Implementing an emergency department patient admission predictive tool
Insights from practice

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Abstract

**Purpose** – This paper aims to show that identification of expectations and software functional requirements via consultation with potential users is an integral component of the development of an emergency department patient admissions prediction tool.

**Design/methodology/approach** – Thematic analysis of semi-structured interviews with 14 key health staff delivered rich data regarding existing practice and future needs. Participants included emergency department staff, bed managers, nurse unit managers, directors of nursing, and personnel from health administration.

**Findings** – Participants contributed contextual insights on the current system of admissions, revealing a culture of crisis, imbued with misplayed communication. Their expectations and requirements of a potential predictive tool provided strategic data that moderated the development of the Emergency Department Patient Admissions Prediction Tool, based on their insistence that it feature availability, reliability and relevance. In order to deliver these stipulations, participants stressed that it should be incorporated, validated, defined and timely.

**Research limitations/implications** – Participants were envisaging a concept and use of a tool that was somewhat hypothetical. However, further research will evaluate the tool in practice.

**Practical implications** – Participants’ unsolicited recommendations regarding implementation will not only inform a subsequent phase of the tool evaluation, but are eminently applicable to any process of implementation in a healthcare setting.

**Originality/value** – The consultative process engaged clinicians and the paper delivers an insider view of an overburdened system, rather than an outsider’s observations.

**Keywords** Emergency treatment, Information systems, Patients, Software tools, Medical care, Australia

**Paper type** Research paper
Introduction
A major issue for the health system is the overcrowding of the Emergency Department (ED), leading to access block, which affects not only the ED but the efficacy of a hospital’s overall operation (Kunz Howard, 2005). Resultant impact on patients and staff is acknowledged as being an increasing problem (Brown, 2002; Cameron, 2006; Curry et al., 2003; Richardson, 2006). The Emergency Department Patient Admissions Prediction Tool (EDPAPT) Project aimed to develop a forecasting tool that accurately and reliably predicts ED admissions, and is easily used by bed managers, for whom the knowledge of ED requirements enables them to determine and manoeuvre overall bed usage. Likewise, when planning elective surgery, they can take such numbers into account when considering hospital bed requirements.

Devising an information technology (IT)-solution tool such as the EDPAPT is moderated by the imperative that it meets the needs of those for whom it is intended. The effective translation of technological innovation into a solution for clinical practice dilemmas is highlighted in the current literature (Harrop et al., 2006; Hendy et al., 2005), wherein the advisability of user input into the development is stressed. Aware of the impact that such introduction can have, and the need for strategic implementation, a consultative process was carried out as part of the EDPAPT Project. This included discussion with potential users and key players in the ED and in bed management in order to gather their expectations and functional requirements for a predictive tool. Eliciting input from clinicians via semi-structured interviews served a dual purpose. First, it delivered qualitative data in the form of a valid insider’s account rather than an observer’s supposition. Second, it fostered the strategic dynamic of clinician buy-in, as input during development invests a sense of ownership in the subsequently launched product.

Background
While information communications technologies (ICTs) are acknowledged in the current literature as augmenting efficiency in health care, they can engender both solution and problem (Sintchenko et al., 2007). Coiera and Hovenga (2007) propose that the implementation of ICTs can run ahead of the users for whom they are developed. In the context of a phenomenological study, Harrop et al. (2006, p. 300) explored clinical staff perceptions of ICTs. Participants reported that in a busy work situation, they subtly prioritised between interacting with a patient or with a computer programme, their priority being patient care. They conveyed a propensity to interpret ICT data, moderating it according to contextual information and past experience. Developers of ICTs may not fully appreciate the inherent dynamics to which their creations will be subjected. They need to be culturally informed regarding the subtleties of the particular clinical arena into which their innovations will be installed, and utilised. Such awareness will deliver ICTs that “fit snugly into the rhythm” of the user’s work. Harrop et al. (2006) depict an interaction between user and ICT, rather than a computer standing as a final arbiter.

ICTs can augment patient flow by facilitating the bed managers’ role, which Parker (2005) describes as being fulfilled with the use of arduous phone calls, unremitting paperwork and ward visits. This creates an imperative to deliver solutions, particularly as the movement of patients through the system is recognised as being the major tactic to decrease access block (Fatovich and Nagree, 2005).
By utilising ICTs in decision support, write Sintchenko and Coiera (2003), it is possible to simplify tasks and reduce cognitive effort, while maintaining decision quality. Sprivulis et al. (2007) recommend broader interoperability between sites and agencies to realise benefits to both provider and patient.

