

# In-hospital Mortality among Unplanned Admissions to a Medical Intensive Care Unit

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## Abstract

**Objective:** Despite advances in medicine, adverse clinical events, especially cardio-respiratory arrests, still occur in hospitalized patients. Unplanned Intensive Care Unit (ICU) admissions are frequently a result of this failure to recognize or appropriately treat the 'pre-arrest' period, when signs of physiologic deterioration are often evident. Although survival rates to hospital discharge for cardiac arrests are universally poor, the patterns of clinical deterioration and outcome of unplanned medical ICU admissions is not well studied.

We aim to evaluate whether unplanned medical ICU admissions are associated with higher in-hospital mortality.

**Design:** Prospective observational, 3-month data collection and analysis of case records and charts. In particular, intubation rates and reasons for unplanned admissions were analyzed.

**Setting:** 18-bed medical Intensive Care Unit in Changi General Hospital, a regional 790-bed hospital in Singapore.

**Patients and participants:** All medical and cardiac

admissions to the Medical ICU from the general wards from October 2007 to January 2008. Direct admissions from the emergency department were excluded.

**Measurements and results:** A total of 423 admissions of which 37 (8.7%) were unplanned and 386 (91.3%) were planned. Data was analyzed using SPSS 12.0.1, and Pearson Chi-square for comparison. P value <0.05 considered to be statistically significant.

There was a statistically significant difference in hospital mortality between planned (54 deaths, 14%) and unplanned admissions (25 deaths, 67.6%), ( $p < 0.001$ ). All but 1 patient in the unplanned group required intubation. Desaturation was the commonest reason for unplanned admissions, followed closely by sudden cardiorespiratory collapse and hypotension.

**Conclusions:** The high mortality rate among unplanned medical ICU admissions is a cause for concern. Implementing a system of early critical illness detection and specialist intervention may help reduce such mortality as well as provide more definitive planned palliative decisions.

**Key words:** critically ill, Intensive Care Unit, mortality.

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## Introduction

Despite advances in hospital medicine, adverse clinical outcomes, especially cardio-respiratory arrests, still occur in hospitalized patients. Unplanned Intensive Care Unit (ICU) admissions are a frequent result of this failure to recognize or appropriately treat the 'pre-arrest' period, when signs of physiologic deterioration

are often evident [1]. It has been reported that patients show evidence of clinical instability for a median duration of 6.5 hours before a “critical event” (cardiac arrest or unplanned ICU admission) [2]. This window period of opportunity for critical care intervention has been a target of interest with the advent of Medical Emergency Teams (MET) and Rapid Response Systems in Australia and North America. Universally, the survival rate to hospital discharge for cardiac arrests is poor [3]. However, the outcome of such unplanned ICU admissions is not well studied.

We aim to evaluate whether unplanned ICU admissions are associated with higher in-hospital mortality during a 3-month period in a healthcare institution not currently using a MET system. In particular, we were also interested in intubation rates and reasons for unplanned admissions.

## Material and methods

The study was carried out in the 18-bed Medical Intensive Care Unit (MICU) of Changi General Hospital, a regional 790-bed hospital in Singapore. The MICU admits medical, including neurological patients as well as cardiac patients. The cardiac patients admitted to MICU also included those requiring monitoring after acute percutaneous coronary intervention. A prospective observational data collection and analysis was made of all planned and unplanned medical and cardiac admissions to the MICU from the general wards between 1<sup>st</sup> October 2007 to 31<sup>st</sup> January 2008.

We defined unplanned MICU admissions by the following criteria. Inclusion criteria: (i) patients from general wards (including high dependency unit, acute stroke unit, isolation wards and security wards), (ii) patients with cardiorespiratory arrest in the ward, (iii) patients with clinical deterioration (hypotension, desaturation, change in mental state, respiratory rate or heart rate) in the ward requiring immediate MICU admission, (iv) patients resuscitated and/or intubated by MICU team immediately prior to transfer to MICU. Cases will be considered if they satisfy criterion (i) plus one or more from criteria (ii) to (iv). Exclusion criteria:

patients admitted to MICU directly from the accident and emergency department, cardiac catheterization laboratory or endoscopy rooms. In addition, cases electively referred to and reviewed by the MICU team in the ward are excluded.

All other MICU admissions within the study period were considered as planned cases.

Data was analyzed using SPSS for Windows (version 12.0.1) and Pearson Chi-square test for comparison, taking a p value <0.05 to consider as statistically significant.

## Results

There were a total of 423 MICU admissions during the study period of which 386 (91.3%) were planned and 37 (8.7%) were unplanned.

