Abstract

Excessive waiting time for elective surgery and a lack of information regarding patient’s status in the waiting list have left the patients upset and unsatisfied while waiting for their turn to receive the treatment. The situation was made worse by inefficient waitlist management that possibly results in unexpected delay and negative impacts on the health condition of the patients. In this paper, we investigate current waitlist management systems implemented in Australia’s five states and suggest a design prototype that could better address patient needs and empower them by providing personalised information about their waitlist status and decision support on implications of changing their preferences.

1. Introduction

Elective surgery is a category of surgery where the ailment is considered as not being life-threatening for the patients so the surgery has a low level of urgency. Due to high demand, elective surgery patients are usually put into a waiting list. Waiting lists act as a rationing mechanism between the demand for elective surgery and the supply of resources available to perform the surgery [15]. Although low in priority, the inconvenience and chronic pain suffered by the patient during their wait can still be significant and disturb their everyday life. Excessive delays may cause patients to miss the optimal timing for surgery and result in severe negative health consequences, as in the case of Cataract surgery[4].

Currently, elective surgery waitlist management practices are far from optimal for patients. Excessive waiting time and poor waitlist management has been an ongoing issue in many OECD countries [17]. In many cases, patients complain, not only about excessive waiting time, but about the lack of sufficient information provided to them during their wait. Minimal communication between physicians and patients contributes to low patient satisfaction with the waitlist management process. Patients may only ask questions of the physician during consultations, but in reality, many questions arise outside visits.

In addition, to customer satisfaction issues that relate to the lack of information about their status, there are complications that arise from the linking of aspects of public hospital funding to the state of their elective surgery waitlists. The low level of transparency of elective surgery waitlist information can encourage data manipulation because hospitals have incentives to manipulate waitlist statistics. Two recent data fraud scandals in Victoria State, Australia in 2009 sound the alarm in this aspect. In these cases, hospitals removed patients from waitlists and secretly put them in a “patient-initiated deferral” category to falsely improve hospital performance. The new category meant a patient could wait up to a year for their surgery yet hospital records would show a much shorter wait [12]. This kind of problem could potentially be alleviated if there was more transparency in the management of waitlists and patients were able to see changes in their status. Patients could then query their status change.

In summary, patients often have extended waits for elective surgery because of the non-urgent nature of their ailment and a shortage of resources. Patients complain less about the wait than the lack of information and sense of powerlessness that arise from the structure of the system.

It is the aim of this paper to argue that patient satisfaction with waitlist management may be improved if they have adequate timely information about their position in the queue, projected surgery date, and implications of changing their preferences. We provide a theoretical underpinning for this and present a prototype patient-focused waitlist management system. In doing this the paper responds to a call in the Information Systems domain for more research to be done in the area of customer information systems, especially in examining how theorizing can help to enhance the development and design of services and applications and the socio-psychological implications of the customer experience [18].

This paper contributes to the debate on patient-centered health care and how this might be
manifested in ways beyond provision of electronic health records. In particular, this paper contributes to elective surgery waitlist management in Australia because none of the five states has implemented a system that provides personalised information or sense of control to patients.

Further, this paper contributes to the discussion around theories supporting patient centric information systems. Although there have been a number of papers in the health care literature discussing simulation and other computer-based models for elective surgery and other health care scheduling problems (see examples of such studies in [6,7,16]), none of these studies addressed the issue from the patient’s perspective.

The rest of the paper flows as follows. In the next section we provide background on information provision to elective surgery patients. We then provide the theoretical basis and use this to analyse existing elective surgery waitlist management systems. The result of the analysis is a good understanding of the information needed by patients and a related list of high-level and detailed system functionalities, which are presented in tools including use case diagrams, use case descriptions, sequence diagrams and site maps. Finally, the user interfaces of the system prototype are presented. A discussion follows of how the outcome of this project addresses the problem identified with existing systems and the paper concludes with future work to extend this project.

2. Context: elective surgery waiting information Australia’s five states

Analysing the current practices of elective waitlist information provision on Australia’s five states’ health portals shows significant insufficiencies in the design of the systems.

In the state of South Australia, for example, only summary statistics are shown for hospitals in several categories (Figure 1). In the state of New South Wales, the only statistics are again high-level summaries of the information in reports that include statements such as “95 per cent of Category 3 patients were admitted for elective surgery within 365 days” [2]. The state of Queensland presents a quarterly summary report [14].

