

# **Acute hospital medical staffing during the night shift**

**KEN HILLMAN AND SEAN BEEHAN**

Ken Hillman is Professor of Anaesthesia and Intensive Care at the University of New South Wales. Sean Beehan is Director of Perioperative Services at the Liverpool Hospital, NSW.

## **Abstract**

*There has been little or no attempt to define the need for 24-hour medical cover, nor its appropriateness in acute hospitals, despite the great cost implications and the question of the quality of that care. This study examined the medical activity during the 'night shift' in an acute hospital. There were an average of 2.59 calls per night, most from the emergency department (247/475) and general wards (108/475). Many calls were related to active resuscitation (88/475) and immediate treatment (83/475). Over 40% (81/286) of patients had to be transferred to a higher level of care, such as an intensive care unit within the hospital. By collecting data on the demands of health care during what amounts to over a third of the hospital's time, it was established that a high level of medical care was required. Appropriate levels of staffing, using junior doctors trained in acute medicine, was able to be provided to match need as determined by these data, and extra staff at higher costs were avoided.*

## **Introduction**

The organisation of the medical and nursing workforce in acute hospitals is an area where there has been little attention, or research. An example is the organisation of medical staff to cover an acute hospital on a 24-hour basis, which has changed little in the last 50 years, despite enormous changes in the character and nature of hospitals. The responsibility of providing appropriately trained medical cover is also an area which has attracted very little attention. Usually, someone from the clinical service or a medical administrator provides a junior medical staff roster, while those directly responsible for hospital costs attempt to review or reduce those costs. There are little or no data to guide these decisions. As the cost of providing 24-hour medical cover is substantial, and the

question of quality in health care is becoming more important, it is surprising that there has been little or no attempt to define the actual workload, appropriateness or function of junior medical staff rostered to cover the hospital. The workload is at its maximum in acute hospitals during normal daytime hours. This is related to elective activities such as admissions, investigations, procedures and consultations. The workload during evenings and weekends can also be busy, usually as a result of urgent admissions. Night shift (10.00 pm to 8.00 am) activity is usually reserved for urgent admissions as well as unpredictable emergencies within the hospital. The workload of emergency departments and intensive care units (ICUs) is less variable over a 24-hour period than the workload of general wards. In larger acute hospitals with junior medical staff cover, medical problems during the night shift are either directly addressed by the junior medical staff or referred to the specialist in charge of the case, usually by telephone, for further action if necessary. Less urgent problems are addressed the next day.

Medical staff from different specialties and at varying levels of training and seniority cover the night shift of an acute hospital in a great variety of ways. Yet there appears to be little knowledge of the exact nature of the work and appropriateness of staff cover required during the night shift (Henneman, Hockberger & Chiu 1989). What little has been published seems to have been based on the opinion of individuals (Hamilton 1985; Robstein 1985; Dailey 1986; Davidson 1986; Donovan 1986; Rosen & Markovchick 1985; Rosen & Markovchick 1986; Schelble 1986). However, it would appear important when managing a hospital's resources and guaranteeing quality of care that medical cover, for what amounts to over one-third of the hospital's operational time, is appropriate and cost-effective. In an attempt to examine the nature and size of the workload during a night shift, it was decided that all calls to medical staff in an acute hospital during the night shift over a six-month period would be examined.

## **Patients and methods**

At the time of the study, Liverpool Hospital was a 500-bed general hospital dealing with a wide range of specialties, excluding cardiothoracic surgery. The data were prospectively collected over a six-month period. The medical staff covering the night shift were informed of the purpose of the trial and asked to record all calls and enquiries that originated outside the ICU or coronary care unit (CCU), including calls that resulted in admission to either of those units, on a specifically designed form. The completed forms were collected and checked at the completion of each night shift, apart from weekends when they were compiled on Monday morning.

The medical cover during the night shift was as follows. The general wards were covered by an intern (first-year medical trainee). There was an on-duty (in the hospital) anaesthetic registrar (vocational training trainee) and an on-duty surgical registrar covering a busy surgical service. The ICU and CCU were covered by a resident (non-vocational medical trainee) and a second anaesthetic registrar. The registrar attached to the ICU not only worked with the resident in the CCU and ICU but covered all acute medical problems as well as being the leader of the trauma and medical emergency teams. During the night shift, the emergency department was staffed either by two senior residents or one resident and one emergency registrar.

The data recorded included the following.