The planned admissions were made up of mainly cardiac patients with acute myocardial infarction and/or post percutaneous coronary intervention (PCI) procedure (**Figure 1**).

Almost all (n =36) unplanned MICU admissions required intubation and mechanical ventilatory support.

Nearly all intubations (n =35, 97%) were emergent and thus carried out in the general wards.

Desaturation, based on abnormally low pulse oximetry readings, (n=14, 37.8%) was noted to be the commonest reason for an unplanned admission followed closely by sudden cardiorespiratory collapse (n =10, 27.0%) and hypotension (n =8, 21.6%) (**Figure 2**).

There was a statistically significant difference in hospital mortality between planned (54 deaths, 14%) and unplanned MICU admissions (25 deaths, 67.6%), p <0.001 (**Figure 3**). Among the unplanned admission group, 18 deaths occurred in the MICU while 7 deaths were in the general wards, mostly as a result of “do-not-resuscitate” orders instituted post-MICU discharge.

## Discussion

This study concentrated on unplanned MICU admissions. This population is less well defined as compared to unplanned surgical Intensive Care Unit admissions, which has been described as a global safety indicator in surgical patients [4]. We decided to define unplanned MICU admissions generally as those requiring an urgent MICU transfer from the general ward. These ward patients are in crisis, and would have fit Medical Emergency Team activation criteria in studies reported in the literature. They are also mostly in an impending or actual cardiac arrest status.

The Medical Emergency Team (MET) and Rapid Response Team (RRT) concepts were developed by hospitals in Australia & North America respectively, to aid early identification and rapid specialist treatment of physiologically unstable conditions so that rates of unexpected cardiac arrests, deaths and unplanned ICU admissions may be decreased [5,6]. The MET usually comprises a doctor (with critical care specialist skills) and a critical care trained nurse. They bring along to the bedside, advanced life support skills, drugs and equipment [7,8]. Following deterioration in a patient's clinical condition [7], commonly identified by pre-specified vital sign changes, the MET can be activated to respond to these 'pre-arrest' situations. Early intervention of clinically unstable patients significantly can reduce the incidence of mortality from unexpected cardiac arrest in hospital [8], but challenges still remain in the implementation of the MET in many centres [9].

Reasons for this disparity in mortality between planned and unplanned MICU admissions may be explained by the inability to recognize critical illness in general ward patients. This could be from lack of monitoring tools or inexperience of ward staff among other factors. The failure to obtain early specialist consult and critical care intervention may have led to

