Scheduling unplanned surgery: a tool for improving dialogue about queue position on emergency theatre lists

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Abstract

Theatre use is heavily influenced by the presentation and scheduling of emergency cases for unplanned surgery. This research guided the development of a triage standard for scheduling emergency surgery in New South Wales public hospitals and aimed to contribute to a better understanding of decision-making practices.

An emergency-surgery survey asked questions about urgency of a set of clinical conditions and appropriate time frames for patients to receive surgical treatment for these conditions. Surveys were distributed via 71 NSW public hospitals. A total of 198 decision makers responded: surgeons (42.8%), anaesthetists (24.7%), and nurses (32.5%). Principal component analysis was applied to reduce the data to three urgency classifications, and analysis of variance was used to assess variance of opinions between professional groups. The data suggested that the parameters that distinguish the codes (1, very urgent; 2, semi-urgent; 3, least urgent) were not unequivocally apparent. Although there was a consistent approach to the "urgency 1" and "urgency 3" categories, there were significant differences between responses when determining "urgency 2".

The data indicated that when making decisions, anaesthetists act as intermediaries between surgeons and nurses. There was significant disparity between individuals when respondents were asked to state an ideal time for the commencement of surgery and the maximum length of time that the surgery could wait. This presented a need for a risk assessment tool to be incorporated when developing a dynamic prototype triage instrument.

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What is known about the topic?

Although a complex clinical decision-making process, there is little empirical evidence about how decisions are made in scheduling unplanned surgery in Australia.

What does this paper add?

Surgeons, anaesthetists and nurses completed a survey that highlighted significant differences among these professionals in applying the "urgency 2" (semi-urgent) category to unplanned surgery patients. The researchers then developed a triage tool in an attempt to reconcile these differences through structured discussion.

What are the implications for practitioners?

Other practitioners may find a triage tool to be a useful aid for decision making in scheduling unplanned surgery.

THIS PAPER REPORTS on a part of larger research examining decision-making processes around the scheduling of unplanned surgery. In accordance with current NSW Health policy,[1] "unplanned surgery" is defined as surgery that is unscheduled and thus, unexpected.

Despite its strategic importance, problems remain with the management of unplanned surgery in New South Wales public hospitals. The scheduling of unplanned surgery typically involves negotiating (and re-negotiating) established surgery lists, whereby patients requiring non-elective surgery are attended to before those requiring elective surgery.[2] Consequently, this situation prolongs delays in receiving medical care and some health outcomes are adversely affected;[3] however, there is inadequate understanding of the relationship between health outcomes and surgical delays.

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The importance of managing unplanned surgery has been acknowledged by NSW Health. Two reports released early in 2000 identified critical care, acute care, and care for people with complex and ongoing health needs as priorities for the NSW health system.[4,5] "The NSW Government's action plan for health"[6] articulated the way in which these priorities would be managed. This included improving the quality and accessibility of public hospital facilities, specifically in the areas of acute care, chronic care, emergency services, intensive care, and primary health care.

To oversee this effort, the Acute Care Implementation Working Group was convened.[7] The specific purpose of this group was to improve access to public hospitals and clinical care through the system-wide implementation of evidence-based practices. One of the strategies identified to achieve this was the improved management and utilisation of operating theatres. It was believed that this, in turn, would increase throughput and efficiency in operating theatres; improve hospital access for emergency and elective patients; and reduce surgery waiting lists. The Steering Committee proposed a number of key recommendations, including the development of strategies to improve practices in the utilisation, forecasting, and management of emergency surgery.

A literature review revealed that the management of operating theatre lists[8-11] appears to be ad hoc. In Canada, for instance, it was found that the waiting times for elective surgery were not only determined by the number of patients on the waiting list, or by how urgently they required treatment, but also by the management of the waiting list. To improve the management of operating theatre lists in Canada, the Western Canada Waiting List Project[12] was established to produce standardised criteria to determine patients' relative status on the waiting list. Focus groups involving members of the public suggested the criteria had public support. Despite this, the criteria received little support from clinicians who managed the waiting lists, and they were somewhat reluctant to change their waiting-list management practices, preferring to adhere to less standardised, conventional methods.[13]

1 Respondent demographics (n = 198*)

Type of respondent	No. of respondents
Surgeons	
Surgeons VMO	54
Staff surgeons	15
Surgical registrars	14
Total	83 (42.8%)
Anaesthetists	
Anaesthetists VMO	22
Staff anaesthetists	13
Anaesthetic registrars	13
Total	48 (24.7%)
Nurses/Managers	
Theatre managers	18
Floor coordinators	15
Theatre nurses	14
Hospital administrators (also nurses)	15
Other managers	1
Total	63 (32.5%)
Total respondents	194*

*Missing data (n=4, 2%)

In the United Kingdom, Hadley and Forster[14] found that operating theatre lists are typically compiled in an unplanned manner, and the negotiations and modifications that follow are also extemporised. Even when theatre lists are established, they are seldom observed, often because of the need to accommodate patients who require unplanned surgery.[15] This gives rise to extended surgery delays.

A similar situation is found in NSW public hospitals. In an investigation of management practices within operating theatres, NSW Health[7] noted the lack of standardised procedures — a finding which also extended to the management of unplanned surgery. To date, there has been little Australian research exploring the management of unplanned surgery. In fact, the lack of Australian literature, and in particular NSW studies, would suggest that there is little empirical evidence to support current management practices.

