performance, and organizational impacts, for example increased profits, sales, cost reduction, staff reduction, ROI, application portfolio.

The framework was empirically tested and supported in IS research (Iivari 2005). It has been adopted widely and customised for use in different business contexts (DeLone and McLean 2003). It has also been adapted in evaluating HIS in healthcare (Lau 2007; Meijden et al. 2003). The framework was found useful in examining and classifying the impacts of clinical information systems for inpatient care in hospitals (Meijden et al. 2003). Lau (2007) adapted and extended it to assess HIS implementation in Canada Health Infoway. In his extended framework, the Net Benefits component evaluates a large set of systems and their impacts on a wide scope of the national health system in terms of quality, access and productivity of HIS-enabled services. As the focus of the study reported in this paper is the adoption of one single HIS in an organisation, DeLone and McLean revised framework (2003) was selected and adapted for use in the aged care sector.

RESEARCH APPROACH

Research approach

The purpose of this study was to evaluate the impact that an information system has on service provision in the organisational setting of a single service provider. Case study was selected as a research strategy to gain a rich understanding of the system's impact as perceived by the care staff. Case study was defined as "*an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context*" (Yin 2002). Within this overall research strategy, a mixed methods approach was adopted for data collection and analysis. Mixed methods research has been increasingly used in different fields including social and behavioural sciences (Teddlie and Tashakkori 2003), healthcare research (O'Cathain et al. 2007), and information systems research (Petter and Gallivan 2004). Mixed method research uses "*quantitative and qualitative data collection and analysis techniques in either parallel or sequential phases*" (Teddlie and Tashakkori 2003, p.11). Rationales for benefits and difficulties of mixed methods research are discussed at length in the literature (Teddlie and Tashakkori 2003). Benefits include a richer source of data, a richer understanding of a complex phenomenon due to combining strengths of both quantitative and qualitative data, and a greater diversity of views compared to what the research team would have gained using a single method. Challenges include more time, more work and high skills required from the research team. Using a case study with multi methods in evaluation research was strongly argued for by various authors (e.g. Ellinger et al. 2005).

The case study strategy was appropriate to this study because it allows the researchers to understand how care staff perceptions and experiences when adopting a new system and assess its impact on their service provision in the context of the adopting organisation. Qualitative data enabled the researchers to reveal meanings from the participants' viewpoints. Quantitative data enabled the researchers to collect data from multiple care facilities in both the areas of residential aged care and disability support as well as covering different dimensions of impact at different individual and organisational levels. This paper focuses on impact evaluation.

Research design

The host organisation providing the context for the case study is a large aged care provider in Victoria, Australia. This organisation provides a range of services including residential aged care services (RS), community services, disability support (DS), and early childhood services and specialist education. The host organisation recently adopted a new electronic nursing documentation system in two areas of residential services: RS and DS. The residents in RS include the elderly and people whereas the residents in DS are young people with a brain acquired injury. The users of the system include the RS and DS management and nursing staff. The RS was in the transition from a paper-based documentation practice to electronic documentation. The residential model was introduced to DS for the first time. Therefore, the system was introduced to every recruited DS staff. In both the

areas, the same system with common functions of progress notes, assessment forms and charts, and care plans was installed and implemented by the same IS team. The overall evaluation study took place in July – November in 2010. The empirical data collection took place in October and November, six months after the system was first introduced and during its implementation period scheduled to complete in 2011.

Quantitative data was collected through a random sampling questionnaire. The questionnaire was designed based on an adaptation of DeLone and McLean's framework (2003). Findings from Meijden's review (2003) of evaluations of HIS impact in inpatient care were used to operationalise the net benefit component of DeLone and McLean's framework. The net benefit component was broken down into individual work, organisation's care provision (care outcome, care coordination and administration, and efficiency) and strategic benefits. The questionnaire consists of eight sections and 41 questions. Most of the questions were formatted using the five point Likert scale. Hard copies of the questionnaire were printed and made available to the staff of the participating service areas. Out of 110 hard copies distributed to the staff, 35 valid responses were returned (32%). Among all the 35 respondents, 29 are care staff, two were admin staff, and four were facility managers/coordinators. It is interesting to note that more young respondents were found in Disability services (DS) than in aged care residential services (RS) whereas more female respondents were found in RS than in DS.

