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An Exploratory Qualitative Study to Identify Factors that Influence the Use of Electronic Patient Journey Boards in Queensland Health

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Abstract
Technology in the healthcare and use of Information and Communication technologies (ICT) in healthcare is on the rise among the developing economies. In spite of some limitations and limited use of ICT in the healthcare domain, ICT is expected to grow in the Australian Healthcare system. This research paper provides preliminary findings on views expressed by users regarding the use of Electronic Patient Journey Boards (EPJBs) in Queensland Health. Initial data was collected through a qualitative approach in order to understand the views of health professionals regarding EPJBs. This was achieved through interviews, brainstorming sessions and focus groups held with healthcare professionals who have used the EPJB and those who will be using EPJBs in the future. This qualitative data was analysed through the lens of three key critical variables, namely people, processes and technology. The preliminary findings show that these three variables are critical for the success of the use and implementation of EPJBs in the healthcare domain. Furthermore, this research paper was also able to identify factors that will have a significant influence on the implementation of a technology in a healthcare setting. This study is limited to Queensland Health and needs further research to test the findings of the study in order to apply the findings more generally.

Keywords: Electronic Patient Journey Board; Patient Scheduling; Patient Information Flow

1 Introduction

Management and administration of patients and the associated logistics involved in a busy multi-layer hospital are quite complex processes [1, 2]. For example, it is essential to be able to provide timely answers to critical queries regarding care services, and the ability to identify patient details immediately at any point in time is crucial. Identification of appropriate consultants, identification of processes that a patient need to go through, the ability to carry out initial assessments on incoming patients based on given conditions, and the identification-appropriate process required for discharge and subsequent follow-up sessions are just some activities which fall in this sphere. An essential element of all these activities is the 'care' aspect which nurses and allied health staff, in addition to physicians, play a key role. Therefore, the idea of EPJB was initiated and pursued by healthcare professionals and academic researchers, in order to present a uniform view of patient data to all healthcare staff actively involved in patient care.

Electronic Patient Journey Boards are not new. The original concept was conceived at Flinder's University

in Australia and many installations of this concept are found in Australia and in the UK. The primary aim of the EPJB is to provide pertinent patient information in addition to a 'whole of ward status', at a glance. The users of EPJB can access computing facilities located in central points in a ward, with a provision to update patient care information as and when care is provided, through a set of drop-down boxes and self-explanatory data entry fields. The unique feature of the EPJB discussed in this paper is it's installation in multiple locations within a public service, and integration of patient data arising from many other external systems. This makes the EPJB discussed in this paper a unique system, as this provides an organizational view rather than a ward view.

To facilitate the development of the system, and to allow it to be properly understood, some critical questions were raised. These questions included:

- *Where is the patient?* The EPJB informs all stakeholders involved in the care of patients, the location of each individual. It also conveys any information concerning planned transfers or discharge.

- *What is next for the patient?* The EPJB displays the current investigation and management plan for each patient. Also, if there are any risks identified, such as 'infection, aggression or malnourishment', these will be displayed.

- *Which consultant is looking after the patient?* Each patient is assigned to a particular Consultant or team. These are clearly identified.

- *When will the patient be medically fit for discharge?* One of the greatest benefits provided by the EPJB is the visibility of the planned discharge date. The whole team of medical, nursing, allied health and administrative staff are focused on having all assessments and planning done by this date, in preparation for the patient's departure.

- *Has the patient been reviewed by allied health?* Is allied health review continuing or is the patient ready for discharge? One unique feature of the EPJB is its ability to track allied health referrals and display their status in a clear and concise 'traffic light' manner.

- *What else does the patient need before discharge?* The EPJB allows for a list of specific tasks that need to be completed before a patient departs. Discharge summaries, contacting families and obtaining scripts are a few examples of the list provided.

Identification of complex processes and understanding workflow will help improve the quality of care in a healthcare environment [3, 4].

In essence, the Electronic Patient Journey Board is a one-stop shop for all staff involved in care; available information can be provided in a form that is easy to comprehend, as well as easy to update in an effective and efficient manner [5]. Thus, the primary objective is to provide a visual clue, through the available information so that details pertaining to a patient's journey can be made available in a form that is easily understood and presented in a form that is easy to manage.

Prior to the start of the EPJB project, it was essential to understand certain processes involved in patient care provided in public health agencies, as said care is varied and quite complex. For example, in many wards that we visited, current and updated information was not readily available to all stakeholders, owing to other time-critical operations in the ward. The information was often presented on a manual whiteboard that was not updated regularly for lack of time or a champion. Therefore, it was essential to understand said processes in various wards, such as maternity, cardiology, emergency and so on, in order to consolidate the critical information flow in a form that can be presented on a single unified screen using computing technologies. Through this understanding, certain benefits can be achieved, such as making data entry simple so that care information can be updated regularly, leading to effective currency of information, and encouraging staff to use the EPJB so that team interaction can be improved. These were some of the major objectives of the EPJB project. The following diagram provides a view of a traditional patient whiteboard that was manually updated in many Queensland Health wards.

2 Electronic Patient Journey Board

As stated above, the primary objective of the initial EPJB project was to present the patient care information process in an electronic format. It was decided to follow a structure similar to a spreadsheet format, as many users were familiar with this type of structure. This choice resulted in the information being presented in rows and columns, where rows represent patient data and columns represent a range of care activities. A major challenge encountered by the development team was prioritising the various activities that took place in the ward, accommodating all these in rows and columns, and presenting them in a one-screen format so that scrolling could be avoided. This resulted in a conceptual visual provision of 'traffic light' type colour allocation,

Figure 1: Traditional journey board planner

with a readily recognisable system consisting of red, amber and green colours, used to display the status of various referrals and the immanency of an expected date of discharge. This concept helped to consolidate a vast amount of data in a visual format, with the ability to provide an overall picture of various patients in the ward. The data architecture was developed in such a way that healthcare staff were able to 'drill down' patient information to explore details about individual patients. This model was then presented in a simple electronic format as shown in figure 2 below.