Figure 1: Online elective surgery waitlist information: South Australia

The state of Victoria is advanced compared with the static elective waitlist information sharing practices in other states. A three step online system is provided for patients to access to waitlist information (Figure 2). After logging on to the website provided by the Victorian government, a patient can first choose an elective surgery procedure and then select hospitals that provide such procedures. The patient is given an estimated time to treatment for each hospital, based on the statistics from the past 12 months. Patients are able to select and compare information about hospitals. Patients can also access general information about average waits by hospital or by procedure, but not about their position in the queue.

Figure 2: Online elective surgery waitlist information: Victoria State
2.1. How does the paucity of information affect elective surgery waitlist patients?

With only limited information publically available, there is a lack of personalised information. Patients have to contact their admitting authority directly in order to access more personalized information on their queuing status and implications of preference changes. This means that patients have to rely on health professionals to provide them with instructions and information. Consequently hospitals and health practitioners are considered to have more power in contrast to general patients. This “information asymmetry” [5] can lead to emotional anxiety, with negative impacts on the patients’ mental and physical health [10]. Patients can become vulnerable: their perceived control over their own destiny, their wills and rights can be thwarted by the group in the strong-end power situation. Therefore the provision of sufficient and transparent (comprehensible) waitlist information to general patients is important.

A difficulty arises, however in the design of systems that better support patient needs for information and their decision processes. System design is best informed by theory [9]. The next section outlines a theory that supports the design of such a system. Following sections describe the implementation of the theory in developing a prototype system.

3. The IT empowerment theoretical framework

We propose that the analysis and design process for such an elective surgery waitlist management system can be guided based on IT empowerment theory. We follow the ‘IT Empowerment’ theoretical framework [11] in order to justify and design an online advisory system targeted at addressing patients’ particular information needs. The IT empowerment theoretical framework is considered applicable to elective surgery waitlist management because of emphasis on ‘patient empowerment’ in health care.

The theory of IT Empowerment, which is raised in the empirical work by Li and Gregor [11] on online government advisory services, states that optimized explanation features of customer online advisory services lead to improved decision advice satisfaction and decision process comprehension, which in turn results in people’s higher sense of control, better perceived power relationships relative to the administrative agency. This finally enhances the service provider image of the administrative agency.

Decision process comprehension and decision advice satisfaction should be the guiding principle in order to apply this theory to the provision of elective surgery waitlist information that empowers patients. Cognitive transparency is the most significant predictor of the empowerment outcomes among all the empowering indicators relating to decision process comprehension and decision advice satisfaction. In particular, an effective online advisory system should provide optimized explanations, such as justification-type ones wherever appropriate [8,11].

It’s worth noting that none of these empowering features were implemented in the Australian State systems described in Section 2.

This very brief introduction to IT Empowerment allows the discussion to move to the discussion of the development and design of an elective surgery waitlist management system (EWMS) that follows next.

4. The EWMS analysis and design process

An agile development process was used for the proposed “Elective Surgery Waitlist Management System” (EWMS) prototype, due to the novel nature of the system and the need to frequently elicit requirements from potential system users. The agile process starts with understanding of the problem context and key stakeholder relationship dynamics. It proceeds to analysis and initial design. Verification of the design may lead to repeated Analysis/Design steps before the prototype is ready for release.

The context has been introduced in Section 2 and linked to IT empowerment theory in Section 3. It is extended below and the relationships and power dynamics of the key stakeholders, are looked at in Section 4.2 in order to identify the scope of the system so that major and detailed functionality requirements for the EWMS can be discussed in Section 4.3. This leads to the detailed design strategies for the EWMS that are discussed in Section 4.4 and presentation of the prototype in Section 5.

4.1. Problem context

Any EWMS is part of a bigger and more complex health care information system. In Australia, the health care information system is known as Medicare [13]. In general, Medicare manages patient health records and coordinates subsystems. Elective surgery waitlist management is a subsystem within the
Administration division that deals with scheduling, admission and record keeping.

Due to the size of the health care system and complexity of its processes, elective surgery waitlist management cannot stand alone and still deliver good performance. Much information flows from another subsystems and this can affect performance of the elective surgery waitlist management subsystem. For example, if a patient’s health insurance (managed by another subsystem) expired while the patient was listed on an elective surgery waitlist, the registration cost, treatment cost or other related healthcare benefits and eligibilities may change. Therefore if the patient failed to extend his or her health care insurance then he or she may be removed from the waitlist. Consequently, any elective surgery waitlist management subsystem needs to be integrated into a larger scale system.