Age group	DS	RS	Total	Gender	DS	RS	Total
Less than 40	64.3%	23.8%	40.0%	Female	71.4%	85.7%	80.0%
40 and over	35.7%	76.2%	60.0%	Male	28.6%	14.3%	20.0%
Total	100%	100.0%	100%	Total	100%	100%	100%

Table 1. The respondents' age groups and gender

Qualitative data was collected through a series of interviews with management, administrative and care staff. In total, there were nineteen one-hour semi-structured individual interviews including fifteen from aged care and four from disability care. The interviews were structured into three sections: context, usage, and evaluation. In addition, the researchers visited the care facilities and made observational notes. Descriptive statistic was used to analyse the quantitative data (Neuman 2003) and coding and thematic analysis was used in analysing qualitative data (Kvale 1996; Strauss 1987). Both the analysis results were triangulated to define findings. The findings were discussed using different rounds of communication and validation of findings: within the research team and presented to the senior management in written reports and an oral presentation.

IMPACTS OF A HEALTH INFORMATION SYSTEM ON RESIDENTIAL CARE PROVISION

This section will present key findings in terms of the six components of DeLone and McLean's evaluation framework. The six components include: use, use satisfaction, system's quality, information quality, service quality (in terms of communication, training and support), and net benefits. The net benefits components are broken down into impact on individual work and the organisation's service provision. This paper primarily focuses on the overall results of both service areas and highlights some significant differences between them.

Use: attitudes and usage

How important is the use of the adopted clinical information system	DS	RS	Total
Very Important	57.1%	61.9%	60.0%
Important	35.7%	33.3%	34.3%
Moderately Important	7.1%	0.0%	2.9%
Not at all Important	0.0%	4.8%	2.9%
Total	100%	100%	100%

Table 2. The respondents' attitudes about the importance of the system

With the exception of one strongly disagree in RS, all the other respondents were positive or neutral about the importance of the system. Almost everyone agreed or strongly agreed with the management decision to use it in RS (95.2%) and in DS (92.9%). 94% gave a positive response (agree or strongly agree) with regard to their commitments to learning and using it.

The most frequently practice adopted by the staff is to document nursing information after visiting the residents, for example "*documenting what I remember and see as important*". Some the of the interviewed care staff said they used memory aids such as paper notes to record important information. There were contradictory views in regard to whether to document nursing information directly into a laptop while visiting the residents in their rooms or later. The interviewed data revealed different perceptions held by the staff about whether documenting nursing information in the residents' rooms would affect their 'professional care image'. The most frequently access pattern was to access the system at the start and end of each shift. A small number of care staff documented nursing information during the day when they had time or their residents had rest.

When visiting the resident in his/her room, I document assessment data directly into the system using a laptop		After visiting residents, I select and document the data that I remember and see as important into the system	
Always	8.6%	Always	34.5%
Usually	17.1%	Usually	27.6%
Sometimes	8.6%	Sometimes	6.9%
Rarely	11.4%	Rarely	3.4%
Never	54.3%	Never	27.6%
Total	100%		100%

Table 3. The practice of documenting residents' health assessment data using the system

There were different types of nursing documents including progress notes, assessment charts, assessment forms, and care plans. The most frequently used document type was progress notes. This reflects the fact that progress notes were introduced first and at the evaluation time other document types were still being introduced to the staff. Most the staff documented nursing information into the system while a minority of respondents scanned and attached documents into the system. In general, scanning should be avoided because it's difficult to search for information in the scanned documents. As revealed in the interviews, scanning was still done in order to store documents signed by the care staff or general practitioners using the system.