Although ICTs are now essential in the health care setting, their application should be tailored to the site, and integrated with existing workflow. This will ensure that they enhance rather than hinder the workplace (Coiera and Hovenga, 2007).

**Aim**
The aim of the detailed consultation process with ED staff and bed management planning staff was to define User expectations: What do you expect? and Functional requirements: What do you need?

**Method**
The study was executed using a Naturalistic Inquiry approach within a qualitative framework.

**Setting**
Two hospitals in South East Queensland, Australia – the Gold Coast Hospital and Toowoomba Hospital – were chosen as the study sites because of their different demographic characteristics. Toowoomba reflects an entire, fairly stable population (~90,000) served by one ED. By contrast, the Gold Coast has one of the busiest EDs in the state, a large itinerant population (~524,000), several other EDs serving the area, and is not only the host for annual events such as Schoolies Week and Indy car racing, but a continual stream of vulnerable tourists.

**Participants**
The 14 interviewees were selected based on their position within the organisation, being purposively selected in order to build a comprehensive depiction of the situation under examination and to achieve maximum variation. These key informants included four after-hours Coordinators/Evening Supervisors/Bed Managers (BM), two Nurse Unit Mangers (NUM), five ED Consultants/Directors (EDCons), two Directors of Nursing (DON) and one Health Administrator (HA).

**Recruitment**
Following the obtaining of the requisite ethical consent from the appropriate Health Service Districts, participants were initially contacted via e-mail with an attached Information Sheet and Consent Form. This was followed up by a phone call to arrange a suitable appointment for interview, after which participants were thanked by e-mail for their contribution to the project.

**Data collection**
Individual interviews were utilised, being an effective means by which to gain maximum input from clinicians and managers for whom constraints of time and responsibility made focus group attendance a strategic improbability. The interview schedule utilised is:

- Tell me about the current system of admissions/bed allocation.
- Would the proposed predictive tool be useful to you?
• What do you expect it will do for you?
• What do you need it to do?
• What do you hope it will do?
• Further suggestions/requirements.

That none declined to participate in the consultative process showed their willingness to contribute, manifested in their obligingly factoring an interview into their obvious limitations of time, and on some occasions, of space.

Data analysis
The semi-structured interviews were taped, transcribed verbatim, and analysed. Throughout this process, participants’ identities were masked by de-identification of their name and workplace as much as is possible without minimalising their input. Thematic content analysis utilising Van Manen’s (1990) framework of analysis was conducted to consider the consensus of issues and patterns of disparity in the responses of the different informants.

Findings
Participant data are discussed here according to the interview schedule and features: the current system, what participants expect and require of the tool, plus their unprompted suggestions and comments.

(1) Current system of admissions
Respondents’ replies to the initial question regarding the current system of admissions and bed allocation tended to be either an observation with recommendations or, Conversely, an individual’s debrief. Content analysis of participant responses has realised these overarching themes: Context, Culture, Crisis and Communication

While long, descriptive accounts have been mined to collate key data, the following exemplary one-liners served as an introductory summation for both participant and interviewer:

• The system is in meltdown here (EDCons1).
• Organized chaos it is most of the time (BM1).
• It is very reactive (BM2).
• It is a matter of putting out “spot fires” (EDCons2).
• It is a bit of a joke as you can appreciate (BM3).

Context. An understanding of the dynamics of the context, physical location, structure and the personnel involved, is important in the development of a predictive tool. The interviewees indicated that these factors would moderate its uptake and efficiency. Context was clearly described by a DON, who observed both the interplay between departments, predominantly surgical and medical, and the system structure as a whole. Particularly pertinent is the fact that: “many of the different players work in isolation to one another and they don’t necessarily communicate across the silos, or across the divisions, or work groups” (DON1).
Bed managers are situated within the context, however, and, while playing a key function therein, do not always perceive their role to be so. They report feeling segregated and not part of a team with which to network, to use as a sounding board, or from which to derive support. This is a lack because: “you do need a lot of support and a lot of credibility, authority in that role because you do have an organizational view” (BM2).