This model was tested with pilot wards in Queensland Health and the feedback received was very encouraging. In essence, the pilot users indicated that the EPJB is effective in streamlining the workflow in a ward setting. For example, pilot users believed that the EPJB would provide visual clues to the care team so that timely action could be taken based on the information available. Furthermore, it appears that one of the advantages of the EPJB is to provide a unified view of patient data, including any action taken by staff on ward.

The initial trial was encouraging and the team started implementing the EPJB in multiple sites in Queensland Health. In order to understand the individual ward needs, a pre-interview session was conducted. The main purpose of this interview was to gauge individual feelings, needs and perceptions so that these could be accommodated in the system's development, subject to technology constraints. This prompted the development team to pose the following question for the interview:

What are the benefits of, and issues involved in, implementing and using an Electronic Patient Journey Board in your hospital?

3 Methodology

A combined approach (mixed methodology) of qualitative and quantitative methods was used to strengthen the study outcome in terms of the human, social and psychological factors [24]. This study investigated human psychological factors using interviews and quantified these factors using a survey instrument. As stated earlier the scope of this paper is restricted to qualitative data only.

With limited information currently available on the use of EPJBs, the exploratory and qualitative research method is appropriate [6-8]. Exploratory research is suitable for the theory-building stage, and aims at formulating more precise questions that future research can answer [2, 9, 10]. Further, case study is suitable for learning more about a little known, or poorly understood situation [11]. To improve the quality of data and research findings, a multiple-case study with focus group interviews was employed in this study to obtain the primary data from health professionals [12, 13]. Users' experiences, requirements and feedback on using current patient journey boards are also incorporated in this study.

A number of brainstroming sessions, focus group interviews and individual interviews were conducted to formalize data collection. Initially, a high level brainstorming session was conducted to understand the technical and user issues. The purpose of this approach was to understand the context. The brainstorming session culminated in developing a user data collection strategy. This was essential to recruit users as they were busy in the wards, and need to be backfilled for the interviews. The individual interviews were mainly with senior administrators to understand the management views, and these were correlated with user views. The focus groups were the main approach to understand the problem domain. The size of the focus groups was not uniform and varied between 5 and 10, depending on the site and availability of staff on the day of the focus group interview. The staffs were recruited through ward managers, and a Queensland Health project officer organized the recruitment. The criteria for participation were that the user should have participated either in the manual patient journey board system or in the electronic patient journey board system. Participants recruited for the study were employed at Queensland Health hospital wards, and were well aware of the operational procedures employed in the wards. The focus group questions were almost similar in the sense that the technical questions were identical, and there was a variation in ward specific questions. For example, every war was provided with a standard view, but ward specific information was populated to cater to specific needs. Therefore, the questions included generic as well as ward specific questions.

There were a total of fourteen focus group interviews conducted with staff of Queensland Health. Each focus group consisted of five to ten participants. The users of current EPJBs such as doctors, nurses, administrators and other medical professionals were contacted for their voluntary participation in this study. Each focus group normally took 45 minutes to one hour. In terms of interviews, the protocol was developed before the interviews, as well as pilot tested and refined by the feedback of practitioners and researchers. All interviewees were encouraged to provide personal experiences and valuable feedback on using and managing the EPJBs. The structure of the interview protocol is provided in Table 1. The protocol was developed based on previous users' experiences and literature.