1. The status of the caller: intern; resident; nurse; registrar; trauma or medical emergency call; other.
2. The origin of the call: emergency department; general wards; operating theatres; outside the hospital; obstetric ward; nursery; haematology ward; paediatric ward; trauma call; medical emergency call.
3. The action taken was classified as follows:
  - (a) Resuscitation. This referred to immediate life-threatening intervention for problems with airway, breathing or circulation, and included cardiopulmonary resuscitation.
  - (b) Immediate treatment, but not acutely life-threatening, for example, thrombolytic therapy for acute myocardial infarction.
  - (c) Review, assessment or advice. This referred to non-urgent problems such as adjustments to fluid therapy or reviewing an admission with a recent cerebrovascular accident, where no specific therapy was required.
  - (d) Telephone advice.
4. The placement of the patient: ICU; CCU; a general ward; deceased; discharged home; or no patient movement.
5. Further consultation required: specialist informed or not. The calls were classified according to their specialty, that is, medical/surgical/paediatric or obstetrics and gynaecology. Calls which primarily involved a technical skill were classified as procedural.

## Results

There was a total of 475 calls over the six-month period, an average of 2.59 per night. The compliance rate for questionnaire return was 100%. Most of the calls were from other medical staff (Table 1). Of these, the majority were related to medical problems or procedural assistance. The geographical origin of the call is listed in Table 2. The majority of calls were for medical problems (286/475). Other calls were for surgical reasons (104/475), or related to obstetrics (19/475). Of the 51 miscellaneous calls, 43 were to secure intravenous access where others had failed. The remainder included procedures such as taking arterial blood for investigations. The diagnostic categories of the medical problems are listed in Table 3.

**Table 1: Status of caller, including medical and procedural indications for that caller**

Status of caller	Total calls	Medical	Procedural
Intern	75	44	23
Resident	108	80	12
Nurse	26	12	5
Registrar	126	88	10
Medical emergency	19	16	-
Trauma call	14	0	-
Unspecified status from the emergency department	107	45	1
<b>Total</b>	<b>475</b>	<b>286</b>	<b>51</b>

Resuscitation was carried out on 88 occasions; 83 required immediate treatment; 147 required review and 25 involved a telephone enquiry. Most resuscitation calls (47) were from the emergency department. The average time spent on each resuscitation was 70 minutes (range 10 min to 5 hr 10 min, SD 51 min). The average time for immediate treatment was 47 minutes (range 15 min to 6 hr 30 min, SD 53 min) and the average time for patient review was 34 minutes (range 5 min to 2 hr 20 min, SD 20 min).

**Table 2: Geographical origin of call, including number of medical calls from that area**

<b>Origin of call</b>	<b>Total calls</b>	<b>Medical calls</b>
Emergency department	247	165
General wards	108	74
Haematology ward	1	1
Paediatric ward	15	4
Obstetric ward	13	2
Nursery	8	0
Operating theatres	20	4
Outside hospital	24	18
Trauma call	14	0
Medical emergency call	21	16
Unspecified	4	0
<b>Total</b>	<b>475</b>	<b>286</b>

**Table 3: Diagnostic categories of medical referrals**

<b>Diagnosis</b>	<b>Number</b>	<b>Percentage</b>
Angina	80	27
Cardiogenic pulmonary oedema	30	11
Cardiorespiratory arrest	23	8
Self-poisoning	21	7
Arrhythmia	21	7
Heart failure	18	6
Charting	18	6
Asthma	11	3
Chronic respiratory disease	11	4
Epilepsy	10	3
Shock	11	4
Coma	6	2
Hypertension	6	1
Gastrointestinal bleed	5	2

*continued*

**Table 3: Diagnostic categories of medical referrals *continued***

<b>Diagnosis</b>	<b>Number</b>	<b>Percentage</b>
Diabetic emergencies	4	1
Metabolic disturbances	3	1
Cerebrovascular accident	3	1
Meningitis	2	1
<b>Total</b>	<b>286</b>	<b>100</b>

Almost 80% of patients had to be referred to a different location within the hospital (Table 4). Specialists were frequently consulted after the registrar's assessment (197 occasions). Of these, there were 129 calls to physicians, 42 to surgeons and 16 to paediatricians. During the period of the study, no physician was required to visit the hospital for emergency care after 5.00 pm and before 8.00 am.

**Table 4: Placement of patients**

<b>Placement</b>	<b>Total</b>	<b>Medical</b>	<b>Procedural</b>
No patient movement	136	66	37
CCU	79	74	0
ICU	65	44	0
High dependency unit	59	36	0
General ward	59	29	1
Discharged home	24	7	0
Deceased	27	21	4
Unspecified	26	8	9
<b>Total</b>	<b>475</b>	<b>286</b>	<b>51</b>