Hence the dichotomy that BMs consider they are separated from the “silos” – not part of any and yet required of by all, and held responsible while not perceiving a commensurate level of responsibility. One BM described colleagues as being very stressed and feeling like they are: “the brunt of things, abused a little and hounded” (BM3). In order to cope, BMs are reduced to surviving: “just that eight hour shift, and sometimes to the next hour” (BM2). That BMs are: “overwhelmed and flooded” (EDCons2) was acknowledged by an ED consultant who had noted, for example, the number of calls BMs receive in one day. Most of these result in: “putting out spot fires, as they are trying to micromanage things as they come up . . . with no time to stick their head up . . . to look around and see what is coming” (EDCons2).

A recurring discussion point has been that “seven into five won’t go”: “Unfortunately . . . even though emergency departments are a seven days a week business, discharge seems to be a five days a week thing. On the weekends you end up under bedded, whereas towards the end of the week, usually towards like Thursday or Friday, even Saturday, when the discharges happen on the Friday your bed stocks aren’t too bad” (NUM1). This situation exacerbates the problem of streamlined patient flow.

Crisis. Such prevailing contextual dynamics engender a sense of latent crisis, with potential legal implications, described as: “purely crisis management . . . you are legally in a very bad space. You are having demands put on you from the powers that be that you have no influence over, and yet you have people underneath you that you are having to deal with, decisions made for you and you have to now instruct” (BM2). Interviewees highlighted an important overarching factor that underpins the crisis and that no one feels they have influence over, the fact that: “they won’t close our front doors . . . emergency patients cannot be turned away” (BM2). Thus “the only pathway we can put a block in is the elective door” (BM2). Hence the inestimable value of being able to predict the quantity of emergency patients requiring hospital admission.

Cancellations. Cancellation of elective surgery patients is a major concern for participants, and all were cognisant of the personal impact this has on patients and their families, plus the subtle manner in which repeated cancellation erodes their trust of the health system in general, and local carers in particular. “The impact can be quite devastating . . . Our clinicians are so used to it now, they don’t even consider the consequences” (DON1).

Communication. From the data it is obvious that an important component of management, particularly in crisis mode, is communication between both staff and departments. Participants reported a need for first, providing staff with access to strategic information, and second, their utilisation of it. One BM highlighted the lack of tools that supply such information. Not having the right tools means that: “the powers that can make those decisions don’t even have the accessibility of the right information to make those decisions” (BM1).

Culture. Patient care is enacted in a milieu of “gaming and it is those cultural things” (DON1). This is manifested in non-compliance with processes, particularly data entry
such as predicted discharge dates. “Getting people to accurately fill it in” (NUM1) is a source of great frustration conveyed by one nurse unit manager.

There is reportedly a “perverse disincentive” (EDCons2) on the part of ward staff to communicate the current status of bed stocks, and projected and imminent discharge dates. This is embedded in ward culture and informed by the knowledge that: “if you discharge a relatively well patient, you know that bed is going to get filled before the sheets are cold with a sick patient who is going to be a high level of care. So you want to hang onto that low level patient for as long as you can” (EDCons2).

Within this culture, there is no perceived significant reward for doing the right thing, as expressed by a DON: “There needs to be consequences for ignoring a red light. There aren’t consequences now, and there are very few rewards for people who do [comply] (DON1).” It could be argued that, conversely, there are consequences for ignoring the system, the red lights and other warnings, but the ramifications are not necessarily felt by those doing the avoidance. Rather they impact firstly on patient care, and secondly, they have adverse effects on other players in the “game”, as several people reclassified their work practice.

As various participants elaborated on the gaming aspect, it became clear that this strategy was imbued with two distinct dynamics that can be formulated as the following equation:

\[ \text{Game} = \text{Culture} + \text{Behaviour} \]

One consultant explained: “It is gaming and it is those cultural things, while various links in the chain are under resourced or under pressure, you get those diverse little edges in the pool, whirls and whirlpools and stuff that slow down the overall flow” (EDCons2).

On a positive note, however, “the people who learn how to play the game also learn to ask the right questions of the right people, so that they can manage within this chaos” (DON1).