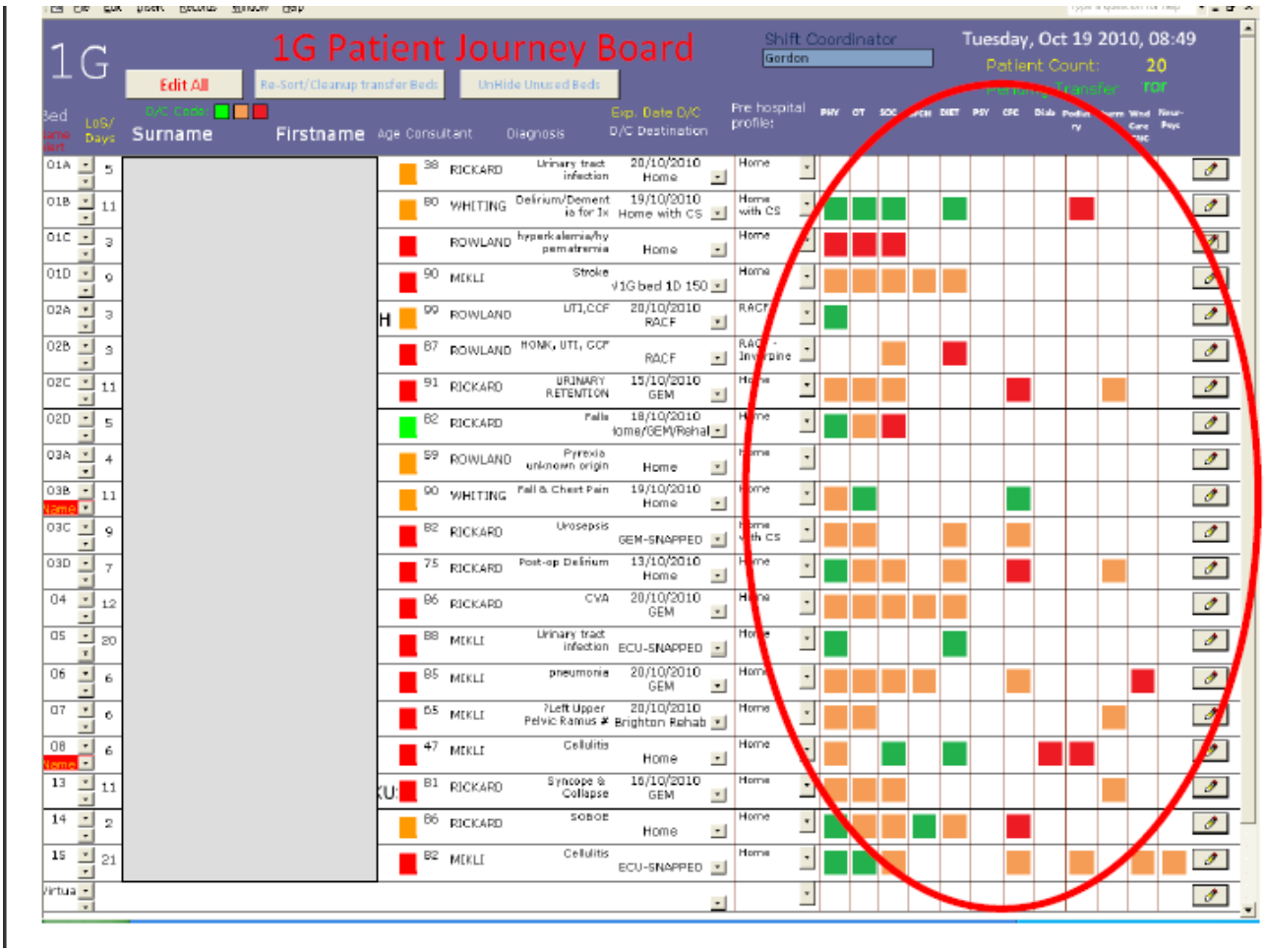

Figure 2: Computerized journey board planner

No.	Topic
1	Introduction of this research and interview
2	Brief explanation of personal background and expertise
3	Brief explanation of previous experience of using PJBs
4	Users' feedback regarding patient aspect
5	Users' feedback regarding working process aspect
6	Users' feedback regarding technology aspect
7	Following up for unclear points
8	Open discussion
9	Summary and acknowledgement

Table 1: Interview protocol used in this study.

Data were collected from staff in QH wards involved in client care and focused on their behavioural patterns of acceptance and usage of technologies, as well as their opinion on the usage of these technologies. The participants were recruited specifically for this purpose. The recruitment and scheduling aspects were managed by QH through their regular processes.

The qualitative method employed in this study included semi-structured in-depth interviews to gain a sufficient further understanding on the topic from QH professionals in their work settings. The aim of these interviews was to identify any unknown factors that may affect the adoption of technology. The interview data collection involved two specific stages. In the first stage the existing literature was reviewed in order to identify various issues impacting technology adoption. This was the 'exploratory' stage. The main purpose of this stage was to identify factors in order to derive an interview instrument. The second stage involved actual data collection through interviews. This was the 'evaluative' stage. These stages are explained below.

3.1 Stage 1 – Literature Review (Exploratory)

An extensive literature review was carried out at this stage to integrate the materials available into the interview questionnaire in order to assess behavioural aspects of technology acceptance. The interview questionnaire consisted of over 16 themes and an information sheet was prepared after this comprehensive literature review. The purpose of this was to ensure that QH professionals were comfortable in answering the technical aspects of technology as appropriate to their working environment. This stage did not identify any mediating factors and only focused on the main factors influencing the acceptance of technology. The literature covered three main aspects: motivational aspects, experience aspects, and habit.

3.1.1 Motivational Aspects

Motivation is defined as the fun or pleasure derived from using a technology, and it has been shown to play an important role in determining technology acceptance and use [15]. Motivation (conceptualized as perceived enjoyment) has been found to have a direct influence on technology acceptance and use (e.g., van der [26]. In this context, hedonic motivation (as a surrogate of motivation) has been found to be an important influence of technology acceptance and use [16]. Thus, hedonic motivation was explored in the interview as a predictor of behavioural intention to use a technology.

3.1.2 Experience Aspects

Prior research on technology use has identified experience as an important factor in technology acceptance. Experience reflects an opportunity to use a target technology [18]. Experience is studied by measuring usage time from the initial use of a technology by an individual.

3.1.3 Habit

Habit has been defined as the extent to which people tend to perform behaviours automatically because of learning [21]. Kim et al. equate habit with automaticity. Habit, in this study, is viewed as prior behaviour (see 18), and is explored as the extent to which an individual believes the behaviour to be automatic (e.g., 21).

There are two key distinctions between experience and habit. One distinction is that experience is a necessary but not sufficient condition for the formation of habit. A second distinction is that the passage of chronological time (i.e., experience) can result in the formation of differing levels of habit depending on the extent of interaction and familiarity that is developed with a target technology.

Different individuals can form different levels of habit depending on their use of a target technology, and their level of maturity in an organisation. This warrants investigation into prior use as a predictor of habit, and this can be explored either through their mental models based on current usage or a controlled experience with the target technology in their attempt to understand the impact of habit on technology use.

In the context of this study we explored each area in regard to pre and post implementation of technology.

Facilitating conditions also play a crucial role. In our study, QH provided the facilitating conditions, however,

due to ward-specific functions, facilitating conditions varied across participants. In addition, due to the clinical nature of the work, clinical conditions were considered to be more relevant. Therefore, this aspect was explored in interviews, but not in great detail.

3.2 Stage 2 – Interviews (Evaluative)

In order to extract opinions about technology in a specific domain such as QH, the selection of sample is crucial. It is important that the opinions expressed by QH professionals should be unbiased and pertaining to technology only — rather than the effects of technology on current workflows, especially within the scope of this study. The samples for this project consisted of four sets of people from QH. The first set comprised the senior managers, who have oversight of strategic operations. The second set is ward managers who have oversight of tactical aspects. The third set is ward professionals who have oversight on operational aspects. The last set of samples included others, and was comprised of people who did not fall under the first three categories.

While information systems research identifies a range of sampling techniques, such as random and clustering, the sampling technique used for this study may be classified as 'purposive' sampling. The study was conducted with QH to meet their immediate needs. As the assessment is 'real', extreme care needed to be exercised to preserve the integrity of QH values and standards. This warranted high levels of experience in conducting the assessment, and professional knowledge about the assessment aspects. In order to assure completeness in assessments, this approach of 'purposive sampling' was followed in this study.