Decision making in clinical prioritisation

Although decision making has an important role in other societal institutions, within health care it has a number of distinct qualities. It involves a reactive approach, non-negotiable time stress, and often major personal consequences. This is especially evident in the operating theatre, and for this reason, the scheduling of surgery has been described as a complex activity,[16] a perpetually difficult problem due to an ever-changing environment,[17] and even as a political battle.[18] It therefore appears that health care decision making has a distinct footprint with great significance.[19,20]

There has been much research exploring medical decision-making practices — particularly in the context of surgery.[21-23] Parmigiani's decision theory characterises decision making by its capacity to comprehensively consider information from diverse sources, especially in situations of great uncertainty, making it particularly valuable, both theoretically and pragmatically, in the clinical context. Decision theory integrates logic; evidence from numerous sources, including expert opinion and published research; particular values; and the effects of implementing individual actions.[24]

According to Gabel and colleagues,[2] most operating theatres classify unplanned surgery according to relative urgency. "Typically, they are divided into three levels, corresponding to cases that should be attended to immediately, within 4–6 hours, and within 24 hours".[2] Formalised classification systems are lacking in many NSW hospitals,[7,25] and when use of triage categories is evident, there is no agreed coding standard.[26]

Clinical decision making focuses on minimising *risk* — that is, possible health outcomes that have a negative impact on the overarching objective of surgery.[27-30] Clinical decision making appears to involve elements of rational choice theory.[31] It is deductive, based on evidence-based practices that maximise patient health, and is therefore judicious. Given that surgical teams perform complex technical procedures, often under adverse circumstances, this deductive reasoning is particularly important in the operating room. However, rational choice theory does not prescribe the course of action for all medical conditions that might require unplanned surgery because of the ambiguities and uncertainty of clinical outcomes. Furthermore, although ultimate decision-making power typically rests with senior staff, different health care professionals who may be involved in the scheduling of unplanned

2 Clinical priority when deciding emergency surgery

Clinical category	*n*	Mean	SD
Threatened airway	188	1.12	0.717
LSCS fetal distress	184	1.16	0.611
Ischaemic visceral organ	189	1.58	1.130
Surgical bleeding	188	1.61	0.956
Haemodynamic instability	191	1.80	1.431
Blood loss >15%	183	1.83	1.095
Ruptured visceral organ	180	1.88	1.135
Ischaemic limb	182	1.90	1.180
Central nervous system injury	175	2.02	1.438
Vascular repairs	181	2.13	1.339
LSCS maternal distress	185	2.57	1.686
Cardiac injury blunt	169	2.57	1.926
Systemic sepsis	189	2.65	1.553
Threatened sensory loss	189	2.98	1.755
Compound fracture	183	3.10	1.439
Threatened loss of mobility	186	3.20	1.997
Coagulopathy	174	3.78	2.273
Unstable facture	184	3.79	1.862
Severe pain	189	4.13	2.062
Contaminated wound	189	4.47	2.038
Age	181	4.73	2.318
Unsuccessful suicide	153	5.06	2.385
Repair of tendons	185	5.26	2.129
Known infectious risk	173	6.00	2.119
Abscess drainage	189	6.03	1.959
Threatened cosmetic outcome	183	6.13	2.089
Terminal illness	168	6.37	2.163
Intravenous drug user	157	6.46	2.014
Closed fracture	188	6.59	1.805
Diagnostic procedure	185	6.86	2.058
Uncomplicated fracture	182	7.06	1.750
Valid N (listwise)	119		

LSCS = lower segment caesarean section. ◆

surgery may have different judgements. This allows much room for dissension, as professional values influence judgements about the probability of risk.[32,33] As Berry[34] states, "Usage of the term 'risk' varies, or at least given different types of emphasis in different scientific disciplines . . . some disciplines are very much concerned with objective measurable aspects whereas others . . . also allow for consideration of more subjective aspects".[34]

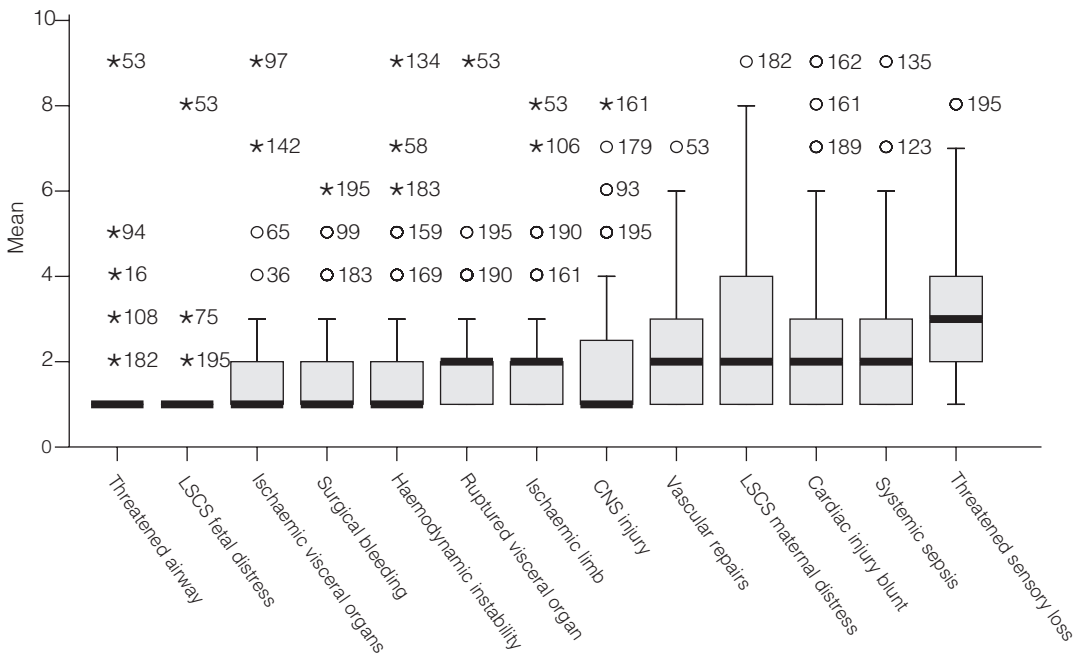
Critics of decision theory allude to this.[35,36] Despite the value of its rigour and clarity, the theory has been criticised for failing to explain health care decisions made through the use of seemingly irrational factors, such as emotion and intuition. It is therefore possible that not all decision-making practices within health care are the result of calculated assessment. This assertion remains probable given some of the difficulties, such as the rising volume, complexity, and quality of medical information; the disintegration of scientific investigations; the importance of hypothesis testing and risk factor identification; and the scarcity of systematic reporting of uncertainties.[37] There are also economic considerations, as hospital administration struggles to balance the professional judgements of different health care professionals and the costs associated with these judgements.[38] Collectively, these problems make it difficult to manage and synthesise the body of information that requires thoughtful consideration when making sound decisions.