Such insight is particularly valuable for this project. Devising the EDPAPT is one part of the development, while enculturation is clearly another - a fact that is envisaged by several participants as being a key factor in the utilisation of the Tool. To influence this dynamic was beyond the scope of the EDPAPT project. It was, however, an important phenomenon to acknowledge in the devising of the tool; and acknowledged by one participant as needing “another round of funding” (EDCons1).

In answering this first question on the current situation, participants delivered significant insights into the arena of care delivery, revealing the daily – often hourly – machinations of hospital workings. It is at this juncture that the potential, if not imperative, for tools such as the proposed EDPAPT to alleviate systemic malfunctioning is apparent.

(2) Expectations
Conveying the current reality had highlighted for participants the potential for the Tool. At this point of the interviews, there was often a sense of a change of direction and affect, as respondents were keen to consider something that is offering relief. Asking participants about the usefulness of the proposed tool, and what they would require and hope it would do, delivered insight into its intended effectiveness, based on their expectations. Participants responded favourably to the fact that the EDPAPT is
offering solutions, and envisaged its potential to impact on effectiveness and efficiency, foster forward planning, allow the observation of an overall organisational view, and facilitate strategising.

**Impact on effectiveness and efficiency.** A tool that could predict what type of patients would be coming in would mean: “you can shuffle your resources around to be able to utilise to its best effectiveness, best efficiency, and you can then also look at what is going to happen over the next few weeks” (BM3). The ability to plan ahead, particularly in the allocation of staff, beds and theatres would realise the optimum usage of costly resources – a concept that participants at bed manager level were required to factor into their deliberations.

**Foster forward planning.** That accurate prediction will be of inordinate benefit was a somewhat rhetorical comment on several participants’ part. Thus: “if you know the third Tuesday in May is going to be a bad day, we would have to start making allowances for that Tuesday, so you have a time frame” (BM2). They stressed that the capability to know ahead when “bad” days will occur will provide an opportunity to anticipate and plan.

**Observe an overall organisational view.** A total system view was acknowledged as a key strategy for facilitating patient flow and relieving access block, as: “one predictive tool leads into so many systems, and you can start assessing the needs of other areas” (BM3).

**Strategise.** One NUM envisaged that the tool would: “give bed management an idea where during this period of time they would have to be looking to find a certain amount of beds” (NUM2). Such ability would enable BMs to be anticipatory in their deliberations, rather than reactive in the locating of beds. Furthermore, it would relieve the burden of moving beds and relocating patients, and of staff delivering out-of-context care to outliers.

**(3) Requirements**
Analysis of the data from the question: “What do you need [the tool] to do?” delivered specific user requests. Participants were quick in forthcoming with specific features:

- availability;
- reliability;
- relevance.

These were further qualified in the participant’s considerations. In order to deliver these characteristics, they considered that the EDPAPT – any tool – would need to meet certain requirements by being:

- incorporated;
- validated;
- defined;
- timely.

**Incorporated.** To ensure its usability, a tool has to be easy to locate and employ: “It needs to link into existing things we have got; I don’t think it needs to be a new system” (NUM2). It is crucial that it is readily available and relevant to the situation at hand.
Validated. A word of caution was this directive that: “we need to make sure that they validate it … and the clinicians themselves are very comfortable and happy that the maths works” (NUM1). Assurance of the rigour of the calculations will ensure user confidence, without which clinicians will not utilise an instrument of any kind.

Defined. Likewise, participants emphasised: “be very clear about what constitutes a bed. And is it departure ready from an ED consultant or is it departure ready from an inpatient registrar, once they have seen them, which will always delay the process?” (NUM2) Potential discrepancy and assumption led to the discussion and consolidation of terms by the project team. This was vital given the multidisciplinary makeup of the team. It also rendered the consistency that the participants were requesting as they highlighted the ambiguity that non-definition can cause.

Timely. Time is all-important to the process of patient flow – timing and lack of time. There are optimum times to bring together overall planning with view to predictions, bed stocks and staffing. At interview, BMs were immediate in their responses for their preferences for timing and update, reflecting that they had grasped the manner in which they could most effectively utilise a predictive tool. The best times for them to do so differed in the two interview sites, but were constructed around the same constraints of specific, regular daily meetings and handovers.