In the second stage of the research a set of 64 interviews were scheduled to assess user views on the technology in a real world environment. It should be noted that the technology had not been implemented prior to the interviews so as not to affect participant views in regard to embracing the technology. This approach, though not desirable, was used in order to assess the views as to how technology would be received by health professionals, and to accommodate various constraints associated with developing a technology that had a common shell and 41 varying ward needs,. To ensure the interviews were conducted on time, QH staff scheduled visits, and organised a rostering system for staff to participate in the interviews. Appropriate ethics approvals were sought and obtained through QH ethics committee based on National Principles.

The interviews were conducted so as to minimize any disruption to participants' work schedules, ensure comfort in answering questions, minimize any travel time by interviewees, synchronise the 'interview' language with participants and to prompt participants when unfamiliar aspects were encountered by participants.

The instruments of this research consisted of two broad categories of questions. The first category related to the adoption and use of technology. The second category consisted of 'influencing' variables. The influencing variables are those that have an influence on the technology adoption, but beyond the technology itself. For example, these variables can be organisational issues or procedural issues. Open-ended questions were included in the instrument to obtain unbiased and non-leading information. Prior to administering the questions, a complete peer review and a pilot study were conducted in order to ascertain the validity of the instrument.

After the documentation of each interview on a digital recording device, an independent staff member working with Queensland Health transcribed the recordings. These transcripts were then analysed by the authors aiming to answer the research question mentioned above in this research study. The data were analysed in five steps. The first step in preparation of the analysis is to screen and format the transcripts. The second step is to screen the transcripts by Leximancer^{TM} as a preview for noteworthy terms and ideas. The third and principal step is to analyse the transcripts, and filter out or underline any ideas or factors that are relevant to the research question. The fourth step is to go through each factor to avoid duplications in the meaning. The fifth and last step is to group these factors into three main aspects: People (P), Process (Pr), and Technology (T). In addition, further analysis was done to place all the factors into two categories, dependent on them having a positive or negative influence on the use of computerised journey boards. It is anticipated that factors will be identified in terms of "benefits" and "issues to consider" in implementing and using EPJBs. The process and the procedure adopted in this research enabled the identification of such factors, and these are further illustrated in the next section.

3.3 Qualitative Data Analysis

The qualitative data analysis consisted of two phases. The first phase involved generating a set of initial analytics to determine the direction of extracting evidence, and the second phase involved providing the evidence.

In terms of initial analytics, the data was analysed in three different ways. The first set of analytics involved a word frequency cloud using the interview transcripts. The purpose of this analytic process was to assure that we explored relevant and appropriate themes, and the word cloud provided assurance through a key-

Figure 3: Summary of word frequency map

word search. The second set of analytics was undertaken to develop a pictorial representation of the interview data, representing major themes explored. The interconnection between key themes, and the links between the themes through thick and thin lines, provided visual assurance that relevant and appropriate themes were considered in the interviews. The third set of analytics involved exploring the occurrences of keywords in terms of frequency distribution. This provided a pseudo statistical validity.

3.3.1 Word Frequency Cloud:

The Word Frequency Cloud is a technique in NVivo that documents the most frequently appearing words in a transcript. For the purpose of this study, the number of most frequent words was fixed at 100, and the transcripts of all interviews were run en-block.

The procedure basically analyses words based on their occurrence, their distance, and their context, and develops a frequency table of occurrence and percentage. Once this was established, words that did not appear more than a certain arbitrarily chosen number in the overall context were assumed to be less significant in the overall context of the study and removed from the word frequency run procedure. This procedure was repeated many times to remove any words that did not make sense or add value to the analysis (for example words such as 'yes', 'I", etc). The following diagram is a screen shot of the word frequency table (also called the 'word cloud') to provide an initial view point for further in-depth qualitative analysis.

Using NVivo, researchers generated a word frequency map to assure that keywords were addressed in the interviews. The following word frequency Cloud indicates keywords extracted from interview transcripts and provides an initial direction for further exploration.

The above word cloud demonstrates that many key concepts were included. For example, patient, board, ward, good, information etc were the words used by interviewees and represented the gamut of topics dis-

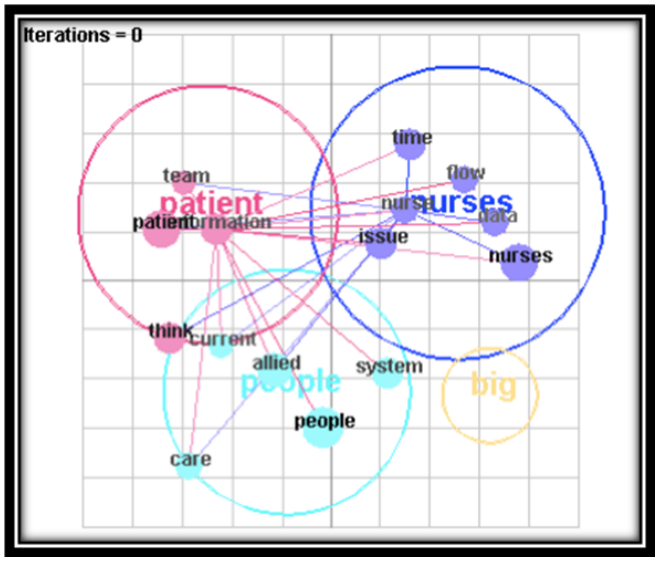

Figure 4: Computerized journey board planner

cussed. The topics were discussed with the interviewer (in this case the researcher) and this provided another level of reliability to ensure that each participant had the same opportunity to discuss these terms. The proximity and the size of the words represents the importance and connection between keywords.

The above word cloud and word frequency table provided an initial path for further analysis, as the cloud indicated that key words were captured in the interview process, thus indicating 'reliability'. Further, the research team conducted over 60 interviews and the themes were found to be saturated around the twelfth interview, indicating that the qualitative process employed in this study was reliable and appropriate. In fact, after the sixth interview, most of the technology related issues were saturated in the interview process, thus indicating a very high level of reliability.