Ongoing research in NSW suggests that in addition to clinical factors, other matters influence the scheduling of unplanned surgery.[37,39] These include time, logistical factors, and the dynamics between staff members who are involved in the decision-making process. Current policies for scheduling surgery, particularly unplanned surgery, fail to acknowledge these additional factors.

Impact of multidisciplinary practice

Despite the dominance of the medical profession, those who are part of this profession do not work in isolation.[40,41] Decision making within the hospi-

3 Box plot of clinical priority of items with a mean less than three



O = outliers. ★= extreme cases. LSCS = lower segment caesarean section. ◆

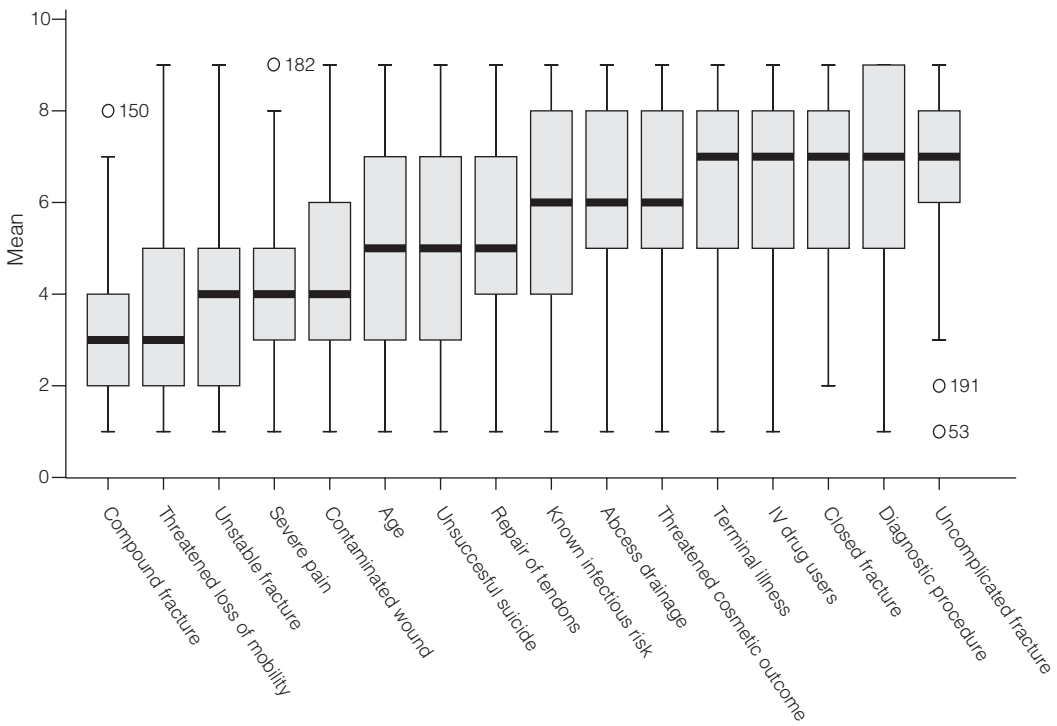
tal setting is influenced by staff members from multiple disciplines. Within the operating theatre, this can include surgeons, anaesthetists, nurses, registrars, managers, and administrators. The dynamic between these individuals can potentially thwart effective decision-making practice.

There may be communication issues; individual staff members may have varied perceptions of the same event, or they may be unclear about their role within the event.[42,43] This poses a problem among staff members of both different and the same disciplines. Communication difficulties are exacerbated by the lack of a clear command structure within the operating theatre. According to a recent review of two hospitals in Sydney, this is particularly the case between surgeons and anaesthetists.[37]

Other authors paint a more volatile picture of the operating theatre, suggesting that staff members can become quite territorial, if not malevolent.[44] One Australian study on governance within the hospital operating theatre[45] observed interactions between surgical personnel and documented the chain of command, where nurses were subordinate to surgeons. They also identified strategies that were employed to negotiate this hierarchy and pursue particular interests. These investigative efforts are pertinent to this research as they define interactive practices among surgical personnel that might influence scheduling of unplanned surgery. The multifaceted and complex nature of decision making around unplanned surgery has the potential to increase workplace frustration.[37] This can have untoward effects on patient health outcomes, which in turn can reduce public faith in health care services.[46] It is therefore important to define an approach that will facilitate effective decision-making practices in this area.

