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Editorial

QJM

The critically ill: following your MEWS

A 62-year-old man with a chest infection is admitted to hospital as an emergency. For the following 5 days, he remains on a ward with a tachycardia of 120–130 bpm and respiratory rates in the mid 30s to low 40s. Despite supplemental oxygen, his recorded saturation often dips below 90%. Five days after admission, he becomes confused and then drowsy. At this time his systolic blood pressure falls below 80 mmHg. His urinary output is not recorded, although his creatinine increases over 6 days from 212 mmol/l at admission to 369 mmol/l. Doctors are concerned and make frequent visits, analyse several arterial blood gas samples and institute intermittent mask continuous positive airway pressure (CPAP) support. Six days after admission a registrar, not involved in the patient's care, notices from the end of the bed that the patient is moribund. The patient is admitted to the intensive care unit (ICU) and is intubated, ventilated and haemofiltered. The patient dies on the ICU 24 days later.

This really happened, although some details have been changed to maintain patient confidentiality. Such patients are common on hospital wards across the UK. How do we know this? Because in our hospital, and in another 50 or more, intensive care outreach services (ICORS) have been established over the last year.

Compared to patients admitted to ICU from theatres/recovery or the Accident and Emergency (A&E) department, those admitted from hospital wards have a higher percentage mortality (Figure 1).[1] Indeed, about 30% of those admitted from a ward to the ICU have survived a cardiorespiratory arrest whilst in the 'safety' of a hospital ward. The median time these patients are in hospital before ICU admission is about 6 days. However, the longer the patient is in hospital before ICU admission, the higher their eventual hospital mortality. Some patients are referred to ICU but not admitted, often because of a lack of beds or nurses. These patients have an increased mortality.[2,3]

There are also concerns about the care on the wards given to patients after ICU discharge.[4] Of ICU patients with a predicted mortality $<20\%$ who die, about half survive to leave the ICU.[1] They return to the wards and die later in their hospital stay. Overall, about 27% of deaths of 'ICU patients' occur after patients have been discharged from the unit. Over half of postoperative deaths occur on hospital wards, with the majority occurring >5 days after surgery.[5,6] We also have good evidence that patients discharged prematurely from ICU have an excess mortality.[7–9] If mortality for critically ill patients is to be decreased, hospital wards are an obvious place to focus effort. Patients on the wards are accessible, but are they recognized as being seriously ill and are they receiving appropriate management?

Suboptimal hospital treatment is common in the period before ICU admission, and is associated with increased ICU and hospital mortality.[10,11] A pilot study based on retrospective record review suggested that nearly 11% of patients suffered an adverse event while in hospital.[12] Many hospital deaths are potentially preventable.[13,14] Several studies have shown that abnormal physiological values are usually charted in the hours before patients suffer an in-hospital cardiorespiratory arrest.[15–18] Abnormal physiological values are also common in the 24 h before ward patients are admitted to the ICU (Figure 2).[19] About 80% of these patients, where values are recorded, have heart rates, respiratory rates and oxygenation outside the normal range.

All acute hospitals have cardiac arrest teams. Best results are achieved following a witnessed arrest where competent resuscitation is started before arrival of the team. Arrest teams are relatively ineffective and expensive, and avoid the real problem, which is preventing arrests.[20–23] Mortality is 80% for the relatively small percentage of patients who arrest on the wards and then survive long enough to be admitted to ICU.[1] This compares with 44% for all other admissions from the wards.

