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### History of Outreach

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Ken Hillman describes the evolutions in health care which have led to the development of hospital wide preventive patient-centred care for seriously ill patients.

#### The History of Hospitals

The word "outreach" is being increasingly used to describe care of the seriously ill or potentially seriously ill by specialists in Intensive Care Units (ICUs). The term "outreach" in itself is significant as it moves from defining the seriously ill in geographical terms within high dependency environments to defining them in terms of patient characteristics. It is a move away from treating patients according to man-made silos, so characteristic of hospital care, to a patient centred one. The concept appears so sound that it is hard to believe that it should be any other way. In order to understand why it has taken medicine so long to establish a system around patient needs rather than according to artificial constructs, we need to explore the history of how hospitals came to function as they do and how that led to increasing numbers of potentially preventable deaths and serious complications.

Hospitals have their roots in Christian monasteries in medieval Europe (Porter 1979). Initially they were small and mainly for pilgrims. This was followed by the great age of hospital building which coincided with the first universities such as in Bologna (1158) or Oxford (1167). Medical facilities were soon established within these universities and the hospitals became the centre of medical education and research. This largely remains the case today; hospitals being the self-proclaimed flagships of medicine.

Hospitals, especially the larger ones were where teaching and research was carried out. Until approximately the middle of the 20th century they were mainly for the poor; the name "hospital" was associated with death, pestilence and insanity (Porter 1979). Professional nursing and antisepsis changed the reputation of hospitals.

#### Islands of Care

Hospitals still largely consist of islands of territory based on centuries of tradition (Hillman 1999; Hillman et al. in press). Senior doctors "own" patients, supported by their own junior medical and nursing staff. Individual wards are supervised by a senior nurse, supported by more junior nurses and ancillaries. Operating theatres (OT), diagnostic suites and emergency departments (ED) are separate and distinct departments. All these geographical sites in a hospital interact with each other, but largely on their own terms.

Medical training itself does not lend itself to management of at-risk patients who fall outside the specific expertise of the supervising specialist. There is little in the way of undergraduate education in resuscitation and critical care medicine (Harrison et al. 1999). After graduation, doctors usually spend 1-3 years gaining experience in hospitals. However, they may not be exposed to formal training in the increasingly complex area of resuscitation. Moreover, medical specialisation is increasing (Donini-Lenhoff and Hedrick 2000), reducing a trainee's experience and resulting in limited skills of specialists in managing acute illnesses involving several interacting organs (Chantler 1999; Grumbach 1999), and sometimes non-existent skills in resuscitation (Thwaites et al. 1992).

At the same time the hospital patient population is changing. The general population is aging (UN Secretariat 1998) with changing disease demographics and increasing co-morbidities (van Weel and Michels 1997). Combined with pressure to decrease hospital length of stay and streamline care, hospitals increasingly care for patients who are often seriously ill with complex conditions, even on the general wards.

These factors combine to make hospitalised patients vulnerable to deterioration. In summary, the factors include: disjointed islands of care; doctors not adequately trained in acute medicine and resuscitation; nurses who record and observe deteriorating patients, but are not engaged with an appropriate response system; and a population of patients who are often old with multiple co-morbidities. These factors are seen in the light of increasingly complex surgery and procedures, as well as patients receiving powerful drugs with potentially serious side-effects.

#### **Potentially Avoidable Deaths and Serious Complications**

It is not surprising that in an environment where there is little in the way of a patient centred system that operates across the usual hospital islands of care, that there is a large number of potentially avoidable deaths (Brennan et al. 1991; Leape et al. 1991; Wilson et al. 1995). Studies show that for up to 50% of patients, who are not designated as "not for resuscitation" (NFR), severe disturbances of vital signs are documented in the clinical notes. In this group there was no appropriate response in the 24 hours before death (Hillman et al. 2001; Goldhill and McNarry 2004).

The same potentially preventable antecedents were noted to occur before other serious adverse events such as cardiac arrests (Hodgetts et al. 2002; Schein et al. 1990) and unplanned admissions to the Intensive Care Unit (ICU) (Goldhill et al. 1999; Hillman et al. 2002; McQuillan et al. 1998).

Factors noted to be associated with the failure to recognise and institute an early response to these serious antecedents include a lack of organisation, lack of knowledge of what constitutes a seriously ill patient and lack of supervision of junior medical and nursing staff (Goldhill et al. 1999; McQuillan et al. 1998).

These factors may also help to explain the failure of interventions in patients admitted to an ICU late in the course of their illness. There were many studies in the 1980s and 1990s evaluating goal directed therapy in patients admitted to an ICU, where supranormal levels of oxygen were delivered according to protocols. After initially promising results, larger studies demonstrated that this approach had no beneficial effect on patient outcome (Gattinoni et al. 1995; Hayes et al. 1994; Hinds and Watson 1995). Interestingly, patients in these studies were seen as either responders or non-responders in both the intervention or control groups. This observation is probably related to the extent of organ damage before resuscitation attempts were commenced.

#### **Systems for Managing the Seriously Ill in Acute Hospitals**

Currently patients who are critically ill are managed in specialised areas. They are initially managed in the ED. During and immediately after surgery, they are managed in the OT complexes with appropriate monitoring and by specialised staff. More seriously ill patients are managed in intensive care or high dependency environments. The latter may be of a general nature or specialised, such as in neurosurgical or cardiothoracic units.

As described previously, the patients most at-risk in general hospitals are not those in specialised units, but those on general wards where lack of monitoring and awareness concerning serious illness, combined with inappropriate or delayed responses, can cause serious complications and even death.