This paper reports on empirical research to develop a triage model via principal component analysis (PCA) and describes the variance between professional groups when determining urgency between clinical conditions, allocating ideal com-

4 Box plot of clinical priority of items with a mean greater than three



mencement time and maximum acceptable treatment delay. The purpose of this instrument is to aid dialogue between professional groups and thus facilitate appropriate decision-making practices when scheduling unplanned surgery.

Methods

Recruitment process

Convenience sampling was applied to a list of NSW public hospitals that was collected at a state-wide workshop that had representation from 71 operating theatres. At this workshop, operating room managers nominated their organisation for access. The researchers selected four metropolitan and four rural hospitals from eight different Area Health Services to limit bias on the basis of geography. One Area Health Service chose not to participate for reasons unknown to the research team.

5 Principal components matrix of clinical urgency*

	Component	
Clinical category	**1**	**2**
Threatened airway	0.776	–0.162
LSCS fetal distress	0.758	–0.068
Ruptured visceral organ	0.734	0.224
Ischaemic limb	0.708	0.188
Vascular repairs	0.676	0.089
Blood loss >15%	0.535	0.083
Compound fracture	0.462	0.436
Coagulopathy	0.252	0.217
LSCS maternal distress	0.199	0.123
Threatened loss of mobility	0.124	0.664
Threatened sensory loss	0.322	0.616
CNS injury	0.005	0.595
Severe pain	0.026	0.585
Systemic sepsis	0.055	0.572
Age	0.068	0.565
Cardiac injury blunt	–0.008	0.515
Unstable fracture	0.040	0.504
Surgical bleeding	0.320	0.383
Ischaemic visceral organ	0.226	0.337
Contaminated wound	0.089	0.284
Haemodynamic instability	0.091	0.249

*Extraction method: PCA. Rotation method: Varimax with Kaiser normalisation. Rotation converged in three iterations. LSCS = lower segment caesarean section. ◆

As a research partnership between the University of Western Sydney (UWS) and NSW Health, approval to conduct the present study was gained from the UWS Human Research Ethics Committee and from the ethics committees of the seven Area Health Services within NSW.

Following ethics approval, a Hospital Site Coordinator was appointed for each participating hospital to assist in the collection of data. This appointment was directed by relevant senior personnel within each respective hospital. Hospital Site Coordinators were asked to recruit decision-makers in operating theatres, including surgeons, anaesthetists, nurse managers, floor managers, and administrators. Coordinators were then asked to invite research participants to voluntarily complete an anonymous survey for the purpose of the present study. All completed surveys were returned to the principal investigator for analysis with Statistical Package for the Social Sciences (SPSS) version 11 (SPSS Inc., Chicago, Ill, USA).

The analysis of survey responses allowed for the realisation of three aims — namely:

- To measure clinical urgency of a set of clinical conditions;
- To test the variance among responses of nurses/managers, anaesthetists and surgeons when determining urgency; and
- To measure disparity between professions when determining ideal times for the commencement of surgery and the latest time that surgery should commence.

Research tool

The "Emergency Surgery Survey" was developed through prior exploratory research and was refined by clinicians in a multi-centre pilot study. It contained questions about the perceived urgency of a set of clinical conditions, the various factors that may influence the scheduling of unplanned surgery, ideal times for commencing unplanned surgery, and the maximum acceptable

delay of unplanned surgery. Although predominantly a closed-answer survey, it also invited extended responses regarding scheduling practices and difficulties encountered.

Results

A total of 198 surveys were returned. The respondents were grouped into three cohorts: surgeons ($n = 83$; 42.8%); anaesthetists ($n = 48$; 24.7%); and nurses/managers ($n = 63$; 32.5%). Box 1 indicates respondent demographics according to these cohorts.

Clinical priority

Box 2, Box 3 and Box 4 depict respondent opinion regarding the clinical priority assigned to various clinical conditions when scheduling unplanned surgery. Collectively, the cohorts indicated that a threatened airway and lower segment caesarean section (LSCS) fetal distress were of greatest clinical priority, while items such as diagnostic procedure and uncomplicated fracture attracted the least priority.

Box 3 demonstrates disparity between respondents about other clinical conditions. In this graph, outliers are marked with a circle while extreme cases are denoted by an asterisk.

Box 4 illustrates the cases of relatively less urgency (with a mean greater than three). Comparing Box 3 and Box 4, it is evident that there is little variance in opinion about very urgent cases. There is also less disparity about least urgent cases. However, the semi-urgent cases display most disparity. This may suggest that semi-urgent cases cause most discussion and potential friction between decision makers when scheduling unplanned surgery. This is further explored by reducing the data into factors and then analysing the variance between groups.

Reducing the data by application of principal components analysis

The dataset was reduced to three factors or components; namely, *very urgent* (*urgency 1*), *semi-urgent* (*urgency 2*), and *least urgent* (*urgency 3*). The assumption made was that any item with a mean greater than five had lowest priority and was thus least urgent. The next step was to perform PCA on the items with a mean less than five.

As depicted in Box 5, two principal components were extracted in three iterations, explaining 34% of the cumulative Eigen value. The method of rotation was Varimax. The Kaiser–Meyer–Olkin measure of sampling adequacy is 0.724 or *very good*.

The items were computed into three new variables — namely:

- Items under Factor 1 are urgency 1, reliability Alpha 0.78;
- Items under Factor 2 are urgency 2, reliability Alpha 0.75; and
- Items with a mean less than 5 are urgency 3, reliability Alpha 0.81.