3.3.2 Pictorial Representation of Interconnections:

While the word cloud provides keywords and their relationships, it does not represent the major themes. In order to generate major themes, the research team used Leximancer, a text analytics application. The interview transcripts were submitted to this application, and the parameters were set for 1000 iterations so that major themes and their relationships could be understood. The following diagram is a pictorial representation of what was accomplished.

From the diagram, the analytics application returned three major themes – patients, nurses and people. The three circles are overlapping with almost the same thickness for the perimeter, indicating the equal importance of these three themes. Main issues within the themes

Concept	Absolute Count	Relative Count
People	25	100%
Patient	21	84%
Nurses	20	80%
Think	19	76%
Issue	17	68%
Time	15	60%
Board	15	60%
Technology	14	56%
Allied	14	56%
Team	13	52%
System	13	52%
Care	13	52%
Information	12	48%
Training	11	44%
Current	11	44%
Nurse	11	44%
Should	10	40%
Anonymous	10	40%
Process	10	40%
Flow	10	40%
Medical	9	36%
Work	9	36%
Day	9	36%
Data	9	36%
Computers	9	36%
Issues	8	32%
Terms	8	32%
Big	8	32%
Hours	8	32%
Problem	7	28%
Person	7	28%

Table 2: Actual key words and their relative count

are shown as 'text' labels, for example 'time' in the nurse circle, indicating this is an issue among nurses. Similarly, labels such as satisfaction, allied, care etc indicate the range of sub themes among the main theme discussed. The lines between these sub themes indicate relationships between the themes.

3.3.3 Keyword Occurrence:

The keyword occurrence is a technique used in this study to understand how many times a keyword features during the interview as a way of assessing the importance of the keyword. NVivo produced a frequency distribution and allocated a weight to each keyword so that the strength for each keyword could be assessed. The following is a list of keywords extracted from a cross section of the interview transcripts.

A full list of keywords for the transcript is provided in Table 3.

The above analytics provided a glimpse of the total picture, and highlighted trends to be explored in more detail. The purpose of conducting these three initial steps was to ensure that the research was exploring what it intended to explore, and that interviews were conducted in a way so as to answer the main objectives established at the beginning of the study. These three analytics provided adequate reliability and confidence to further explore the text data.

The research team conducted manual analyses based on the word query facility within the software application to explore main themes. At this stage, interview transcripts were split into PRE technology implementation and POST technology implementation. The following two sections provide a summary of interview comments on the main issues identified during the text analysis process.

3.3.4 PRE - Main Issues:

Patient Flow: Our current patient flow is flawed. We have been using whiteboards and they've been all ruled up, and allied health, and it's supposed to be multi-disciplinary, the reality is it's not multi-disciplinary. The nurses don't/won't use the journey board. Confidentiality is an issue because the patient journey board we currently have is in the main flow of traffic.

Processing: As far as processes go it would be very useful if it was utilised by the multi-disciplinary team because we would all know what was happening. But it's not used, so therefore not functional. The technology - it's a whiteboard with sticky metal dots saying, 'yes', 'no' or 'still underway'. The technology is very, very archaic. Absolutely. Our average lengths of stay to what

Word	Count	Weighted Percentage (%)
Interviewer	367	2.05
Think	267	1.49
Patient	220	1.23
Just	202	1.13
Board	193	1.08
Know	193	1.08
One	174	0.97
Epjb	172	0.96
Information	172	0.96
People	166	0.93
Good	144	0.80
Journey	137	0.76
Like	133	0.74
Get	131	0.73
Actually	130	0.73
See	129	0.72
Got	123	0.69
Going	122	0.68
Really	121	0.68
Need	111	0.62
Staff	103	0.58
Put	100	0.56
Time	100	0.56
Ward	94	0.52
Things	91	0.51
Yes	91	0.51
Find	86	0.48
Thing	83	0.46
Patients	82	0.46
System	82	0.46
Process	81	0.45
Well	79	0.44
Data	78	0.44
Discharge	78	0.44
Handover	74	0.41
Want	73	0.41
Use	72	0.40
Lot	71	0.40
Now	71	0.40
Look	70	0.39

Table 3: Summary of key word and their relative percentage in this study

they should be, is completely out of whack.

Teamwork: So, there are a lot of problems with allied health involvement. I don't think that allied health see the urgency for patient flow from the same perspective. The other thing of course, for example, with pharmacists, and physical therapists, particularly, we don't have enough. There's not enough. We're at the end of the food chain up here and we do not have enough physios and pharmacists. The other allied health people I think are probably okay, they don't see the urgency for patient flow. When it first came in Allied Health (AH) really came on board with it but then because of the rotation with new AH staff there was sort of inconsistencies with how they wanted their referrals and everything done. Because the idea that I sort of had was – the staff before, so if there was like night staff they would actually populate the EPJB for who they needed to refer AH to you know like physios and stuff like that and then come 8am the physios would come up and talk to the TL look at the EPJB say 'yes got the referral' and change it.

Communication: And the issue of communication between those fields. Until a nurse gets time to physically pick up a phone, and you're probably ringing ten (10), twelve (12) times.

Time Availability: There has to be a better way. Speaking from being a nurse on the floor, if you're trying to coordinate the ward and look after your patients, to take that time to ring all those services - even just for one patient - that might be five (5) different services you've got to try and get a hold of. That takes a lot of time.

Computer Access: There are two (2) issues. One (1) is you physically don't have computers in the right locations. Physically there are three (3) in coronary care and four (4) in medical three (M3); which works very well if it's after hours because that's enough. But 'in' hours it's bedlam. The doctors don't have dedicated computers. Allied health don't have dedicated computers.

3.3.5 Main Themes:

Ease of Use: Well we used to have the EPJB as a whiteboard and that's just replaced it and it's much easier. They only have to - they're probably not putting in so much as it's pulling other information from other places, they're not having to put in as much as they did before. They seem to be ... I haven't heard any complaints, there's nobody whingeing or griping you know. it's just having the time for them to do it and the EPJB just makes it convenient because it's done on that main screen. It's done with 6 types of a key, the dates in; it's easy enough when they're handing over like I said to do it as they're speaking. I usually sit there in there

of a morning and do it. They might say she's not going home Wednesday now she's been extended till next Friday so then you just enter that date and there's just more consistency with it and if that's what they want us to do as they hounded us for that to put in length of discharges or stays or whatever.