(4) Further suggestions/requests

To the open-ended request for further suggestions or requirements, interviewees were obviously keen to have the opportunity to contribute their insight and requests, initiating a diverse range of topics.

Implementation. Implementation was of notable importance, being a topic introduced by participants. The introduction of a new innovation is anecdotally a commonly misplayed, generic process. Drawing on previous experience, one NUM recommended that implementation be a process that: “comes from higher up down then they might be more responsive, but if it comes from ED particularly then, yeah, see you later” (NUM2). As a consequence of such experiences, participants recommended various tactics for implementation:

- appropriate, effective initial launch;
- stepwise introduction;
- utilisation of clinician colleagues; and
- ample instructions for use.

Appropriate, effective initial launch:

It is how you sell it (BM3).

The first contact creates an impression that moderates the value and importance that clinicians attach to an innovation.

Stepwise introduction:

The way you push a new concept, a new service – it’s little steps (BM2).

This comment exemplifies several participants’ conveyed recollection of a variety of previous “hit and run” implementations.
Utilisation of clinician colleagues:

You have to get clinician buy in and coming from a clinician it often works really well (NUM1).

Introduction of an innovation needs to be strategic. It is fostered by clinician feedback, with the process being facilitated when administered by colleagues who understand the workings and know the requirements of their particular area.

Ample instructions for use:

You can give them the tool but you have to teach them how to use it (DON1).

Supply does not ensure usage. Neither does the assumption that clinicians will work out how to use a new tool, or be motivated to do so. This leads to the current dissatisfaction that several participants expressed, and eventual non-use.

These exemplary comments regarding implementation are particularly pertinent, being derived from experience plus perceived frustration by some participants at seeing a series of costly, mal-introduced panaceas for the often overwhelming situation clinicians and managers encounter daily. Some of these systems would have been sound strategies but their inapt instigation ensured that their efficacy has not been realised in the settings in which these interviews have been conducted.

Comment at this juncture confirmed that with appropriately planned implementation, the EDPAPT would potentially not be yet another target of misuse or disuse. Participants verified the importance of the user consultations as an equally valid part of the EDPAPT project.

Added comments. Inviting respondents to contribute further comment in a deliberately unstructured part of the interview rendered particularly valuable information that would enhance the Tool’s development and ensure its relevancy.

Recommendations:

If it is user friendly, easy to read, and we can build in some decision-making points around the tool, which will be the key (DON1).

Various participants’ comments suggested that previous innovations have not always delivered these required characteristics, despite their being aware that such features would obviously be advantageous.

Bed management/patient flow:

To me that is the real value of what this is. It’s to say, look you’re going to need 25 beds for ED patients tomorrow, start planning today, don’t wait until, oh gee, it is a surprise, one has come through the door, fancy that (EDCons2).

The proactive practice that a predictive tool can facilitate is clearly invaluable in a situation when the participants do not need to be “taken by surprise”. Bed managers, particularly, extolled this advantage.

System responsiveness:

Don’t bring in a tool and expect staff to change their practices around the IT system. The IT system has to respond to the needs of the people using it. It has to happen two ways, the tool influences behaviour, but the tool has to be also informed by the behaviour (DON).
The project team were acutely aware of this interplay, and considered the dynamic between user and tool throughout the EDPAPT development, harnessing it to moderate the process.

**Staffing:**

It will help us to predict our staffing requirements. If we knew that there was going to be lots of vacant beds next Tuesday, we should start to plan to decrease staff on that day now... or cancel some of our Agency pre bookings (DON1).

Considering the excessive cost of agency staff, the latter notion would also realise substantial financial benefit. The ability to anticipate staffing numbers generally would render savings not only in financial terms, but also in the inordinate amounts of time devoted to workforce procurement and allocation.

**(5) Future potential**

While the EDPAPT has been developed to address a specific area, participants conveyed a sense of immense future potential. This DON seized on further fiscal benefits:

Some work is more valuable to us financially than others. So if we could link our decision making to income as well as throughput, then a tool like this would be absolutely brilliant and would actually help us to choose which services to continue and which services not to (DON1).

Going a step further, one ED Consultant envisaged:

I would see this as being the first part of a strategy... a piece of software whereby we can run a whole hospital (EDCons3).