Scheduling can also affect waitlists. Scheduling subsystems maintain hospital resources such as surgery equipments and human resources such as specialists, GPs and nurses. In one possible problematic situation, the specialist who is performing the surgery may be unavailable due to annual leave, sick or resignation from his or her job. In another, scheduled maintenance of surgery rooms or surgery equipment may cause delay in surgery. An elective surgery waitlist management system needs to respond to these and other changes to resourcing. If the surgery waitlist management system fails to cope with those situations, the waitlist may experience significant delays, inaccurate estimation of surgery dates and decreased patient satisfaction toward waitlist management.

The above analysis shows that an elective surgery waitlist management system needs facility to interact with other healthcare information systems. The people who interact with the systems should also be considered. Stakeholders are discussed in the next section.

4.2. Key stakeholder relationship dynamics

Any elective surgery waitlist management system has four types of users that interact with each other within the system. They are the patient, health authority, general practitioner (GP) and specialist or doctor. Figure 3 gives an overview of stakeholder interactions in the system proposed in this paper.

The patient refers to any person who requires medical attention, care or treatment. In this context, patients include people who are listed in any surgery waiting list. The patient is the health care service acceptor. The Patient’s goal of using the system is to receive more transparent and satisfactory information and obtain more control on his or her position in the queue for elective surgery. Since increasing the patient’s satisfaction toward waitlist management is one of the major motivations for the prototype system discussed in this paper. While it might be desirable to have a system where patients can affect their waitlist status, this is outside the scope of the proposed elective surgery waitlist management system (EWMS).

The health authority oversees the elective surgery waitlist management system. Their role is to register patients, surgeries, hospitals and assign patients to a specific waitlist. The health authority is the health service controller. System administrators are expected to have a reasonable level of computer literacy because have authority to access and change important aspects of the system such as waitlists.
In the proposed EWMS (Figure 3), system administrators have authority to register users and assign patients to waitlists, but they require approval from higher jurisdictions. This acts as a control against manipulation of the lists. For example, before a system administrator registers a new patient to the system, he or she needs to present authorization from higher jurisdiction that verifies that all requirements and paperwork for this patient have been completed and approved. Only then may the system administrator register the new patient on the system. Of course this will not prevent systemic fraud on the part of hospitals, but it does provide an avenue whereby changes might be recorded and audited.

The general practitioner is the person who provides primary and continuing medical care for patients and is usually the first point-of-contact for patients. Their role in the system is to diagnose, recommend treatment and, if necessary, add patients to surgery waitlists. General practitioners also need to respond to patients’ enquiry. General practitioners may update the waiting list when patients feel unsatisfied with their waitlist status, need further consultation or perceive that their health condition has changed. After health authority system administrators, general practitioners have the most power to adjust waitlists.

Specialists focus on diagnosis and surgery. This group of users is also overlooked by health authorities under current elective surgery waitlist management structures, but in the prototype EWMS they can retrieve patient information (including diagnostics) from the general practitioners who recommended the patients, and access other relevant medical patient records. This part of EWMS functionality aims at making it easier for specialists to analyse patient situations and decide on optimal treatment strategies. Under this system specialists have similar power to patients to adjust waitlists.

The proposed EWMS is innovative in being able to push alerts to system users at a pre-specified time interval. For example, the system could remind the patient a week ahead of their surgery. The alert might be email, mobile or fixed-line phone etc., as defined by the patient.

4.3. System functionality requirements

An understanding of the problem domain has been achieved, including the system context and the relationship dynamics of the key stakeholders in the system, so we can now describe requirements for system functionality (which incorporated preliminary inputs from both domain experts and patients), as presented in Table 1. All the numbers in this table correspond to the numbering in Figure 3.

| Health Service Providers | (1) Register user: |
| Health Professionals (E.g., GP, Specialists) | (2) Add patient to waitlist. |
| (3) Update account information. | (10) Respond to patient comment or enquiry. |
| (11) Remove patient from waitlist. | (12) Update waitlist [change patient priority] |
| (13) Update waitlist [change patient priority]. | (14) Review long wait patients. |
| (15) View waitlist. | |
| Health Service Controllers | (18) Register and remove hospital. |
| Health Authorities | (19) Register surgery type. |
| (20) Assign waitlist to surgery. | (21) Review and sets policy and rules [i.e. set GP reffereal guidelines]. |
| Health Service Acceptors | (5) Update account information. |
| Patients | (6) View waitlist information. |
| (7) Withdraw from waitlist. | (8) Contact GP. |
| (9) Transfer waitlist. | |
| EWMS | (4) Generate surgery date estimation and push queuing information (notifications) to patients. |
| | (13) Response to specific user events (e.g., GP removes patient from waitlist) and update waitlist accordingly. |
| | (16) Keep a log of the events taken. |
| | (17) Pushes periodical reports to health authorities. |