Time Savings: Yes, because what we did to reduce time was basically instead of each nurse handing over, we've gone to just the TL handing over the whole ward. The oncoming TL is to have the EPJB up and click on the next name as they're speaking and then they're to go out of that handover and then they sight their patients. The TL's liked it from the TL handover sheet it showed them who the physios were already on, stuff like that.

Uptake: I'd probably say 70 - 80%. I think they really like it, put it this way they wouldn't like to go back to the old way of writing it up on the board.

Currency of Information: Before we had the EPJB we never had to enter discharge dates. We used to get in trouble for it and we would try to and you'd go in there and it's locked by another user and it would be just be good if Trend could pull that information from the EPJB.

Old White Board vs EPJB: well how are they going to do it to if we're to go back to the old white board it's just so messy and so untidy and a lot of the time wasn't getting updated but this way they have to update it because it's a handover sheet do you know what I mean? It's the patient's journey basically.

Training Needs: No it doesn't take long for them to learn because everything's there. You've just got to tick things and you've got your drop down's like if someone's had a fall if it's high medium or low and there's forms to fill out which we teach them what to do. It all goes in the UR notes, everything's there. It's not like we have to write too much and that's a good thing. If we don't have to write then the nurses will do it. We've basically got train the trainer now. Enough of our staff can train the new ones

Positive Impact: The EPJB has made a huge difference to the impact on our length of stays and a huge impact on giving the staff a lot more knowledge as to where we're at with our patients. They know where we're up to with our patient care - they know that the physio's seen them, they don't have to go to the UR chart and flick through and say 'Oh, I think a physio's seen them' whereas now we can look at the EPJB - 'physio's seen them' we know that for sure

Access: Yes that's right because out on the ward they've got their computers and they can do exactly what they want and then it comes to me on here so I know who's gone home and who's going home tomorrow. . So bed management - so if name says 'we need some

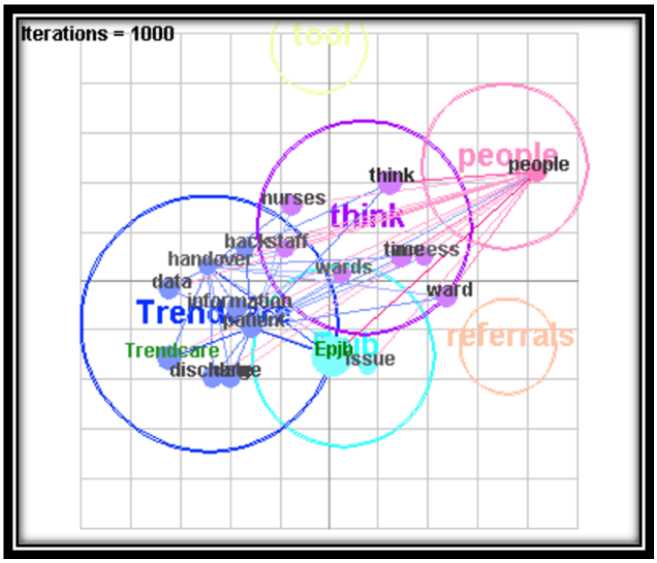

Figure 5: Summary of theams and their concentrations

beds' she can sit on there and look. . I don't have to get out of my chair to go and run and find the nurses and say 'hey, what's going on out here?' It's good having a comments section down here.

Attitude: I feel they're coming to like it the more they use it, the more they realise it is a good system so I'd mark it probably another 8.

The research team examined the issues, and provided comments to the software team responsible for managing changes. The changes included program code, hardware procurement, placement, functional routines, workforce issues and team communication aspects. These aspects were further verified for compliance and execution.

The details in Table 4 pertain to post analysis technology implementation interviews.

3.3.6 POST Analysis

3.3.7 Factor Loading: POST

The research team also conducted a tree map to verify reliability of the themes in a pictorial manner.

3.3.8 Tree Map

The next stage in the data analysis process was generating a tree map. The purpose of the tree map was to ascertain that the themes that were extracted adequately met the objectives and were represented by the key words. In generating the tree map, the visual provision indicates the weight of the key words as shown by the size of the rectangle allocated to the keywords.

In the word frequency table (Figure 6), prominent words depicting this study appear on the left side of

Concept	Absolute Count	Relative Count
Epjb	163	100%
Trendcare	74	45.3%
Think	65	39.8%
People	51	31.2%
Ward	42	25.7%
Time	39	23.9%
Discharge	39	23.9%
Nurses	35	21.4%
Date	35	21.4%
Data	34	20.8%
Patient	31	19%
Information	29	17.7%
System	27	16.5%
Staff	26	15.9%
Issue	26	15.9%
Back	26	15.9%
Handover	25	15.3%
Health	22	13.4%
Process	22	13.4%
Access	22	13.4%
Wards	21	12.8%
Training	20	12.2%
Issues	19	11.6%
Tool	18	11%
Find	18	11%
Patients	17	10.4%
Work	16	9.8%
Happening	16	9.8%
Referral	16	9.8%
Pull	15	9.2%
Terms	15	9.2%
Referrals	14	8.5%
Give	14	8.5%
Day	13	7.9%
Call	12	7.3%
Coming	10	6.1%
Hard	10	6.1%