Use satisfaction

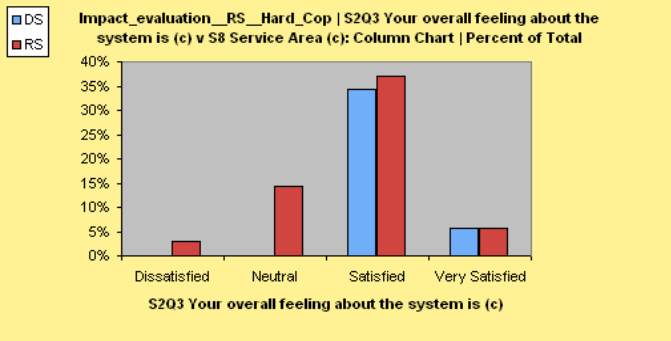

Figure 1. The respondents' satisfaction with the system

A clear majority of the respondents (82.9% overall) was generally satisfied with the system. The RS respondents showed varying levels of satisfactions: from a dissatisfied minority, to about 15% neutral, and a clear majority of either satisfied (mostly) or very satisfied. The DS respondents were either satisfied or very satisfied. None was neutral or dissatisfied. Qualitative data show both their satisfaction as well as areas for improvement. Positive comments were made about the usefulness of iCare, for example "*I find the system helpful for documenting resident health information and searching info about residents' health*", and "*I'm satisfied using the system because it makes work easier for me*". Numerous staff wanted to have a better and more flexible access to the system, for example "*At busy periods more terminals would be helpful*", "*not adequate number of PC to use*", or "*laptop often not working or too slow*", *"(I would like to have) Fast Internet, touch screen, and mouse rather than a rolling ball*".

System's quality

A clear majority strongly agreed that the system's functions were useful, specifically resident records (88.6%), progress notes (97.1%), assessment charts (80%), assessment forms (85.1%), and care plans (88.6%). A minority of the respondents was neutral (between 2.9 – 5.7%). The rest selected N/A as they were not required to use such functions for their jobs. Progress notes received the highest 'score' of importance (97.1%). None of the responses was negative. Security was rated with the highest score (91.4%), followed by reliability (82.9%), easy access (80%), and responsiveness (74.3%). Availability received 57.1% positive and 40% negative. Robustness received 54.3% positive and 25.7% neutral. Availability and robustness were rated lower than other system's quality measures. This was possibly due an incident causing the system to be unavailable the week before the release of the survey.

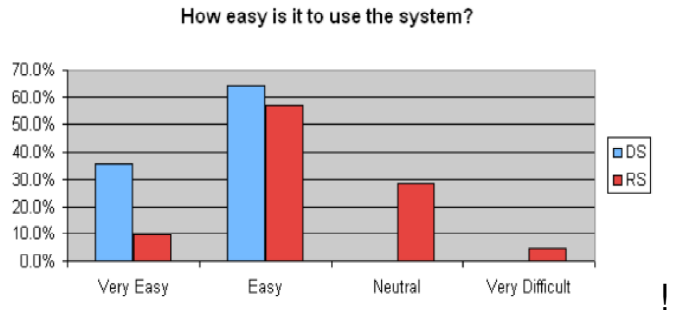

Figure 2. The respondents' perceptions about the system's ease of use

A clear majority of the respondents found the system easy to use. The qualitative data showed a number of usability issues, such as navigation between screens and forms, lack of spell checking and adequate search tools.

Information quality

	z Much worse	Worse	About the same	Better	Much better	Total
Residents' personal details	0%	4.76%	28.57%	52.38%	14.29%	100%
Progress notes	0%	0%	19.05%	42.86%	38.10%	100%
Assessment charts	0%	0%	52.38%	47.62%	0.00%	100%
Assessment forms	0%	0%	47.62%	47.62%	4.76%	100%
Care plans	0%	4.76%	33.33%	52.38%	9.52%	100%

Table 4. The respondents compared the quality of electronic nursing information in relation to the quality of paper-based information

In terms of information quality, the attributes that were highly rated include easy to understand (94.3%), availability (91.4%), easy to read (8.6%), relevance and usefulness (88.6%), accuracy (80%), and consistency (74.3%). Compared to these attributes, being up-to-date (71.4%) and completeness (65%) receive lower scores. As revealed in the interviews, this was largely due to the fact that some system functionality had not been fully deployed by the project in RS. About half of the RS staff was neutral about the quality of the assessment chart and form data whereas the more DS respondents rated these data (as well as progress notes, care plans, and residents' details) more positively. This could possibly due to the fact that these types of assessment were implemented earlier in DS. The RS respondents also compared the information quality of computerised information to the previous paper-based information. A clear majority were in favour of electronic residents' records and progress notes. These documents were implemented first. Other types of documents were still in the implementation progress. Between a third and half of the staff were neutral with regard to this question.