Use cases (an example use case description is given in Appendix Table 2) were used to clarify the requirements with potential system users and domain experts (Figure 4 is an example of use cases for patients). Sequence diagrams were used to describe the processes involved to complete each of the use case (see an example sequence diagram for “patient transfer waitlist”, in Appendix Figure 10).
Site maps were also used to clarify the structure of the proposed EWMS system (an example site map provided for patients is given in Figure 5) and to facilitate a system design that maximizes transparency and traceability and minimizes user’s cognitive load.

Automatic user notification is an important function of this EWMS prototype. The current prototype incorporates a basic queuing algorithm for estimation of patient treatment times, that will facilitate this function, but there is not space to discuss it within this paper.

Treatment time (i.e., the total amount of time a specialist or doctor allocates to a patient) for each patient can be estimated by using various models. In practice, optimal model selection depends on the data available. Several statistical model selection algorithms exist. A linear regression model was implemented in the prototype, but once again space precludes its inclusion in this paper.

Another important feature of the proposed EWMS is the provision of optimized explanations. We consulted the design guidelines given in authoritative reports [8,11] to provide good explanations that facilitate cognitive transparency. For example, justification type explanations (Definitions are provided in [8]) can result in user learning, enhanced satisfaction and better system performance. Hierarchical decomposition, which refers to way of resolving a functional relationship into its constituent parts so that the original function can be reconstructed from those parts by function composition,(see detailed definitions in [8]) is
considered important to reduce user’s cognitive load and enhance their understanding of the process.

5. The proposed EWMS system

Here we describe some of the important user interfaces of the EWMS. In common with existing systems, the proposed EWMS provides a list of surgeries with the same surgery type, along with the estimation of surgery date for each alternative. Consequence of switching hospitals are provided (left panel of Figure 6). When the mouse curser hovers over a particular hospital, a dialogue box pops up to explain detailed impacts on the patient’s elective surgery waitlist status if they change their preference to that hospital (A sample is given in Figure 6). The system also indicates whether there are any financial implications so the patient can make a sound decision in transferring preference between hospitals.

**Figure 6: ‘Transfer waitlist’ user interface**

If the patient chooses one of the alternatives, the system displays detailed information of the new surgery wait list and asks for confirmation (Figure 7).

**Figure 7: ‘Confirm waitlist transfer’ user interface**

This information should help patients to make decisions in waitlist transfer and supply them with personalized information. These system features should address information deficiencies in current systems.

Detailed and well-organized instructions are presented to patients so that they do not need to have a high degree of computer literacy. This is aimed at reducing stress associated with accessing information.

**Figure 8: User options ‘waitlist’ user interface**
The system displays detailed information about the waitlist (Figure 8) with a list of options that patient may take. This feature aims at giving the patient a sense of control and autonomy of their status in waiting list.

One of the options is to withdraw from waitlist. If the patient chooses to withdraw from a waitlist the system will ask for confirmation from the patient.

The system also allows patients to specify whether and how they wish to be notified of impending surgery. They can specify the notification method and time before the admission of the patient. This feature is aimed to keep the patient posted and relieve stress on the patient’s side around the uncertainty of their surgery date. Again detailed explanations are provided to assist the user to understand the process (Figure 9).

![Figure 9: “Subscribe to alert” user interface](image)

6. Discussion and conclusions

In this study, we reviewed the needs of patients by gathering information from literature and related works to arrive at an analysis of online elective surgery waitlist management systems in order to propose and describe a working prototype of the elective surgery waitlist management system.

Existing elective surgery information systems for patient use on government agency health portals are static. The information to patients is mostly high-level statistics, which contribute little to removing uncertainty around the length of wait. Inability to access information about their status is one of the primary reasons why patients have low levels of satisfaction toward surgery waitlist management [reference suppressed during review].

The contention in the paper is that it is desirable to empower patients by giving them options to (a) explore more transparent information about their waiting status and (b) to have better sense of control over their waitlist status and (c) to participate actively in the decision making regarding their queuing process so that patients are more satisfied with the decision made.