6 Analysis of variance of urgency 1, 2 and 3 and surgeons, anaesthetists and nurses

		Sum of squares	df	Mean square	F	*P*
Urgency 1	Between groups	0.909	2	0.454	0.794	0.454
	Within groups	91.533	160	0.572		
	Total	92.442	162			
Urgency 2	Between groups	13.541	2	6.770	8.224	0.000
	Within groups	120.193	146	0.823		
	Total	133.734	148			
Urgency 3	Between groups	5.886	2	2.943	2.019	0.137
	Within groups	198.246	136	1.458		
	Total	204.132	138			

Further analysis was conducted using urgency factors 1, 2 and 3.

Analysis of variance of urgency 1, 2 and 3 between the professions

The means of the three components (urgency 1, 2 and 3) were compared for surgeons, anaesthetists, and nurses/managers. Levene's test indicates the homogeneity assumption for all items has not been violated ($P > 0.05$). This suggests that the population variances for each group in these items are about equal, thus adding to the reliability of statistical analysis of these items.

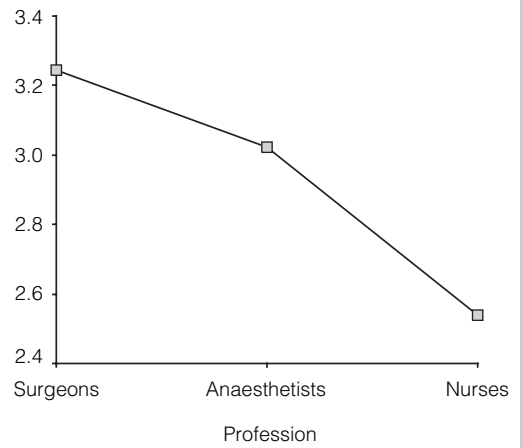
The next stage of the analysis investigated whether there were significant differences between surgeons, anaesthetists, and nurses/managers in determining urgency 1, urgency 2, and urgency 3. This was investigated by analysis of variance (ANOVA). Box 6 tabulates significant differences between surgeons, anaesthetists, and nurses/managers when asked about decision making around urgency 2 cases. Hence, the null hypothesis is rejected, suggesting that there are differences in opinion between the professions in determining urgency 2.

Significant statistical variance of means was found in urgency 2 between surgeons and nurses/managers. There was no significant variance between anaesthetists and nurses/managers; or anaesthetists and surgeons. The means plot of urgency 2 depicted in Box 7 indicates that the opinion of anaesthetists is located between the opinions of surgeons and nurses/managers. This may suggest that when making decisions about urgency classifications, anaesthetists are the intermediary between surgeons and nurses.

Time for surgery commencement

The ideal time for the commencement of surgery and the latest time that surgery should commence were measured. Box 8 illustrates that respondent opinions were diverse. This compilation of ideal times for the commencement of unplanned surgery and acceptable delay of unplanned surgery were compared with the separations found in the PCA of clinical factors. There was no correlation between responses to the urgency classification and indications of acceptable timeframes. This may imply that individual decision makers have no consistent approach to prioritisation in terms of combining two prioritisation constructs, namely, an urgency classification and determining acceptable timeframes.

7 Means plot of urgency 2 and surgeons, anaesthetists and nurses



Box 8 indicates that suggested boundaries of time are as follows:

- Urgency 1 items commence within 60 minutes, and definitely no more than 6 hours;
- Urgency 2 items commence within 2 hours, and definitely no more than 12 hours; and
- Urgency 3 items commence within 7 hours, and definitely no more than 45 hours.

Analyses of variance between surgeons, anaesthetists and nurses/managers were not significantly different.

Combining the information presented in Box 8 with the findings of the clinical construct for priority setting, it appears that the boundaries of these constructs are fluid. There is some clarity when determining clinical urgency 1 and 3. However, urgency 2 is more nebulous and this may be cause for conflict. There are significant differences between surgeons and nurses/managers when determining urgency 2 and the anaesthetists appear to be intermediaries. Hence, part of the priority setting tool must address the difficulty in determining urgency 2.

With regard to time as an urgency construct, there is little clarity on ideal commencement times or the maximum-allowed delay times when making decisions. There is greater consensus between operating theatre decision makers when determining timeframes for both urgency 1 and urgency 3 conditions. However, the responses became more varied with a flatter distribution as the degree of urgency was reduced. This indicates and confirms that there is generally less potential for conflict between operating theatre decision makers when the condition is deemed very urgent, and when the condition is deemed least urgent. Thus, there must be another identifiable construct — one that was not explicitly explored in this phase of the research. This is suggested by the qualitative material provided through the survey.

8 Mean desirable minimum and maximum times combined

Clinical category	Surgery should occur within	SD	But no more than	SD
Threatened airway	21 min	43 min	45 min	1 h
Caesarean section for fetal distress	22 min	21 min	49 min	39 min
Surgical bleeding	56 min	54 min	2 h	3 h
Haemodynamic instability	57 min	61 min	3 h	5 h
Ruptured visceral organ	60 min	50 min	3 h	2 h
Ischaemic visceral organ	1 h	59 min	2 h	2 h
Caesarean section for maternal distress	1 h	1 h	3 h	4 h
Cardiac injury blunt	1 h	2 h	2 h	4 h
Ischaemic limb	1 h	2 h	4 h	5 h
CNS injury	2 h	3 h	4 h	7 h
Blood loss >15% of blood volume	2 h	3 h	3 h	4 h
Vascular repairs	2 h	2 h	4 h	6 h
Systemic sepsis	2 h	2 h	5 h	8 h
Threatened sensory loss	3 h	5 h	6 h	9 h
Compound fractures	3 h	3 h	6 h	5 h
Patient in severe pain	3 h	4 h	8 h	10 h
Threatened loss of mobility	4 h	6 h	8 h	11 h
Contaminated wounds	5 h	5 h	10 h	10 h
Unstable fracture	6 h	8 h	12 h	20 h
Unsuccessful suicide	7 h	10 h	15 h	19 h
Threatened cosmetic outcome	7 h	10 h	15 h	16 h
Repair of tendons	8 h	8 h	20 h	32 h
Abscess drainage without septicaemia	10 h	9 h	22 h	16 h
Closed fracture	10 h	10 h	24 h	20 h
Terminal illness	11 h	19 h	21 h	27 h
Uncomplicated fractures	11 h	13 h	24 h	21 h
Diagnostic procedure	13 h	14 h	33 h	45 h