In so doing, he has delineated the imperative for further phases of development and implementation of the EDPAPT, because, as put succinctly by this BM:

It will influence an awful lot of areas if you get it right (BM4).

**Discussion**

It is often the case in qualitative research which invites open-ended participant responses that the data thus mined can encapsulate issues of which the researcher may not even have been aware prior to speaking with those in the field. First, in response to the question on the current situation, participants candidly painted a somewhat stark picture of practice. Expecting this to be the shortest of the questions, serving by way of introduction to represent the current status quo, and to tune the researcher into this particular area of practice, the depth to which participants obviously needed to delve was unanticipated. It did, in fact, generate data that manifested the context and culture of a setting into which the proposed predictive tool was to be located, and thus was invaluable to understanding their outlook. Being aware of those who will be actually using it enabled the creation of the tool that is sensitive to their needs.

Second, while their deliberations over requirements were careful and thoughtful, in many instances these were patently not the main issue for several participants, for whom the manner in which any tool would be implemented was of greater import than what that tool would offer by way of in-practice relief. This suggests that they...
perceived no relief to be preferable to the burden of grappling with an awkward, unsolicited, placating panacea.

Allowing participants to then re-evaluate the cultural and crisis spots of practice, this time envisaging a potential solution that would both require and enable change, initiated a dynamic that continued to be explored as the dialogue progressed. Participant response to the EDPAPT concept – its predictive capability and resultant potential benefits – was notably positive and constructive, and their input keen. Such insight is fundamental, given that slow uptake of decision support tools is recognized as occurring when the needs of clinicians are not known (Sintchenko et al., 2007), the socio-cultural dynamics often being equally as challenging as technical logistics (Hendy et al., 2005). Hence the inestimable value of exploring these in detail, particularly as organisational culture is significant in positively influencing the quality of a working environment (Kane-Urrabazo, 2006); and can be informed by cultural norms that may be outside the professional socialisation process (Carney, 2006).

The streamline movement of patients through the hospital system is a key process in the alleviation of ED overcrowding and resultant access block. This progression is mainly facilitated by bed managers and after hours coordinators, who are usually nurse managers functioning in challenging conditions (Proudlove et al., 2007); and who have contributed considerably to this study.

The implications of effective patient flow are not always fully appreciated (Haraden and Resar, 2004), with a resultant propensity for bed managers to perceive their role as being underrated and unsupported (Proudlove et al., 2007), as is borne out in the data. Within this era of evident organisational change, management – particularly that in nursing – is a demanding and stress-filled undertaking (Sellgren et al., 2006). This is an important fact to appreciate, given that improving the flow of patients through the system is the strategy most likely to lessen access block (Fatovich and Nagree, 2005).

Smooth patient flow is hindered by decision-making that is habitually disjointed, being invested in people across various semi-autonomous departments (Burns et al., 2005), who, as revealed by participants in this study, may not have accurate information on which to base their deliberations. This is problematic as the sharing of tactical information promotes cohesiveness. An example is the timely communication of patient discharge to bed managers, identified as enhancing patient flow (Simmons, 2005).

Effective communication is especially significant within an organisation wherein the pervading culture and stress can produce conflict and resultant impediment of the movement of patients through the system (Proudlove et al., 2007). This may be under-girded by subtle gaming such as the “perverse disincentive” (EDCons2) to report as described in the data. It seems that desperate times call for desperate measures in order to survive.

Despite this climate of reactivity, there remains the distinct possibility of attaining “anticipatory and coordinated planning” (Proudlove et al., 2003), achieved using known approaches such as the empty bed buffer (Bagust et al., 1999) and potentially known, via predictive models.

Limitation/further research
This data has been contributed by participants for whom the notion and use of a tool that will predict ED admissions is somewhat hypothetical. However, the planned
subsequent phase of the EDPAPT Project will see the evaluation of the tool in practice. That this implementation will be guided by the input of the participants quoted here is a given.

Conclusion
The participants’ prescription for a tool that is incorporated, validated, defined and timely reflects the needs of current culture and enacted practice, and the manner in which the tool can be utilised within that. From their comments, it is clear that this will be moderated by effective implementation that incorporates appropriate initial launching, subsequent stepwise introduction, utilising clinician buy in, with attendant instructional resources. Thus, having contributed, their expectations are high, but so is their anticipation.

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