Table 4: Summary of post analysis concepts

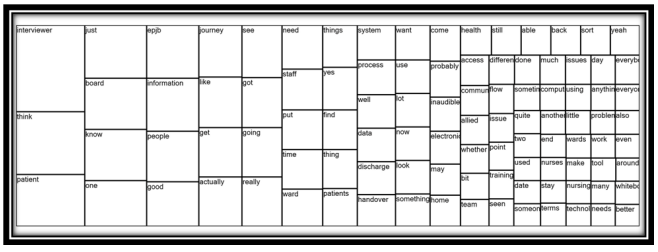

Figure 6: Summary of word frequency map

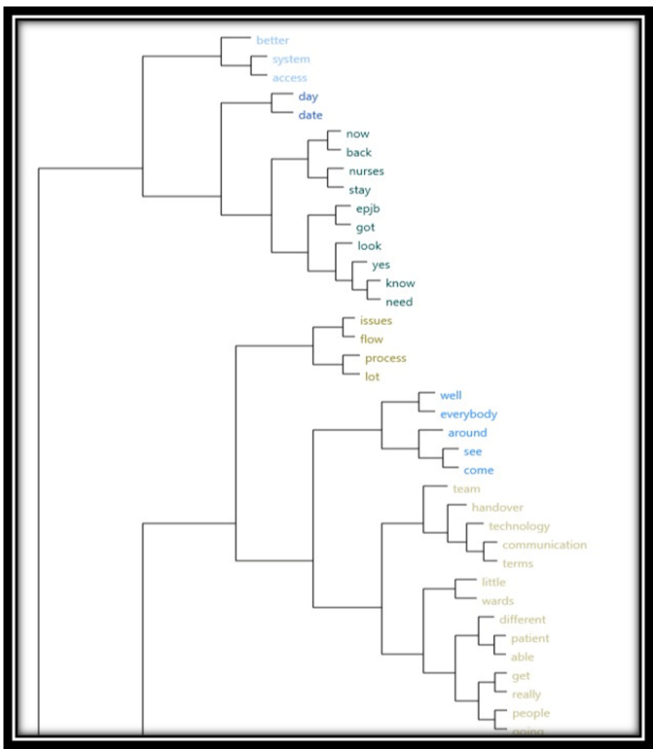

Figure 7: Summary of tree map

the diagram. As shown, these words, while indicating frequency and relative importance, also indicate the main theme of the study. This was further confirmed with a cluster analysis as shown below.

4 Discussions and Data Analysis

As a result of initial data analysis, a series of key terms were identified from the focus group interviews and these are arbitrarily grouped into factors. Among the factors, some are considered as user-orientated benefits, or issues as identified by the participants. The factors identified resulted from users' exposure to manual Patient Journey Board that is currently available in Queensland Health wards as well as their awareness about the Electronic Patient Journey Board system that is planned for implementation. For example, EPJB may be seen as being "useful" for its users, and helps medical professionals "focus" on those patients who may need more attention. Therefore, the EPJB can bring better "convenience" and "coordination" for Allied Health staff or other areas. Similarly, some factors are related to work processes, and the rest are technology-orientated. For example, an EPJB could streamline the work process by reducing the amount of time nurses spent in maintaining a manual whiteboard and a separate handover sheet. These were identified through the analysis and are listed in Table 5.

The forty eight items identified in table 5 were further

No	Item	Description
1	Usefulness	A EPJB is functional in providing necessary information to its users
2	Better Patient Tracking	A EPJB provides better tracking of a patient's progress (discharge)
3	High User Acceptance	A EPJB has been widely accepted in the organisation
4	Better Team Work	A EPJB can make teamwork easier by improving communication
5	Help to Focus	A EPJB can help to focus on those who need more attention
6	Convenience	A EPJB can help users to have a quick look at a patient's progress
7	Better Coordination	A EPJB can help allied health (e.g. handover process between wards)
8	Progress Monitor	A EPJB can provide better monitoring on patients' progress
9	Better Cross-Sectional Information Flow	Cross-sectional information exchange and integrity of information between the units can be reached
10	Streamline Working Process	Saving time for users to sit down and re-type data from memory or papers
11	Better Bed Tracking	The number of available beds can be traced up-to-date
12	Better Work Efficiency	A PJB* can improve working efficiency
13	Better Information Management	A PJB can provide complete and integrated information for patient journey management
14	Discharge Prediction	A PJB can facilitate better prediction of the discharge time
15	Time Saving	A PJB can save users' time by reducing redundant data entry
16	Reduce Mistake	An EPJB can reduce mistakes by discharging patients before they see the referral doctor
17	Reduce Information Loss	A PJB can reduce the information getting lost between units
18	Rich Information	A PJB can encompass all information that is necessary in monitoring the patients' progress and needs
19	User-friendly Interface	A well-designed EPJB can provide a user-friendly interface
20	Flexibility	An EPJB can provide technological flexibility for different needs
21	Pre-use Training	Formal training (1 2 hours) is necessary for using a EPJB
22	Colour Confusing	The implication of colour could confuse users
23	Team Cooperation	Every user needs to help keeping the EPJB up-to-date
24	Instant Updating	A PJB needs to be maintained in an efficient manner
25	Various Requirement	Users may have various needs for the sequence of information presented on a EPJB
26	Difficulty of Switching	(Junior) users may have problem learning to switch to a new EPJB
27	Time Consuming	To keep a EPJB updated could be time consuming
28	Error Prevention	A good EPJB should be able to reduce entry error
29	Difficulty to Read	The print could be too small for some users to read
30	Change of Routine	A PJB may change the previous working routine
31	United Standard/Procedure	Procedures and standards may need to be united before using a EPJB
32	Duplicate Data Entry	Using both an EPJB and the bedside computers (HBCIS) may need duplicate data entry
33	Technology Dependency	If an EPJB has a glitch or blackout, it might influence the functionality of the ward
34	Computer Literacy	Difficulty may be encountered for users with less technological knowledge
35	Supporting Model	Technological supports normally stop after working hours
36	System Security	Users may be unaware of EPJB security protocols
37	System Maintenance	The requirement of system maintenance of a EPJB might be time consuming
38	Screen Space	More details are required in some fields than can be shown on a EPJB
39	Energy Consumption	An EPJB will consume electricity and release heat (LCD is better)
40	Information Consistency	Whiteboards do not always match the printing documents
41	Messy Presentation	Whiteboards provide information in a messy way
42	Office Space	Whiteboards/EPJBs take a lot of space
43	Access to PJB	To enable everyone write their information in peak time
44	Easier Way to Update	How to update the EPJB information in an easier way
45	Non-Integrated System	Some EPJBs are not integrated with the current mobile-systems
46	Information Overwhelming	A EPJB provides too much information and could make new users confused
47	High Cost	EPJB could be too costly for the hospitals
48	Lack of Information	People may not hear or know much about EPJBs