The qualitative material suggests that this construct may be the determination of urgency according to the consequence of delay and the likelihood of an adverse event as a result of delay according to individual level of risk. When analysing the extended responses, the theme of *loss* emerged. Urgency 1 was associated with *loss of life*, while urgency 2 and urgency 3 were associated with *loss of function* or *quality of life* at different levels, or *risk* for this loss. Hence, another construct was added — level of risk (consequence versus likelihood), as depicted in Box 9.[47]

The grid presented in Box 9 coalesces *likelihood of loss* and *consequence of loss*, and provides an indication of degree of risk. This generic assessment tool may prove useful when there is discontent among decision makers about the urgency of surgery, especially when risk for a patient is nebulous. This is particularly the case in situations classified as urgency 2, where most ambiguity is evident. Careful consideration of the

likelihood of loss *and* the consequence of loss will aid queue placing of an unplanned surgical case.

Development of triage tool

Using the quantitative findings outlined in this section, the research team constructed a prototype triage tool for the scheduling of unplanned surgery. As depicted in Box 10, this tool encompasses the key constructs that, according to the research participants, are worthy of consideration. However, further research is under way by the research team to theoretically test the value of the prototype triage tool.

9 Generic risk assessment tool

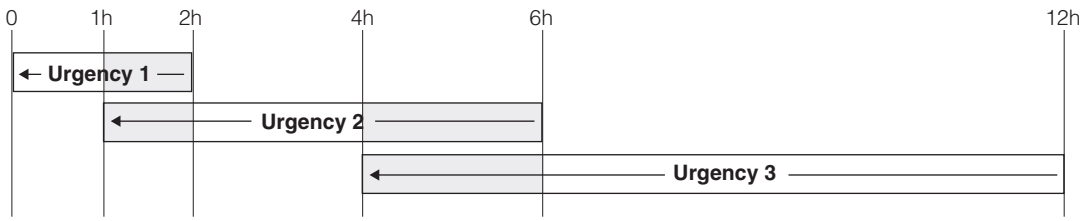
		Likelihood		
		High	Medium	Low
Consequence	High	High	High	Medium
	Medium	High	Medium	Low
	Low	Medium	Low	Low

Discussion

The management of unplanned surgery is complex. There is a lack of standardised practice,[7,13] and even formally established emergency lists are seldom adhered to,[15] resulting in ad hoc decision making. The perceived inefficiencies associated with non-standardised practice have led to a desire to normalise management practice in operating theatres, including the management of unplanned surgery.

Until now, there has been little, if any systematic research into the use of decision-support tools, triage systems, or management techniques in the context of unplanned surgery. Existing

10 Prototype triage tool



Urgency 1

Patient wait has reached or exceeded maximum wait time
Examples may include (but are not limited to):
- Threatened airway • LSCS fetal or maternal distress • Ruptured visceral organ

Urgency 1

Examples may include (but are not limited to):
- Blood loss > 15% • Surgical bleeding • Haemodynamic instability
- Ischaemic visceral organ • Vascular repair

Urgency 2

Examples may include (but are not limited to):
- Compound fracture • Threatened sensory loss • Patient in severe pain
- Threatened loss of mobility

Urgency 2

Examples may include (but are not limited to):
- Contaminated wound • Unstable fracture

Urgency 3

Examples may include (but are not limited to):
- Threatened cosmetic outcome • Unsuccessful suicide • Repair of tendon
- Abcess drainage without septicaemia • Closed fracture • Terminally ill patient
- Uncomplicated fracture • Diagnostic procedure

Risk assesment period

Case progresses along timeline right to left. Urgency 1 is imminent when maximum wait-time has elapsed. ◆

frameworks for stratifying unplanned surgery appear to be normative[48] or descriptive.[2] This paper provides empirical research findings to improve the evidence base for defining valid decision-making constructs. First, the research team measured clinical urgency of a set of clinical conditions; then the variance between the responses of nurses/managers, anaesthetists and surgeons in determining urgency 1, urgency 2, and urgency 3 was tested using PCA; and finally, the disparity between professions when determining ideal timeframes for the earliest commencement of surgery and the latest time that surgery should commence was measured using ANOVA.

Consideration of the urgency classification system suggests that it denotes the likelihood of *loss*. While urgency 1 is associated with loss of life, urgency 2 and urgency 3 are associated with loss of function or quality of life at different levels, or risk of this loss. Expressions of loss are thus commensurate with expressions of risk and enable the clinical ambiguity and uncertainties to be addressed.

However, there were significant differences between responses when determining urgency 2. Surgeons, anaesthetists, and nurses/managers appear to have disparate views about cases that warrant this particular classification and their relative rankings within it. This means that these professionals largely work in confluence in a calamitous emergency. Equally, little disagreement is experienced when the priority is deemed least urgent. It is the urgency 2 category that attracts most dissent and requires effective communication, which can be, as the literature suggests, problematic in a complex environment.