The conventional system of referring from one specialist to another for an opinion about a patient fails when the patient is seriously ill and urgent attention is required.

For many years, the only emergency response to serious illness, which operated at all times and in a systematic way, was the cardiac arrest team. The cardiac arrest team and cardiopulmonary resuscitation (CPR) is an icon of medicine (Hillman et al. 2001). Unfortunately, hospital CPR is futile in more than 90% of cases (Hershey and Fisher 1982; Tunstall-Pedoe et al. 1992). Despite the poor outcome, there has been little to prompt restraint (Priestley et al. 2004) and as a result, it is increasingly difficult to die in hospital without CPR being attempted (Hillman et al. 2001). It also seems ironical that so much research has been devoted to detailed aspects of CPR, such as the most effective doses of drugs and how many cardiac compressions, when it is often an inappropriate and futile perimortem ritual (Hillman et al. 2001).

Interestingly, a shock team was described in 1967 (Frank 1967) to identify seriously ill at-risk patients with shock and to provide a more rapid and appropriate response to the patient. This is a limited and small group of patients requiring a specialised response. Nevertheless, it was one of the first attempts to acknowledge the complications of delayed management of patients with life-threatening problems. A more successful model for the management of the seriously ill has occurred with severe trauma (Pagliarello et al. 1992; Shackford et al. 1986). Patients are identified by a combination of physiological, anatomical and disease criteria. They are rapidly triaged to the most appropriate hospital site, and then managed according to standardised protocols by staff with appropriate skills and experience (Shackford et al. 1986) The Medical Emergency Team (MET) concept is based on the same principles as the management of seriously ill at-risk trauma patients.

## The Medical Emergency Team Concept and METtype Systems

The concept of a MET was first established in Liverpool Hospital in Australia in 1989. The system was based on defining a seriously ill patient in terms of serious vital sign abnormalities and observational states – the so-called MET criteria (Hourihan et al. 1995; Lee et al. 1995). The vital sign abnormalities are extremes of pulse rate and respiratory rate, as well as hypotension. Added to these are the observational criteria: threatened airway, seizures and a sudden decrease in level of consciousness. An important final criteria is “serious concern”, covering the situation where bedside staff are worried about the patient’s state and where it does not necessarily fit in with other criteria and/or where staff feel unable to deal with the situation.

If any of these criteria are met, the old cardiac arrest system is activated and the MET called. Staff comprising the MET would need to be available at all times and would also need to have the skills, knowledge and experience to deal with all medical emergencies in a hospital. Results of the MET were first published in descriptive studies (Hourihan et al. 1995; Lee et al. 1995). Other studies in different environments followed (Daly et al. 1998; Parr et al. 2001).

Out of the MET system came the theme of outreach teams in the United Kingdom (Bright et al. 2004; Counsell 2001; Cuthbertson and Webster 1999; Goldhill et al. 1999). Other early response systems using criteria similar to those of the MET system were developed (Bright et al. 2004; Cioffi 2000; Goldhill 1997; Goldhill et al. 1999). Some of the systems include the Patient-at-risk team (PART) (Goldhill et al. 1999), the early warning scoring system (EWSS) (Morgan et al. 1997), and the modified early warning score (MEWS) (Stenhouse et al. 2000).

In 1999, the UK Department of Health established a working group to examine the delivery of critical care services (2000). The resulting document, “Comprehensive Critical Care”, recommended that a broader approach to caring for the seriously ill be undertaken, including critical care services outside the boundaries of ICUs and HDUs. The outreach concept takes many forms in different hospitals. These include hospital-wide education and awareness programmes as well as nurse and/or doctor led teams similar to the MET concept.

## Studies Evaluating MET and MET-Type Concepts

As yet, there are few studies evaluating the impact of MET-type systems and outreach programmes. One of the first was a study comparing a hospital with a MET system with 2 hospitals without a MET system over a 6 month period (Bristow et al. 2000). There was a significant reduction in unplanned admissions to the ICU in the MET hospital, and a reduction in non-NFR deaths in one of the control hospitals. After adjustment for variables, there was no significant difference in potentially reversible cardiac arrest rates.

A before/after study in one hospital showed a significant reduction in cardiac arrest rates as well as mortality as a result of cardiac arrest rates (Buist et al. 2002). Another before/after study after implementation of a MET system also showed a significant reduction in potentially preventable cardiac arrest rates, as well as overall death rates and a highly significant reduction in ICU bed days as a result of a cardiac arrest (Bellomo et al. 2003). The same group demonstrated a reduction in postoperative adverse outcomes (Bellomo et al. 2004). Only one evaluation of the outreach programme to date has demonstrated a reduction in mortality in general hospital wards (Priestley et al. 2004).

## Where to Next?

It is unlikely that anyone practising acute medicine would advocate that we wait until a patient dies or has serious complications before they are managed by staff with appropriate skills, knowledge and experience. We need to explore better ways of identifying potentially at-risk patients at an earlier stage in their illness and of developing a system which will respond early and manage care appropriately. This challenge will require a system perspective rather than relying on the traditional *doctor:patient* relationship.

This process needs to be constructed around patient needs rather than within traditional silos. There are an increasing number of seriously ill at-risk patients in hospitals. This contributes to large numbers of potentially preventable deaths and serious complications, often preceded by well documented antecedents for many hours before their event. We need to understand more about this patient population in order to develop a standard way of defining the incidence. We need to understand more about the incidence and nature of adverse events in hospital patients and finally to evaluate the impact of various interventions.

Intensivists will be intimately involved in the delivery of MET-type concepts. Further research around this population of patients is required to secure the best outcome for at-risk patients in our hospitals.

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