One solution, first introduced in Liverpool Hospital, Australia, in 1990 is a medical emergency team (MET).[24] The MET extends the role of the cardiac arrest team, with calls based on abnormal patient physiology. Published data suggests that this team has cut the number of arrests on the wards and facilitated earlier ICU admission for some patients.[25] A similar team, the Patient At Risk Team (PART), was piloted in the UK in 1997.[26] This study confirmed that there were sick patients on hospital wards, as well as showing that arrests on the wards could be prevented and intensive care mortality decreased. Others who recognized the same problem have experimented with physiologically-based (modified) early warning scores (EWS, MEWS) designed to alert nursing and medical staff to patients who are unwell and require close supervision.[27,28]

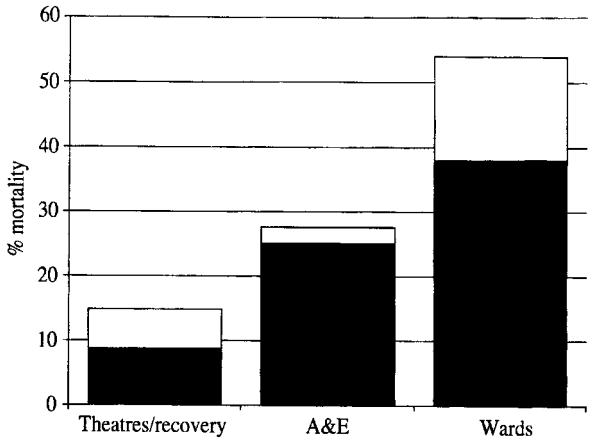

Figure 1. Mortality and location before ICU admission. Percentage mortality for patients admitted from the wards to ICU from theatres/recovery, the Accident and Emergency department (A&E) or the hospital wards. Data is for patients' first ICU admission during their hospital admission. Black bar, death in ICU; white bar, hospital death after ICU discharge.

In 1999, the Audit Commission considered critical care services.[29] One of its highest priority recommendations was to 'develop an outreach service from critical care specialists to support ward staff in managing patients at risk'. This was followed in 2000 by the Department of Health report 'Comprehensive Critical Care',[30] which stated that 'outreach services are an integral part of comprehensive critical care'. Following this report, substantial sums have been invested in ICORS, and most acute hospitals in England have established a service or are in the process of doing so.

A common theme feeding back from ICORS is that a considerable number of critically ill patients are to be found on the wards, and that they are usually easily recognized by abnormal physiological values. In many hospitals, physiological charting is bad, if not abysmal, and respiratory rate is often poorly recorded, although it may be the most important early manifestation of critical illness. Even when patients are recognized as seriously ill, treatment often appears to be too little, too late.

There are several reasons why this might be. Changes in doctor and nurse training have affected continuity of care. The increasing workload and

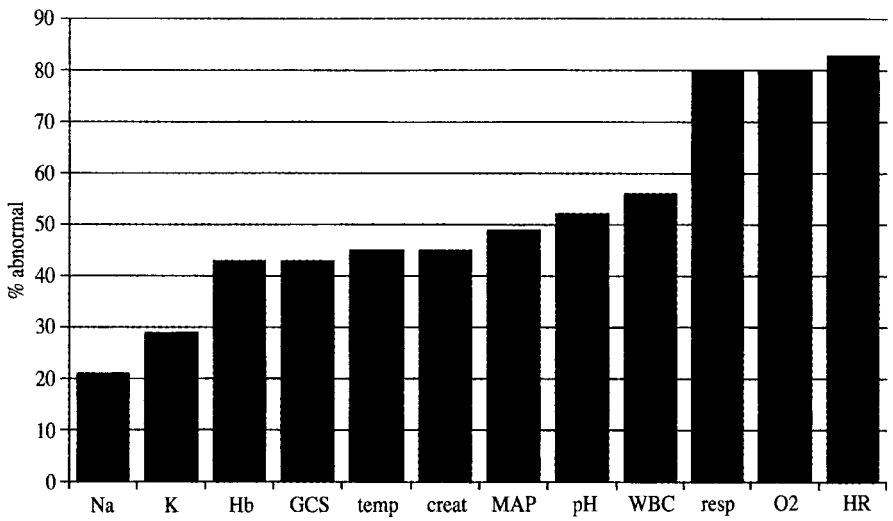

Figure 2. Physiological abnormalities in the 24 h before ICU admission. Percentage abnormal, % of ICU admissions with worst recorded physiological value outside of range of normality defined by Knaus.[38] Na, sodium; K, potassium; Hb, haemoglobin; GCS, Glasgow Coma Score; temp, temperature; creat, creatinine; MAP, mean arterial blood pressure; WBC, white cell count; resps, respiratory rate; O_2, oxygenation (from arterial blood sample); HR, heart rate. All patients were in hospital at least 24 h and had not had surgery in the 24 h before ICU admission.