One important finding is the difference of opinion between surgeons and nurses/managers, where nurses typically classify cases as relatively more urgent. However, the opinions of anaesthetists were located in the middle. This may indicate that when making decisions about urgency classifications, anaesthetists are the intermediary between surgeons and nurses/managers. As suggested in the literature, communication about scheduling practice can be problematic due to the lack of clear command structure between surgeons, anaesthetists and nurses/managers.[37,45] Conflict occurs due to a misalignment of individual goals,[45]and this can potentially delay surgical interventions.

The second important finding is the significant disparity between individual responses when participants were asked to state an ideal time for the commencement of surgery. Equally, there was great disparity between individual responses on the maximum length of time that the surgery could wait. These disparate responses were not related to distinct professional groups. The distribution of responses was dramatically reduced in conditions of urgency 3 (of least urgency), and surgery could thus wait many hours. This indicates that making decisions about suitable timeframes when scheduling unplanned surgery may be relatively more problematic when assigning an urgency 2 than when cases are neither very urgent (urgency 1) or least urgent (urgency 3).

The third important finding is that there was no correlation between responses that lead to the urgency classification and indications of acceptable timeframes. Individual decision makers thus appear to demonstrate changeability, if not variableness when prioristising unplanned surgery, with particular reference to urgency classification and acceptable timeframes. This may partly explain the observed variations in the application of categorisation systems.[49]

The data were then used to inform the development of a prototype triage tool. The tool defines a taxonomy of urgency classifications comprised generically of urgency 1, urgency 2, and urgency 3. The tool is a dynamic multifactored instrument and was developed as a platform for dialogue. The proposed tool may bring to the surface the unwritten or tacit rules used by professionals with competing perspectives; it may provide a common vocabulary for the effective discussion of priority setting; it may act as a catalyst for dialogue between and within professions when scheduling unplanned surgery; and it may ultimately enhance interprofessional cooperation for the purpose of improving the management of unplanned surgery. This is yet to be tested.

Conclusions

When making decisions about unplanned surgical queues in NSW public hospitals, there are significant irregularities and disparities around *urgency classifications* and *acceptable minimum and maximum timeframes* for treatment. These inconsistencies may partly explain the seemingly ad-hoc decision-making practices when scheduling unplanned surgery in operating theatres. However, anaesthetists appear to play an important role as decision-making powerbrokers by having an intermediary role between surgeons and nurses/managers. Other factors that influence the triaging of unplanned surgical cases include logistical or operational factors and interactions between and within professions. Further research into these areas is currently being undertaken. However, the present study has culminated in a prototype decision-making tool, as illustrated in this paper.

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Competing interests

The authors declare that they have no competing interests.

References

1 NSW Health. Waiting time and booked patient management: technical guidelines. Sydney: NSW Health, 2003.

2 Gabel RA, Kulli JC, Lee BS, et al. Operating room management. Woburn, MA: Butterworth-Heinemann, 1999.

3 Wilson RM, Van Der Weyden MB. The safety of Australian healthcare: 10 years after QAHCS. *Med J Aust* 2005; 182: 260-1.

4 Ministerial Advisory Committee on Health Services in Smaller Towns. Report of the Ministerial Advisory Committee on Health Services in Smaller Towns. Sydney: NSW Health, 2000.

5 NSW Health Council. Report of the NSW Health Council. Sydney: NSW Health, 2000.

6 NSW Government. NSW GAP (Government Action Plan) for health. Sydney: NSW Government, 2000. Available at: <http://www.health.nsw.gov.au/policy/gap/publications/healthcover/article1.doc> (accessed Feb 2006).

7 NSW Health. NSW Health operating theatre management project report. Sydney: NSW Health, 2002.

8 Doolan L. Operating room utilisation management. In: Donnelly P, Wadhwa L, editors. Access to surgery. Brisbane: University of Queensland, 1997: 43-52.

9 Lennox DR. Management of elective surgery. In: Donnelly P, Wadhwa L, editors. Access to surgery. Brisbane: University of Queensland, 1997: 53-62.

10 Wadhwa L, Mitra S, Rockett J, Donnelly P. Systems analysis of patient flow and theatre utilisation. In: Donnelly P, Wadhwa L, editors. Access to surgery. Brisbane: University of Queensland, 1997: 63-81.

11 Lindgaard Laursen M, Gertsen F, Johansen J. Applying lean thinking in hospitals - exploring implementation difficulties. Aalborg: Center for Industrial Production, Aalborg University, 2003.

12 Western Canada Waiting List Project. From chaos to order: making sense of waiting lists in Canada. Final report. Edmonton: WCWL Project, University of Alberta, 2001.

13 Martin D, Singer P. Canada. In: Ham C, Robert G, editors. Reasonable rationing: international experience of priority setting in health care. Berkshire: Open University Press, 2003: 42-63.

14 Hadley R, Forster D. Doctors as managers: experiences in the front-line of the NHS. Harlow: Longman, 1993.

15 Ferrera PC, Colucciello SA, Marx JA, Verdile VP, Gibbs MA. Trauma management: an emergency medicine approach. St Louis, Missouri: Mosby Inc.; 2001.

16 Weiss EN. Models for determining estimated start times and case orderings in hospital operating rooms. *IIE Trans* 1990; 22(2): 143-50.

17 Siferd SP, Benton WC. Workforce staffing and scheduling: hospital nursing specific models. *European Journal of Operational Research* 1992; 60: 233-46.

