# Intensive care unit referrals: making decisions

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## ABSTRACT

Referral to an Intensive Care Unit (ICU) is a complex medical process. The decision making involved can be cognitively challenging and subjective. We aimed to identify variables used by clinicians to make decisions during the ICU referral process, define the requirements for cognitive decision making and to detect commonly repeated errors. Applied Cognitive Task Analysis (ACTA) interviews were carried out with 17 doctors and nurses of varying specialties and levels of seniority to create a high-level task analysis of the participant's role in the ICU referral process. Interviews were audio recorded, transcribed and analysed by two researchers in NVivo 11 software. We identified 188 variables used for clinical decision-making during an ICU referral. Removal of duplicates created 30 discrete variables. We found that there was not one key variable or piece of information that was significant to clinicians. Instead a 'big picture' approach was described, where all the data about a single patient was assembled and cognitively processed. 'Often missed' factors in the referral process were also identified. The most common was failure to consult family to discern patient wishes. The 30 variables used in the ICU referral process will inform the development of an interface for the Hospital Alerting Via Electronic Noticeboard project. This aims to identify patients at risk of deterioration in hospitals. Patient wishes were often neglected during the process and mechanisms to address this will form part of future work. We propose the addition of 'F' for 'functional status/family' to the 'ABCDE' acronym that is commonly used to evaluate a patient's condition.

## KEYWORDS

Applied task analysis, cognitive decision making, deteriorating patients

## Introduction

Analysis of the Intensive Care National Audit and Research Centre (ICNARC, 2012) database shows that in 2012 40,290 patients deteriorated to the point they required admission to the Intensive Care Unit (ICU) after spending two or more days on general hospital wards. This was nearly 30% of all ICU admissions. Patients at risk of deterioration frequently go unrecognised and this can lead to unexpected and preventable ICU admissions and deaths (Hillman et al., 2002)

Cognitive decision making is described as a dynamic process integrating different pieces of information over time (Anderson, 2006). In clinical practice it involves gathering and evaluating patient derived data and assessing the probability of a negative clinical outcome over a particular time period. 'ICU Triage' describes making decisions about patients whose care requirements potentially involve ICU. These patients are often at risk of rapid deterioration so decision making is challenging and requires a specific set of cognitive skills.

An Applied Cognitive Task Analysis (ACTA) and a card sorting exercise were undertaken to examine workflow patterns around the identification of patients at risk of clinical deterioration and the process of referral to ICU. This work forms part of the Hospital Alerting Via Electronic

Noticeboard (HAVEN) project which aims to create an automated digital system that identifies patients at risk of deterioration on general hospital wards. Clinicians will be presented with relevant patient data via an interface to enable the early recognition and treatment of such patients. An analysis of current practice is necessary to guide the interface design.

## The problem

We aimed to identify and categorise variables used by clinicians as part of the ICU referral process, to define the requirements for cognitive decision making and to detect commonly repeated errors which occurred during the process.

## Investigation & analysis

### *Applied cognitive task analysis*

Cognitive task analysis is a qualitative method widely applied in the healthcare domain and was used as the basis for our research. Examples of its use include evaluation of an electronic medical record system by primary care physicians (Shachak et al., 2009) and the exploration of cognitive aspects of critical care practice (Fackler et al., 2009).

Semi-structured interviews were carried out by two researchers. Seventeen doctors and nurses of varying specialties and levels of seniority across Oxford University Hospitals National Health Service (NHS) Foundation Trust and Portsmouth Hospitals NHS Trust took part. The only eligibility criteria was having a role in the ICU referral process. Local clinical groups were contacted to find participants. Ethical approval for the interviews was granted by the South Central Research Ethics Committee (16/SC/0264).

The ACTA interview comprised four sections. Together these formed a high-level task analysis of the participant's role in the ICU referral process (Table 1). The template was adapted from Millitello and Hutton's ACTA (1998).

Table 1: Applied Cognitive Task Analysis method

| | |
|---|---|
| Task diagram | To focus the interviewee on the area of work.<br>Output: high-level task analysis. |
| Knowledge audit | To identify ways in which expertise is used and elicit examples using a set of prompts based on experience.<br>Organised around knowledge categories that have been demonstrated to characterise expertise: diagnosing and predicting; situational awareness; perceptual skills; developing and knowing when to apply 'tricks of the trade'; improvising; meta cognition; recognising anomalies; compensating for equipment limitations.<br>Output: table of aspects of expertise, cues and strategies and difficulties. |
| Simulation interview | A situation is simulated for the interviewee and questions are asked about how they respond.<br>Output: identification of variables. |
| Cognitive demand | Combining the information from the other sections to inform the project.<br>Output: identification of difficulties in the process. |

Participants were asked to focus on the cognitively challenging aspects of the ICU referral process. They were questioned about times when they might have identified an opportunity to do something better. They were also asked about times when they had had to rely on their own experience to

assess a situation to avoid being led astray by the information available. Each interview contained a simulation interview that enacted making or receiving an ICU referral, specific to the participant's clinical role.

### *Interview analysis*

The interviews were audio recorded, transcribed and analysed by two researchers in NVivo 11 software. Common themes were extracted. Analysis of the interview data identified 188 variables involved in the referral process. The researchers then eliminated the duplicates. The variables were then classified into one parental node. For example, the node 'Drugs' contains all nodes representing names of antibiotics and medications. This resulted in a list of 30 variables used in decision making (Table 2).