*Table 5: Initial items identified in data analysis. *PJB refers to the manual patient journey board, maintained in the form of a white board*

analysed in detail. The analysis resulted in two dimensions of factors for further analysis - namely, positive and negative influences on the use of EPJB. These constructs include people, process, and technology as these were the focus for the Heath Department with respect to this implementation. The other aspect is to classify the factors into benefits or issues. A benefit refers to a driving factor that motivates potential users to use or implement it in the workplace. An issue is a factor that users or administrators need to consider when planning to install an EPJB. These are shown in Table 6.

The data analysis clearly indicated that the three elements – People, Process and Technology – are crucial in technology implementation. The team conducted pre- and post-implementation discussions with stakeholders who were implementing the technology, and users who would be using the technology. This exercise was useful in many ways. Firstly, the implementation team got to know users and technical teams. Secondly, The independent discussions with users revealed various deviations in procedural aspects between wards in a number of Queensland Health sites. For example, different systems were used to gather patient information and the discussion revealed subtle aspects that are required for integration, access and so on. Thirdly, user requirements varied from site to site, and this knowledge was essential in providing a uniform system with limited customization to suit individual wards. The observation also helped to understand how users use the system, as well as data in their own settings, and these were built into the development. The discussions and visits brought the users and the development team closer together. This, coupled with a telephone line to answer user queries before and after implementation, eliminated unnecessary angst on both sides. The strict project management schedule also helped in terms of procurement and installation activities.

A major deviation from the agreed framework was as a result of the Queensland floods. Despite this, the steps listed above ensured that users were constantly reminded of the significance of the project, and the support received from users assured successful implementation and uptake of the technology. This was very important in the health context as the system was introduced by involving busy users on the ward, who found little time to get involved in system implementation process because of their commitment to providing care to patients. Thus the 'People' element was significant in realising success, in terms of the uptake of the technology.

The findings of this study include identifying the factors, and grouping them by the constructs. The result indicates that in the aspect of "people", both driving factors and implementation issues are major concerns. In fact, it has been discussed significantly that the success of an EPJB is highly dependent on the users' working habit and team culture. While the technology enables real-time information transmission, instant updating is still essential to keep the information up-to-date. In terms of "Process", the benefits are significant, especially in achieving a streamlined process in wards. This helped various teams caring for patients to understand the steps involved in providing effective care, and complying with these in a seamless manner. This involved adjustment to teamwork and working routines in order to guarantee EPJB success. For the "Technology" construct, it is obvious that the implementation issues are significant. The EPJB does not change the content itself; rather the efficiency with which it is presented provides unified patient care information to all team members.

5 Conclusion

This study is unique because a number of techniques and methods were used in implementing a technology that is handled by care provider in a public health environment. This has a wide range of implications in the healthcare domain, as the lessons learned will be useful in implementing other technology in the healthcare domain. This study used a qualitative approach to explore the drivers and issues in implementing and using EPJBs in public health. 14 focus group interviews were conducted with doctors, nurses, and other medical professionals from Queensland Health. The users' experiences were analysed and 48 factors were identified in regard to three main constructs: People, Process, and Technology. Factors were further classified into two groups—benefits and issues—in implementing and using EPJBs. The findings of this study provide an overall understanding of the strengths and weaknesses of the method of implementing a technology in public health that is user orientated, and manages patient care information in order to facilitate efficient processes. The preliminary results are useful for future studies in successfully implementing technologies that have a user focus rather than a data focus.

6 Limitations and Future Implications

It is understood that this study is the first study of its kind, and its findings are limited to a single facility - the use and implementation of electronic journey boards to manage patients in a healthcare facility. This study has provided valuable information for further research, and

Construct	Factors (Benefits/Issues)	Explanation
People	Usefulness Better Patient Tracking High User Acceptance Better Team Work Help to Focus Convenience Better Coordination	Seven factors were classified as being the drivers of using EPJBs in hospitals. These drivers are related to people such as employees and patients.
	Pre-use Training Colour Confusing Team Cooperation Instant Updating Various Requirement Difficulty of Learning/Switching Time Consuming Error Prevention Difficulty to Read	Nine factors were classified as being issues involved in implementing or using EPJBs in hospitals. These are people-related issues.
Process	Progress Monitor Cross-Sectional Information Flow Streamline Working Process Better Bed Tracking Better Work Efficiency Better Information Management Discharge Prediction Time Saving Reduce Mistake Reduce Information Loss	Ten factors were classified as being the drivers of using EPJBs in hospitals. These drivers are related to working process benefits.
	Change of Routine United Standard/Procedure Duplicate Data Entry	Three factors were classified as being the issues in using or implementing EPJBs, which are related to process aspect.
Technology	Rich Information User-friendly Interface Flexibility	Three factors were classified as being the drivers of using EPJBs. The factors are technology-oriented.
	Technology Dependency Computer Literacy Supporting Model System Security System Maintenance Screen Space Energy Consumption Information Consistency Messy Presentation Office Space Access to PJB Easier Way to Update Non-Integrated System Information Overwhelming High Cost Lack of Information	Sixteen factors were classified as being issues for consideration in implementing or using EPJBs in hospitals. These issues are directly or indirectly related to information and communication technology (ICT).

Table 6: Factors classified by constructs.

provides new directions as to how stakeholders can be involved in an effective and efficient way. The findings of this study cannot yet be generalised as they refer to healthcare in Queensland alone; this has provided a narrow data set. Further data collection is required in similar instances in order to discover the applicability of the methods and techniques used so that a generic framework for user orientated technology implementation can be achieved.

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Conflict of Interests

To best of our knowledge there are no conflicts of interest.

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