18 Moran EJ. Winning the political game of OR scheduling. *Hospitals* 1990; 64(12): 58, 60.

19 Bharadwaj A, Sen A, Vinze A. Scheduling cardiac procedures: a knowledge-based approach. *IEEE Transactions on Engineering Management* 1999; 46: 322-34.

20 Bogner MS. Naturalistic decision making in health care. In: Zsambok CE, Klein GA, editors. Naturalistic decision making. Mahwah, NJ: Lawrence Erlbaum Associates, 1997: 61-9.

21 Magerlein JM, Martin JB. Surgical demand scheduling: a review. *Health Serv Res* 1978; 13: 418-33.

22 Wright IH, Kooperberg C, Bonar BA, Bashein G. Statistical modeling to predict elective surgery time:

comparison with a computer scheduling system and surgeon provided estimates. *Anaesthesiology*. 1996; 85: 1235-45.

23 Gordon T, Paul S, Lyles A, Fountain J. Surgical unit time utilisation review: resource utilisation and management implications. *J Med Syst* 1998; 12: 169-79.

24 Parmigiani G. Modeling in medical decision making: a Bayesian approach. West Sussex: John Wiley and Sons; 2002.

25 Acute Surgical Services Working Party. Report. Sydney, NSW: Royal Australasian College of Surgeons; 2004 Nov.

26 Australian Government Department of Health and Ageing. The state of our public hospitals, June 2005 report. Canberra: Australian Government, 2005. Available at: <http://www.health.gov.au/internet/wcms/publishing.nsf/Content/health-ahca-sooph-index05.htm> (accessed Feb 2006).

27 British Medical Association. The BMA guide to living with risk. London: Penguin, 1990.

28 Brown BLJ. Risk management for hospitals: a practical approach. Germantown, Md: Aspen Systems Corporation, 1979.

29 Standards Australia/Standards New Zealand. Handbook: risk management guidelines companion to AS/NZS 4360: 2004. Sydney: Standards Australia/Standards New Zealand, 2004. (Report No. HB 436.)

30 Practising Law Institute. Risk management for hospitals and health care institutions. New York: Practising Law Institute, Mar–May 1979. (Report No. H4-3887.)

31 Johnson AG. The Blackwell dictionary of sociology: a user's guide to sociological language. Oxford: Blackwell Publishers, 2000.

32 Heyman B, Henriksen M. Values and health risks. In: Heyman B, editor. Risk, health and health care: a qualitative approach. London: Arnold, 1998: 27-64.

33 Schuman AN, Marteau TM. Obstetricians' and midwives' contrasting perceptions of pregnancy. *J Reprod Infant Psychol* 1993; 11: 115-18.

34 Berry DC. Risk, communication and health psychology. New York: Open University Press, 2004 (pp. 9-10).

35 Redelmeier DA, Rozin P, Kahneman D. Understanding patients' decisions: cognitive and emotional perspectives. *JAMA* 1993; 270: 72-6.

36 Kahneman D, Tversky A. Prospect theory: an analysis of decision under risk. *Econometrica* 1979; 47: 262-91.

37 King D, Kerridge R, Cansdell D. Ryde/Royal North Shore Hospital review. Sydney: MA International, 2004.

38 Walker BC, Haslett T. The dynamics of local rules in hospital admission processes. *Aust Health Rev* 2003; 26(3): 98-106. Avaialble at: <http://www.aushealthreview.com.au/publications/articles/issues/ahr_26_3_151203/ahr_26_3_98-106.asp> (accessed Feb 2006).

39 Fitzgerald JA, Lum M, Kippist L. Operating theatre bottlenecks: how are decisions about emergency theatre schedules made? Unpublished report, 2003.

40 Matchar DB, Samsa GP. Linking modeling with health policy formation and implementation. In: Chapman GB, Sonnenberg FA, editors. Decision making in health care: theory, psychology, and applications. Melbourne: Cambridge University Press, 2000: 145-57.

41 Freidson E. Profession of medicine: a study of the sociology of applied knowledge. Chicago: University of Chicago Press, 1988.

42 Mackenzie CF, Craig GR, Parr MJ, Horst RL, Level One Trauma Anesthesia Simulation Group. Video analysis of two emergency tracheal intubations identifies flawed decision-making. *Anesthesiology* 1994; 81: 763-71.

43 Gaba DM, Howard SK, Jump B. Production pressures in the work environment. *Anesthesiology* 1994; 81: 488-500.

44 Mayer TA. Trauma team response: management and leadership. In: Ferrera PC, Colucciello SA, Marx JA, Verdile VP, Gibbs MA, editors. Trauma management: an emergency medicine approach. St Louis, Mo: Mosby Inc., 2001: 684-93.

45 Riley R, Manias E. Governing the operating room list. 3rd International Conference on Communication, Medicine and Ethics and the 8th Annual Seminar of the Centre for Values, Ethics and Law in Medicine; 2005 30 Jun–2 Jul; Sydney, Australia; 2005.

46 Sullivan WM. Medicine under threat: professionalism and professional identity. *CMAJ* 2000; 162: 673-5.

47 Standards Australia. Guidelines for managing risk in healthcare. Sydney: Standards Australia International, 2001. (Publication HB 228:2001.)

48 National Confidential Enquiry into Patient Outcome and Death. The NCEPOD classification of interventions. London: NCEPOD, Dec 2004. Available at: <http://www.ncepod.org.uk/functions.htm#classification> (accessed Feb 2006).

49 Audit Commission. Operating theatres. Review of national findings. London: Audit Commission, 2003. Available at: <http://www.chai.org.uk/assetRoot/04/00/02/44/04000244.pdf> (accessed Feb 2006).

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