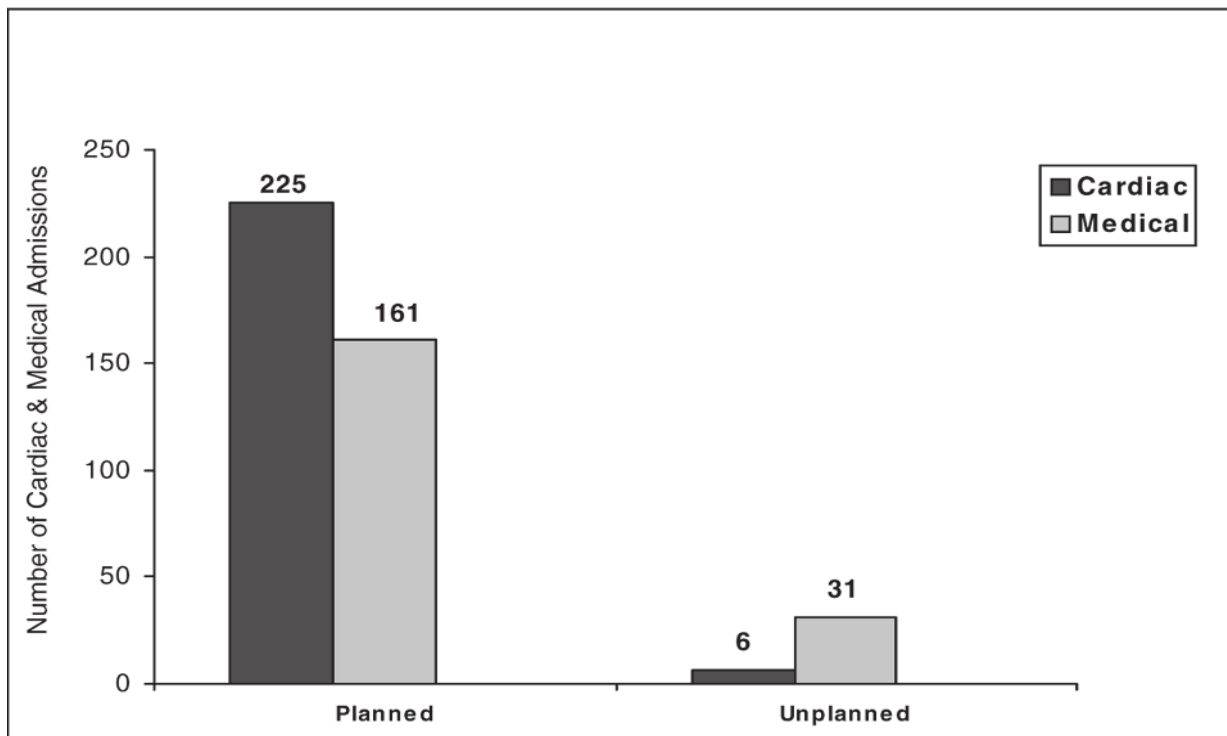
the outcome. Furthermore, survivors of cardiac arrests make up 27% of the unplanned group. Survivors of such events are known to have a high in-hospital mortality rate, not to mention prolonged hospital stay and significant morbidity. Nevertheless, there are limitations to the study. Firstly, our MICU casemix is limited to general medical and cardiac patients. Whether cardiac patients that are post-PCI should be included may be questioned as a less critically ill group with a planned MICU admission. However, our hospital serves only acute PCI in patients suffering from acute myocardial infarctions. No "elective" PCI are carried out. We believe that this is an equally critically ill group of patients with considerable in-hospital mortality [10]. Secondly, we only assessed a limited 3-month period of MICU admissions and may not be reflective of other times of the year. However, we chose this period to coincide with one changeover in cohorts of medical officers (November) and house officers (January). These are junior doctors often in the "frontline" of patients in crisis. Their lack of experience and ability to detect and treat acute illness may have an impact on those unplanned MICU admissions. As such, we wanted a period with a potentially higher number of unplanned MICU admissions for analysis. The longer period of analysis would of course be more representative but could still only be generalisable to our hospital setting.

The high in-hospital mortality rate among unplanned medical ICU admissions is a cause for concern. Implementing a MET system may help reduce this mortality as well as provide more definitive planned palliative decisions.