Table 2: Factors taken into account in the ICU referral process.

| | | | |
|---|---|---|---|
| 1 | Advice or Review | 16 | Limits of Care |
| 2 | Age | 17 | Location |
| 3 | AVPU level (Alert, Voice, Pain, Unconscious) | 18 | Name |
| 4 | Blood gases | 19 | Past medical history |
| 5 | Blood results | 20 | Plan |
| 6 | Co-morbidities | 21 | Previous reviews |
| 7 | Current treatment | 22 | Priority level (see now or next) |
| 8 | Deviations from norms | 23 | Radiographic imaging |
| 9 | Diagnosis | 24 | Reason or main concern |
| 10 | Drugs | 25 | Resus status |
| 11 | Fluid balance | 26 | Stability or instability |
| 12 | Functional status | 27 | Task reminder |
| 13 | Glasgow Coma Scale | 28 | Treatment to date and response |
| 14 | Gender | 29 | Who is making the referral |
| 15 | Infection status | 30 | Why is patient being referred |

### *Card sorting*

The list of variables was then used for an open card sorting exercise to investigate how clinicians classify variables. Open card sorting is a technique frequently used at an early stage of design where participants sort cards into categories which they have created themselves (Paul, 2008). The results will be used to inform the ordering of medical data in the HAVEN interface. An example of card sorting results is presented in Appendix I.

## Resolution of the problem

### *Information for clinical decision-making*

For the clinicians, it was "not one key bit of information but the combination of all of those" that was important. This 'big picture' can be understood as a visual representation of one chosen patient with all of their relevant medical data.

Four needs were identified for good cognitive decision-making by clinicians.

- **Knowledge about hospital organisation**. Clinicians require information about devices, equipment, software, wards and staff availability and capacity. This can vary by hospital. We will not describe this further in this paper.

- **Knowledge about available actions and tasks.** This arises from clinicians' training and experience.
- **Patient's 'big picture'**. This is an understanding of the patient's pre-morbid, current and probable physiological, functional and mental states. Psychosocial aspects, such as family wishes, may also form part of this picture.
- **List of mental skills including the ability of making decisions**. Mental skills and abilities used for making decisions were reported.

### *Missed information*

Two themes emerged during the analysis. Firstly, patient wishes were often neglected during the process. Secondly, junior medical staff were more likely to miss important information than senior medical staff. Additional errors are described in Table 3.

Table 3: Missed information

| **Elements that tend to be missed** | **Example response** |
|---|---|
| Functional status | *"Functional status is often left out or poorly described. Most likely to be the big discrepancy when we follow up with the patient."* |
| Patient and family needs | *"It doesn't get asked enough what the family/patient wants."* |
| Decisions about big picture | *"People making referrals are not very good at making a decision on the big picture. Variable quality in pulling the information together. "* |
| Physical assessment | *"Juniors forget to feel the patients – in response to fluids – are they still cold? Are they septic?"* |
| Specific referral | *"Referrals are heterogeneous so it is difficult to identify any consistent shortfall or failures."* |
| Morally, ethically and clinically appropriate | *"For more inexperienced clinicians – difficult in knowing when it is appropriate. E.g. this week, patient who was referred for full active management, but no documented limits of care, but this was being considered. Nothing had been done about it. If we had known that this conversation had happened, we would approach the peri-arrest differently."* |

### *Common errors*

A number of factors and their potential association with errors were identified and are displayed in Table 4.

Table 4: Identification of potential errors identified during the ICU referral process

| **Factors that may lead to error** | **Example of error** |
|---|---|
| Duration of referral process | *"spending too long taking referral"* |
| Understanding patient's pre-morbid state | *"missing patients functional status"* |
| Knowing when to call the consultant | *"not knowing when to call the consultant"* |
| Lack of awareness of own limitations | *"not knowing which referrals should call consultant for"* |
| Making a decision with contradictory information | *"not knowing how to deal with or recognising political situations ie when a consultant wants a patient to go to ICU and it is not appropriate"* |

| | |
|---|---|
| Involvement of family | *"not speaking to the family"* |
| Whether a previous review has taken place | *"not ascertaining if patient has already been reviewed by ICU team"* |
| Knowing when to complete the review | *"not knowing when to stop reviewing a patient"* |

## Impact & implications

The ACTA interviews, interview analysis and card sorting exercise resulted in a list of variables used in the ICU referral process. It also produced a list of factors commonly missed and errors commonly made during referral. We propose future work is required in the analysis of ICU referral and triage, in particular to ensure patient wishes are not missed. Finally, we propose a new addition to the commonly used 'ABCDE' acronym that is used to evaluate the patient's condition.

### *ABCDE + F systematic approach*

The ABCDE approach was mentioned by many of the ACTA participants. This systematic approach (Resuscitation Council, 2017) is used to assess critically ill or deteriorating patients: A – Airway, B - Breathing, C – Circulation, D – Disability, E – Exposure.

We propose adding 'F' for family/functional status when assessing deteriorating patients for admission to the ICU. This would remind clinicians to consider the patient's premorbid state as well as to consult with family about the patient's wishes.

## Future work

The interviews discovered aids and barriers in the ICU referral process. Further work is required in this field. These results will inform the development of the interface for the HAVEN project.

## Disclaimer

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## Appendix I

Card sorting example