Service quality

A clear majority of staff, especially the DS respondents, agree or strongly agree that they receive good support to learn and use the system. There were negative responses (disagree and strongly disagree) with regard to on-going support and training, and communication about the implementation stages. A small number of comments were made about training and support. They range from positive, for example "*(the) system is useful and I have easy access to residents' health information*", "*the facility gave me support that I need when I'm learning to use (the system)*" to negative "*very little training!!*" The qualitative data revealed that different users preferred different levels, frequencies, or durations of training, and training methods. A flexible approach to formal and informal (in-house) training and support would be required.

Information about the transition process to the system is well communicated	Count	Per cent
Strongly Agree	2	5.71%
Agree	23	65.71%
Neither Agree nor Disagree	5	14.29%
Disagree	2	5.71%
Strongly Disagree	3	8.57%
Total	35	100%

Table 5. The respondents' evaluated communication they received about the transition

Impact of HIS on individual work of care staff

In terms of work effectiveness, most respondents agreed or strongly agreed that the system supported their individual work in terms of enabling them to be better informed of the residents' health, making it easier to do their work, and improving their performance. However, 40% were neutral that the system empowered them in decision-making. 47% of the RS staff was neutral about this question. Only a minority of the (RS) responses was negative. The qualitative data showed some staff resistance to change from paper based to electronic documentation practice amongst the RS staff. This was not the case with the DS staff.

The system makes it easier for me to carry out my job	DS	RS	Total	The system supports and empowers my decision making	DS	RS	Total
Strongly Agree	21.4%	14.3%	17.1%	Strongly Agree	14.3%	14.3%	14.3%
Agree	71.4%	57.1%	62.9%	Agree	57.1%	33.3%	42.9%
Neither Agree nor Disagree	7.1%	23.8%	17.1%	Neither Agree nor Disagree	28.6%	47.6%	40.0%
Disagree	0%	4.8%	2.9%	Disagree	0%	4.80%	2.90%
Total	100%	100%	100%	Total	100%	100%	100%

Table 6. The impact that the system had on individual staff

Impact of HIS on organisation work of care staff

The system was found to be a useful source of nursing information and a good communication tool for the care staff. Flexible and on-time access to information, information sharing and communication between the staff members were positively rated by a clear majority of the respondents. For example, 85.7% of all the responses were positive (satisfied or strongly satisfied) about the staff having flexible and on-time access to the residents' health records. Only 2.9% were negative. The RS respondents were asked to compare the information access in the paper-based practice and when using the new system. 66.7% of them rated their information access when using the system as better compared to the previous paper-based practice. 28.57% were neutral and only 4.67% (one response) was negative (disagree). Compared to internal communication within the care staff, more respondents remained neutral about whether the new system improved communication between the care staff with the external users, such as allied health, specialists, and general practitioners (28%), and the residents' access to external services (33%). As suggested by the interviewed staff, time and assistance were required for some of the external service providers to change their attitudes towards documenting their diagnosis or accessing nursing documents using clinical information systems.

The system has enabled us to monitor the residents' health progress and assessment	DS	RS	Total	The system has enabled us to pick up unidentified or unresolved issues in the residents' health	DS	RS	Total
Strongly Agree	21.4%	19.0%	20.0%	Strongly Agree	7.1%	19.0%	14.3%
Agree	57.1%	57.1%	57.1%	Agree	71.4%	33.3%	48.6%
Neither Agree nor Disagree	21.4%	23.8%	22.9%	Neither Agree nor Disagree	21.4%	47.6%	37.1%
Total	100%	100%	100%	Total	100%	100%	100%

Table 7. The impact that the system had on service provision

The system was commonly agreed by a clear majority of staff to be a good information service and enabler in care service provision, in monitoring the residents' health state, picking up changes, and providing responsive

health services. The interviewed staff shared a common view that more evidence was needed to make a connection between the new (and better) information service and the outcome of care. The RS staff showed more resistance to change in their nursing documentation practice and some expressed their concerns about their time spent with the residents. This could be due to the fact that they went through a big change in documentation practice not experienced by the DS staff.

In terms of efficiency, most respondents agreed or strongly agreed that the system saved their time in documenting and searching for information with 65.7% of all the respondents agreeing that that data duplication has been reduced; 31.4% of all the respondents agreeing that time spent on compliance, risk and management reports has been reduced; 25.7% of all the respondents agreeing that staff allocation and resource use have been optimised; and 19% of the RS respondents agreeing that time spent on aged care funding report preparation has been reduced. Almost 25% were neutral whether the system improved their work process. A minority of negative responses was found. The interviewed managers and registered nurses indicate their need for a process guide (model/map) and process simplification to improve process efficiency and to implement task scheduling. The common process guide should be flexible and adjusted to fit a specific facility. Strategic benefits commonly agreed by the staff were better visibility of their service areas within the organisation, better visibility to external parties such as general practitioners and allied health, their organisation being more innovative and advanced within the community service sector, and that the residents' families will feel more positive about their services.