## Discussion

The provision of appropriate emergency medical cover, for what amounts to over a third of the day, must be an integral part of acute hospital planning. It was quite surprising that no attempt has ever been made to document or define need. As a minimum requirement of that cover, it is essential that the person be skilled in all emergency procedures. While many of the calls during this study came from more junior medical staff, over a quarter were from other specialist registrars

and another quarter were emergency calls. Nearly half of all calls were for urgent action and resuscitation. At the time of the study, the anaesthetic registrars working in intensive care were trained in most aspects of emergency resuscitation, including intubation, ventilation, central line insertion, intercostal catheter, temporary cardiac pacemaker insertion and establishing continuous veno-venous haemodiafiltration, as well as being trained in assessing critically ill patients and being familiar with the latest advanced resuscitation guidelines. Where necessary, the intensive care specialist was called in. However, there are few minimum standards in Australian hospitals, either concerning in-hospital medical cover or whether that cover has the appropriate skills and experience necessary to manage the high number of emergencies and specialised skills documented in this study. The medical colleges covering postgraduate training include minimum standards for supervision, but no one college addresses the issue of the appropriateness or adequacy of the medical workforce covering an acute hospital.

At the time of the study there was only one emergency specialist and a mixture of residents and registrars covering the emergency department. Junior medical staff cover in obstetrics and paediatrics was on call, rather than being on site in the hospital, and the surgical and anaesthetic registrars were often committed to the operating theatres. Therefore, there was no guarantee that they could be immediately available for emergencies. Largely because of cost constraints, a choice had to be made between a second anaesthetic registrar and a medical registrar to cover the night shift. Because of the predominant emergency role during the night shift, it was decided to extend the role of the anaesthetic registrar who, together with a resident, also covered a 14-bed ICU and a 4-bed CCU. However, it was only by defining the nature of the night shift work that the appropriateness of the cover could be determined. In this case most of the calls were of an emergency nature, in which case someone trained in advanced resuscitation such as an anaesthetic registrar was more appropriate than a medical registrar who does not necessarily receive the same formal training in acute medicine. Concerns for patient care (Asch & Parker 1988) have made it compulsory for specialist emergency physicians to be on duty 24 hours a day in certain hospitals in the United States (Henneman 1988; New York State Ad Hoc Advisory Committee on Emergency Services 1987). Some of the small number of other studies have focused on working hours (Asch & Parker 1988) and working conditions for staff (Petersdorf & Bentley 1989; Lieu et al. 1992), but not on the appropriateness of staff skills and experience related to their role and function.

It can be seen that as well as the responsibility of covering the ICU and CCU, the second anaesthetic registrar had an average of 2.59 calls per night outside those units, performing tasks which varied between an average time of 34 to 70

minutes. However, as with many aspects of acute medicine, this commitment is unpredictable. Some of the acute resuscitations took almost the whole shift, while others could be dealt with in less than 10 minutes. This makes planning for appropriate staffing levels difficult. There was a junior resident covering both the ICU and CCU during the registrar's absence and they would call the registrar back to either unit if they were urgently required.

For more elective diagnostic and treatment decisions, the junior medical staff referred to the appropriate specialist on call. Where necessary, treatment was instituted in conjunction with telephone advice from the specialist in charge of the patient. In other cases, definitive treatment was delayed until morning. The anaesthetic registrar informed the consultant physician on almost half of all the occasions when they were called to see a patient. This reflects good communication between junior medical staff and specialists and counteracts the claim that a night registrar's primary role is to protect the specialist's sleep! Moreover, the specialist physicians must have been reasonably satisfied with the registrar's decisions and actions, as there was no necessity for any call-back by specialist physicians during the six-month period of the study. On-call and call-back fees also have cost implications for a hospital.

There appeared to be a large functional overlap between different specialties during the night shift. For example, there were many calls from surgical wards for 'medical' problems, which included resuscitation and emergency review. This is probably not surprising when one considers the increasing age and incidence of co-morbidities associated with surgical patients. As the interaction between chronic medical problems and surgical disease is an integral part of anaesthetic training, it seemed appropriate that it was part of their responsibility. Similarly, there were many procedural calls, mainly for insertion of difficult intravascular lines after another member of the medical staff had failed.

More than half of all patients were admitted to the ICU or CCU after being seen by the anaesthetic registrar. This indicates that the severity of illness of the patients was high. The majority of medical calls were for chest pain. In some hospitals a medical or emergency registrar would have also been available to care for these patients. Since the study was performed, Liverpool Hospital has become a principal teaching hospital and tertiary referral centre and, as a result of increased patient numbers and complexity of casemix, now has both 24-hour medical and emergency registrar cover.

More than half of all resuscitation calls came for the emergency department. The specialty of emergency medicine provides comprehensive training in emergency medicine and resuscitation. An alternative way of staffing an acute hospital may be to use emergency medicine trainees during the night shift to cover all urgent

medical problems within the whole hospital. The principles for managing the acutely ill have a commonality regardless of patient site or diagnosis. In order to use appropriate levels of skill in an efficient fashion, the emergency registrar could also be available for assessment and resuscitation in the general wards of the hospital.