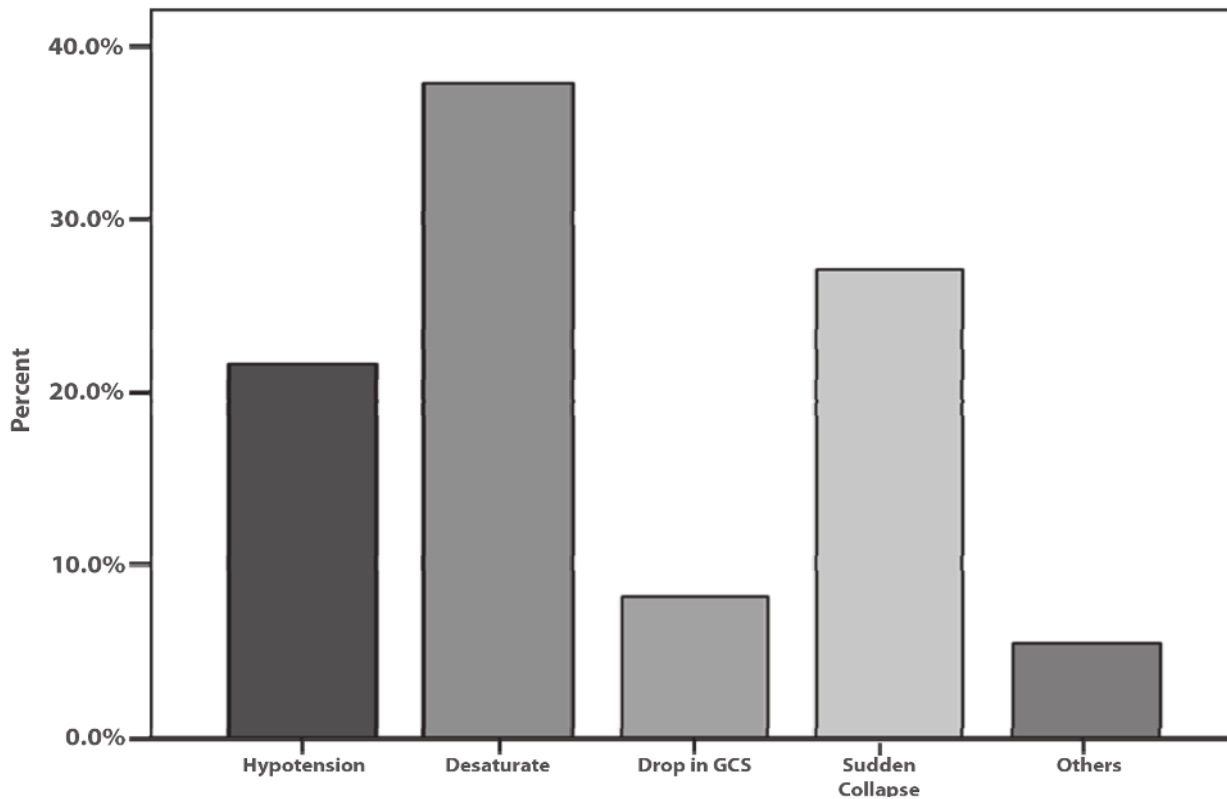
## Acknowledgement

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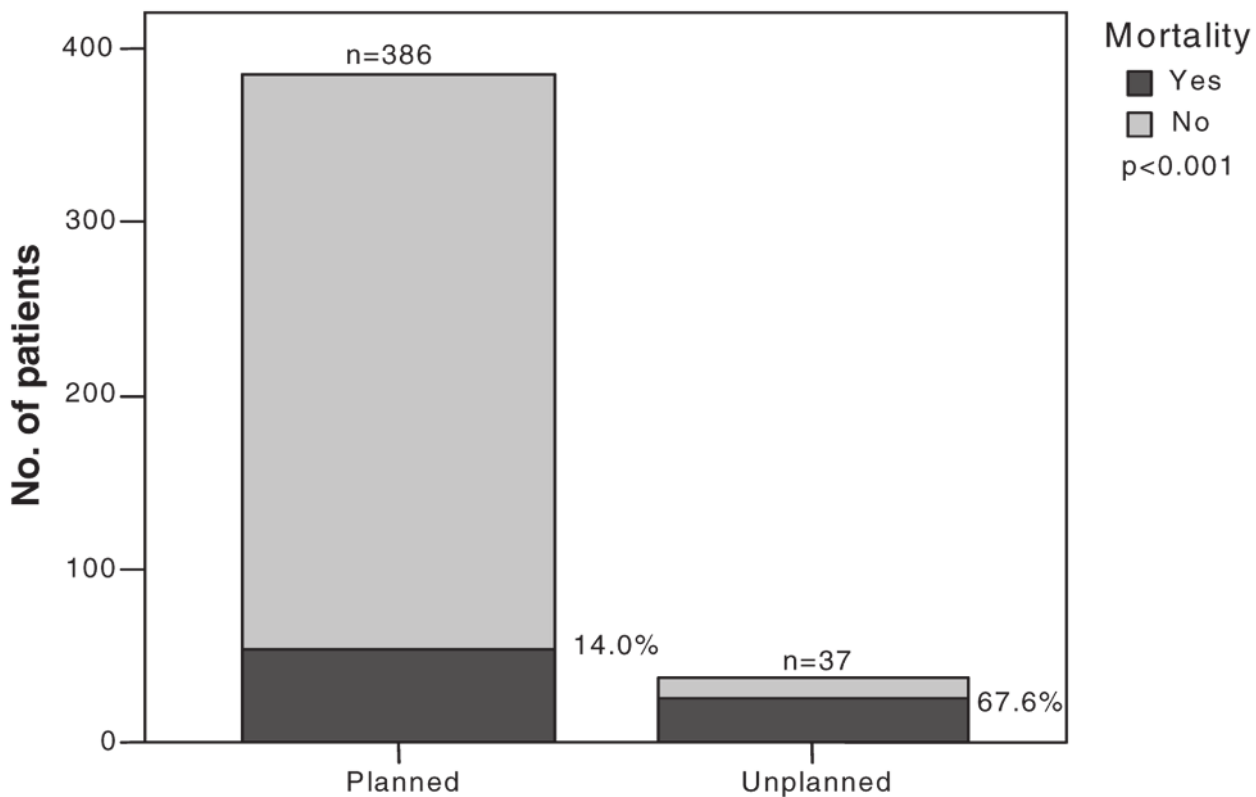
**Figure 1. CARDIAC AND MEDICAL ADMISSIONS**



**Figure 2. CAUSES FOR UNPLANNED ADMISSION**



**Figure 3. MORTALITY AMONG PLANNED AND UNPLANNED ICU ADMISSIONS**



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