The current reporting practices in the five states of Australia do not align well with the “patient-centric” principal given in the government’s health policies [1]. Disclosure of too much elective surgery waitlist information might be a potential threat to individual privacy, but an appropriate level of elective surgery wait status information should be set through consultative approaches and consensus between patients and health authorities.

It is suggested that an effective online surgery waiting list management system will be able to increase patients’ satisfaction toward surgery waiting list, but such a system needs firm theoretical support. The IT empowerment theoretical framework was used in the development of a prototype “Elective Surgery Waitlist Management System” (EWMS). The prototype aims at empowering patients to access to satisfactory and transparent waitlist information and allow them to manage their waitlist in a better way.

In proposing an EWMS that provides more information and a level of decision support, we support the idea that the standards and process for prioritization and waitlist management should rather be a joint-decision process involving the patients, physicians, decision makers and the public [3].

This proposed system should benefit patients, health practitioners and society as a whole. Implementation of this EWMS will allow patients to access personalized information about their waitlist status. This EWMS could relieve health practitioners from routine request handling from patients, such as enquiries about wait status. Such a system will allow health practitioners to focus on their real expertise and possibly become more productive. While the improved transparency of the proposed system and opportunities for improved controls might go some way towards preventing fraud, for health authorities and government agencies, the real benefits arise from reduced patients stress and increased satisfaction.

The analysis and design process for the EWMS prototype also has useful implications for practitioners who are designing and building large scale online customer advisory systems. We wish to highlight the theoretical importance of including the
“socio-psychological” perspective in the system prototype development process. Particularly, for “consumer-centric” information systems, we emphasize the importance of understanding the relationship dynamics of the key stakeholders in the system context to come up with an effective system design strategy to empower the consumers (in this case the patients).

The scope of the paper focused on describing the system prototype on the health care service acceptor’s side, that is, from the patients’ perspective, since this is the major contribution of the proposal. User evaluations and field testing of the system are out of the scope of this current paper owing to page limitations. In the next stage, the proposed prototype will be field tested to gather user’s feedback on the system. In order to develop a system that is aimed to ‘go-live’ after the development process, we also need to integrate this EWMS with other subsystems in the health care system such as surgery system and hospital resource management system. The full system also needs to cope with local government policies as each state in Australia has their own policy about surgery and surgery waitlist.

We believe that this system can decrease the average waiting time for elective surgery and increase the satisfaction level of patients. Average wait time may be reduced by minimization of manual processes. Increased patient satisfaction towards elective surgery waitlist management may be achieved through providing personalised information and so giving patients enhanced cognitive transparency.

References:


Appendices

Table 2. Detailed description on transfer waitlist

<table>
<thead>
<tr>
<th>Package</th>
<th>Elective Surgery Waitlist Management System: Front End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>This use case describes how patients use the control given to them by transferring between waiting lists.</td>
</tr>
<tr>
<td>Precondition</td>
<td>Patient must be logged in.</td>
</tr>
<tr>
<td>Success End Condition</td>
<td>The patient transferred surgery waiting list successfully.</td>
</tr>
<tr>
<td>Failed End Condition</td>
<td>The patient cannot transfer surgery waiting list.</td>
</tr>
<tr>
<td>Actors</td>
<td>Patient.</td>
</tr>
<tr>
<td>Trigger</td>
<td>This use case starts when patient decide to transfer to another surgery waiting list that he/she feels to be better than his/her current surgery waiting list.</td>
</tr>
</tbody>
</table>

Primary Scenario

The patient clicks ‘Waitlist’ link.
The system navigates to a page displaying detailed information of surgery waiting list which the patient is currently listed in.
The patient clicks on the ‘view my option for this waitlist’ link.
The system navigates to a page showing list of option available for the patient.
Patient chooses the ‘transfer waiting list’ option.
The system displays list of surgery waiting lists with the same surgery type as one the patient is currently listed in along with surgery date estimation for each alternatives.
Patient chooses one of the alternatives.
The system will ask for confirmation from the patient, patient confirms waitlist transfer.
The system transfer patient from current surgery waitlist to the selected surgery waitlist and navigate to a page showing that the patient has successfully transferred along with detailed information of the new surgery waiting list.
The system keeps a record of this action in the surgery log table in database.

Secondary Scenario

From step 2: (The system returns an error message)
The system displays an error and informs the patient to try again.
Return to step1.
From step 2: (The system is offline)
The system failed to transfer patient to the selected surgery waiting list.
Displays error message to patient, return to step 2.

Priority Top

Figure 10: Sequence diagram for transfer waitlist