Largely due to cost constraints, acute hospital bed numbers are being reduced across the western world. Many patients who would have otherwise been admitted to hospital are being investigated and prepared for their hospital stay in an out-of-hospital environment. Those who are admitted to hospital are having their length of stay reduced. Early discharge is being supported by a variety of strategies involving increased care in the community. As a result, acute hospitals now have an increasingly complex and at-risk population of patients. Acute hospitals are increasingly becoming environments for the care of the seriously ill, with greater emphasis on emergency departments, ICUs, high dependency units, operating theatres and general wards with more seriously ill patients (Braithwaite, Vining & Lazarus 1994; Hillman 1996). This requires a rethinking of how we staff hospitals after hours. After-hours medical staff are increasingly requiring advanced resuscitation skills and expertise in the care of the seriously ill. More elective and predictable diagnostic and management functions will be managed utilising instruments such as patient care plans after hours. Hospitals need to closely examine what medical cover is provided after hours in the light of its appropriateness and cost.

In summary, this study provides the first comprehensive survey of the nature of problems encountered during the night shift of an acute general hospital as a basis for evaluating the appropriateness and cost implications of that cover. As expected, many of the calls are of an emergency nature. To deal with these problems during the night shift, it is essential that at least one member of the medical staff is trained in all aspects of advanced resuscitation, has all the necessary procedural skills and is always available. Defining function and need can only occur when appropriate data are available. Making those data available, analysing them, and acting on them appropriately is a challenge for hospital managers and medical staff. Medical staffing of the night shift is probably no different from many other systems in acute hospitals. It has developed in an ad hoc fashion, often based on what has always been done. In these times of economic restraint and accountability for quality of care, we will increasingly need to examine issues such as the nature of the workload and the appropriateness of staffing to match that workload.

## Acknowledgements

The authors would like to express their appreciation to the Postgraduate Medical Council of New South Wales for funding this project and also to Mrs Sue Williams who not only ensured 100% compliance with distribution and collection of information but also assisted greatly in the preparation of the manuscript. We would also like to thank Dr Luis Gallur for setting up our database and all the registrars who recorded the necessary information.

## References

- Asch DA & Parker RM 1988, 'The Libby Zion case: One step forward or two steps backward', *New England Journal of Medicine*, vol 318, pp 771–5.
- Braithwaite J, Vining RF & Lazarus L 1994, 'The boundaryless hospital', *Australian and New Zealand Journal of Medicine*, vol 24, pp 565–71.
- Dailey RH 1986, '24 hour coverage: Problems and solutions (letter)', *Annals of Emergency Medicine*, vol 15, pp 871–2.
- Davidson SJ 1986, '24 hour coverage: Problems and solutions' (letter), *Annals of Emergency Medicine*, vol 15, pp 871–2.
- Donovan JW 1986, 'Attending coverage' (letter), *Annals of Emergency Medicine*, vol 15, p 764.
- Hamilton GC 1985, '24 hour faculty coverage' (letter), *Annals of Emergency Medicine*, vol 14, pp 85–6.
- Henneman PL 1988, 'Board certification and emergency department coverage' (letter), *Annals of Emergency Medicine*, vol 17, p 191.
- Henneman PL, Hockberger RS & Chiu C-Y 1989, 'Attending coverage in academic emergency medicine: A national survey', *Annals of Emergency Medicine*, vol 18, pp 34–41.
- Hillman KM 1996, 'Reducing preventable deaths and containing costs: The expanding role of intensive care medicine', *Medical Journal of Australia*, vol 164, pp 308–9.
- Lieu TA, Forrest CB, Blum NJ, Cornfeld D & Polin RA 1992, 'Effects of a night-float system on resident activities and parent satisfaction', *American Journal of Diseases of Children*, vol 146, pp 307–10.

New York State Ad Hoc Advisory Committee on Emergency Services 1987, Final Report, Albany, New York State Department of Health, United States, pp 1–5.

Petersdorf RG & Bentley J 1989, 'Residents' hours and supervision', *Academic Medicine*, vol 64, pp 175–81.

Robstein FJ 1985, '24 hour faculty coverage' (letter), *Annals of Emergency Medicine*, vol 14, pp 85–6.

Rosen P & Markovchick VJ 1985, 'Attending coverage', *Annals of Emergency Medicine*, vol 14, pp 897–9.

Rosen P & Markovchick VJ 1986, 'Attending coverage' (letter), *Annals of Emergency Medicine*, vol 15, pp 764–5.

Schelble DT 1986, '24 hour coverage: Problems and solution' (letter), *Annals of Emergency Medicine*, vol 15, p 871.