Discussion

Overall, the survey respondents and interviewed management and care staff in both the service areas of RS and DS showed a moderate-positive level of acceptance of the system by the care and admin staff. Their use of the system and positive attitudes toward it and its impact on their work demonstrated that super users and early adopters successfully used the system within their care process. An early majority of adopters (or early majority adopters – a term used in the technology diffusion theory by (Rogers 1995) - was formed and took up the system. Some staff resistance in RS has been noted, possibly due to the change from paper to electronic documentation and information retrieval practices not experienced in DS. This highlighted the importance of staff expectations and orientation toward change in system implementation. In all the evaluation areas, from none to a minority of the respondents feel less positive about the system. As perceived by a clear majority of the staff, the system had a positive impact on various aspects of their individual work. According to their perceptions, the system enabled them to be better informed of health state and needs of the residents and assistance them in their performance, reduced time spent on documentation of and searching for nursing information. The system was seen as a good information service and improved information sharing and communication about the resident's health and healthcare between the care staff. Flexible on-line access to nursing information and availability of data useful for various administrative tasks and improvements in the coordination of care were highly rated by the staff. Reduced data duplication, and time and travelling cost savings were commonly agreed to be other positive impacts of the system. Our findings were consistent with a review of HIS evaluation studies in inpatient care (Meijden et al. 2003). The neutral responses to the questions whether the system has positive impacts on care outcome and process efficiency suggested follow-up evaluation when the system has been fully implemented to be advantageous.

We made a number of additional observations in regard to the staff experience with and acceptance of the system. First, most of the staff participating in this study found the system easy to use and useful for their work. They however experienced some limitations, such as the system's unavailability and information incompleteness, due to the fact that the system was not fully implemented at the time of evaluation. Second, there were a few usability and accessibility issues, such as lack of spell checking and search tools, difficulty in navigating between forms, and availability of computers in the facilities. Third, overall a majority of staff members highly rated the communication about the system's implementation and training and support provided. Some staff members expressed a need for iterated communication and a flexible approach to training, such as on-going informal coaching and peer learning. All these observations are consistent with the technology acceptance model TAM (Davis 1989) that staff perceived usefulness and ease of use of a system can be seen as determinants of their acceptance. In addition, staff satisfaction with work visibility, concerns about their professional image and proficiency in using of the system are consistent with a recent survey with 15 residential aged care facilities in NSW (Yu et al. 2009). This survey applied the extended technology acceptance model TAM2 (Venkatesh and Davis 2000) which includes additional social norms such as professional image, output quality, job relevance, experience and so on.

CONCLUSION AND FUTURE RESEARCH

This paper reports key findings from an evaluation of the impact that a HIS has on service provision in two areas of residential aged care and residential disability support. In line with previous evaluations (Meijden et al. 2003; Yu et al. 2008; Yu et al. 2009), the paper makes an incremental contribution to knowledge in the area of HIS impact evaluation through an application of multi method data collection and analysis in a case study. The DeLone and McLean's evaluation framework (2003) was customised and operationalised in the context of residential care for the elderly and people with disability. A series of interviews with the management, admin and care staff was conducted to yield a rich contextual understanding of the staff perceptions about the system. The evaluation reveals the areas where a positive impact was perceived by the staff. Therefore it provides evidence for benefits of HIS for organisations in the aged care and disability services sector. In addition, the paper also highlights important factors in improving the acceptance of HIS by the care staff. Such factors include usability, usefulness, accessibility, and staff empowerment (continuous communication, support and training).

This research has its limitations. The low response rate of the questionnaire and the system's down time a week before the period of empirical data collection may have affected the evaluation results. In addition, as a single case study, this research shares a common prejudice against generalisability. It is difficult to generalise analysis and findings from a case study because while the collected data is rich, it is contextualised. In the short term, another cycle of evaluation will take place when the system has been fully implemented. In the long term, the researchers will conduct more case studies to evaluative HIS impact in different service providers.

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