shorter working hours leave less time for attention to be paid to each patient, and for adequate communication at the end of each shift. Sick patients need frequent expert assessment, and this may not be available. The growth in specialization has taken doctors off wards and into catheter labs and endoscopy suites. Trainees have become generally less experienced, and many consultants lack the skills or the time to recognize or manage these patients. There is a limit to the monitoring and intervention that can be carried out on a ward. The lack of critical care beds means that many patients are not referred to the ICU team until they are profoundly unwell. Once a patient is in a critical care unit, there is growing evidence that intensive care specialists produce a better outcome than physicians without this expertise.[31–33]

The number of acute hospital beds has fallen over the last 25 years, while the population and hospital referrals have increased;[34,35] inevitably, the patients in hospital are sicker. Critical care facilities in the UK are underprovided,[36] and there is evidence that our ICU patients are sicker than those in comparable countries.[1] Critical care bed numbers need to increase at least two- or three-fold to satisfy our needs.[37]

Although the government is taking preliminary steps which should improve critical care provision, in the meantime something has to be done for the sick patients on hospital wards.

In this issue, Subbe and his colleagues demonstrate that five routine physiological parameters; systolic blood pressure, heart rate, respiratory rate, temperature and the AVPU level of consciousness grading, provide valuable information which can help predict acute medical admissions likely to have an adverse outcome. Although all this is unsurprising, summarizing abnormal findings into an early warning score (EWS) provides an easy and workable way of alerting nursing and medical teams. Protocols can be written which oblige nurses and doctors to seek expert help for patients with high scores in any variable or with a given total score. Patients whose scores do not decrease could also trigger a response. Throughout the country ICORS have made their priority improving patient monitoring and introducing an EWS. Most EWSs in use to date are based on the five parameters used by Subbe *et al*. in their modified EWS (MEWS) although definitions and allocated points vary. In many hospitals, observation charts have been redesigned to incorporate an EWS and ward staff are being educated about the importance of accurately recording physiological values.

The EWSs in use have physiological parameters and scores selected by clinicians based on their experience. For the MEWS to be applicable to a wider group of hospital in-patients, we need to know more about which physiological variables are most important, and at what values. We need to know how they are affected by specific conditions and patients, and how they relate to adverse outcomes. It would be useful to know whether further physiological information, such as oxygen saturation and urinary output, substantially improves the performance of the MEWS. At best the MEWS will be a useful screening tool identifying a group containing most of the high-risk patients. It is unlikely to be sufficiently sensitive to detect all patients who will become critically ill or suffer an adverse outcome.

What would have happened to our patient if the MEWS had been in place on the ward to which they were admitted? Based on the worst recorded physiological values, his score would have been three the day after admission, four the following day and then six for the next two days, followed by seven. Shortly before he was admitted to the ICU his score would have been eleven. Nurses and doctors were aware of the abnormal physiology, but did not take action to prevent the patient deteriorating. The EWS does not guarantee that appropriate early action will result, but a score that is high or not improving is difficult to ignore. Early intervention with simple critical care measures might well have saved this patient's life.

The paper by Subbe *et al*. is valuable because it reminds us of the many sick patients on hospital wards and emphasizes the importance of physiological abnormality as a marker of these patients. Most importantly it describes a simple, practical method of using routine physiological measurements to flag up, from among the mass of admissions, patients who should not be ignored.

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