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Emergency Admissions - Count the patients in a bed, not the FCE's

Dr Rodney Jones (ACMA)
Statistical Advisor
Healthcare Analysis & Forecasting, Camberley, Surrey
hcaf_rod@yahoo.co.uk

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Emergency Admissions - Count the patients in a bed, not the admissions

The rise in emergency admissions has been the centre of much recent study and alarm. The basis for almost all analysis of the 'problem' has been Finished Consultant Episodes (FCE's) or episodes of admission. Both count the episode/admission on the date of discharge (as opposed to the date of admission) and both assume that there is very little seasonal change in the average length of stay.

One important fact is generally not explicitly stated, namely, that there are two key assumptions behind the analysis (and the alarm):

- Higher numbers of finished consultant episodes (FCE's) implies a requirement for more beds or put another way, a count of discharges (FCE's are counted on discharge date rather than admission date) tells us all we need to know about bed requirements.

- The so-called trend is an ongoing phenomenon, i.e. the rate of emergency admissions has increased or is increasing over time (and is therefore not likely to return to previous levels).

The second assumption discounts the possibility that the 'trend' may in fact be due to a reversible step-like increase. The first assumption is incorrect for the simple reason that the requirement for beds is driven by the difference between admissions and discharges and not simply by the discharges. At a micro-level this is untrue simply because the admission and discharge are separated in time by the length of stay (LOS). At the whole hospital level the combined complexity of the admission/discharge dates plus the associated individual LOS requires a 'back to basics' method of analysis which simply looks at the number of patients in a bed at any point in time.

To illustrate the difference between bed requirements and FCE's consider a period of time where there are 100 more admissions than discharges. The requirement for beds has increased by 100 while the count of FCE's could even be lower, i.e. the admitted patients could be discharged in the next month and hence the FCE's are not counted in the month in which the admission occurred.

This does not deny the fact that emergency FCE's have risen in recent years but what it does imply is that the underlying changes in bed requirements may be vastly different to the apparent 'trend' in FCE's. Subtle differences in length of stay and case mix all contribute to this difference between FCE's and bed requirements.

Using this basis for analysing the history of emergency admissions, a profile of bed requirement can be derived by counting daily admissions and discharges over past years. An example covering ten days is given in Table One.

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Table One shows us that on the first day there were five more admissions than discharges and hence five more patients in a bed. On the second day there was one more discharge than admissions and so at the end of this day there are four more patients in a bed, i.e. five more from the previous day less one. On the ninth day there are 22 more patients in a bed than there were at the beginning. To count the FCE's tells us nothing of use other than the total number of discharges, that is, how many we get paid for and not how much it costs to deliver the service. The astute reader may thus conclude that the current methods of costing and pricing can actually leave a hospital overspent even in the face of what appears to be the correct activity (FCE's).

Table One: Count of admissions and discharges with the resulting accumulation of patients in a bed

Date	Admissions	Discharges	Admissions minus Discharges	Accumulation of patients in a bed
1/1/96	120	115	5	5
2/1/96	110	111	-1	4
3/1/96	126	107	19	23
4/1/96	99	114	-15	8
5/1/96	135	120	15	23
6/1/96	117	115	2	25
7/1/96	87	100	-13	12
8/1/96	125	115	10	22
9/1/96	119	119	0	22

However, interesting speculations about costing and pricing aside, this type of analysis is best done on a daily basis for the simple reason that it becomes a powerful tool in understanding your real bed requirements and the underlying forces determining those requirements.

One final point about this method needs to be made, namely, it is not identical to bed-days. The two are fundamentally different measures simply because bed-days counts up the length of stay at the discharge date, i.e. it takes past history and imputes it to the day of discharge. For example, the discharge of a patient who has stayed one year imputes all 365 bed-days to the date of discharge. For this reason bed-days are not an appropriate measure for studying the underlying changes in demand or as a basis for the seasonal reallocation of beds.

Figure One gives the result of such an analysis for a large acute hospital where emergency admissions to all specialties (medical and surgical) are included. Immediately apparent is that the onset of the current (local and national) bed crisis corresponds exactly to the outbreak of the Influenza A epidemic in 1993. This epidemic had its onset at calendar week 41 (October) of that year and reached its peak in November (week 45) (1). Emergency patients in a bed rose to a peak of around 125 more than the baseline position in April 1992.

Following on from this epidemic the number of emergency patients in a bed shows some reduction, but, not back to the former level. For this particular hospital having

around 700 overnight beds (excluding Obstetrics) some 50 additional beds became occupied by emergency patients. This corresponded to around 7% of all available overnight beds over and above the previously experienced demand for all emergency beds!

Immediately following the Influenza A epidemic is a dramatic change in the profile of demand for beds. Prior to this epidemic the demand for beds was reasonably static and the summer/winter variation was not large, however, after the epidemic the demand for beds shows considerable oscillation (i.e. a much higher difference between summer and winter demand). At the peaks an additional 100 beds (i.e. around 15% of the entire overnight bed stock) are dedicated to emergency admissions over that required during the summer months. A change in clinical severity may be the principal factor since the primary diagnosis appears to have changed insignificantly.
Overall there is no clearly apparent 'trend' upward in emergency demand for beds other than an 'average' need for around 75 extra beds or a 10% step increase in 'average' bed demand (given that this 'average' is the result of a greater difference between peak and trough demand).

Of interest is the curious response to the 1995 Influenza B epidemic. Emergency admissions do not show the enormous surge seen during the 1993 epidemic. This was characteristic of the milder nature of the Influenza B epidemic as experienced by primary care (1). However the influenza B epidemic appeared diminish the post-winter reduction in the number of patients in a bed and hence by the summer of 1995 some 50 additional emergency beds are occupied by a patient.

In late 1995 there was a further outbreak of influenza-like illness reaching a peak rate of 175 per 100,000 population, i.e. almost as high as that of the Influenza A epidemic of 1993 (2). This influenza-like illness appeared to mark the onset of a dramatic return to the pre-1993 levels of emergency bed requirements. This point appeared to have been reached by July 1996 where patients in a bed had returned to around 25 more than the 1993 level. This minimum was then followed by one of the steepest rises in the number of patients in a bed seen since April 1992.

An interesting observation is that the 1995/96 surge in emergency admissions which was due to the hottest summer on record does not show up in the analysis of bed requirements. The reason is simple, the admissions were relatively uncomplicated and of relatively short stay resulting in a situation where admissions and discharges remained in balance. This is perhaps a good example of the fundamental difference between FCE's and required beds.

The arrow pointing to the December 'spike' reveals a characteristic dip in winter emergency admissions where for a period of one week the demand for beds temporarily declines. This is Christmas week where it is socially inconvenient to be admitted to hospital. Interestingly the magnitude of the dip over Christmas week is almost exactly compensated for by higher the normal admissions in the following two weeks, i.e. the patients do not go away and the demand is simply shifted to a later point in time.

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A closer inspection of the apparent 'random' jumble of peaks and troughs reveals that they are in fact highly 'predictable' in that they nearly always occur at the same point in time every year. For instance, the point of minimum emergency bed occupancy is nearly always the week of the summer solstice. These observations imply that the required bed pools can be predicted in advance and that a weekly re-allocation of beds between specialties is not only possible but probably highly desirable (if maximised throughput per bed is a desired outcome).

Also relevant is the fact that the changes in demand for beds do not follow the clear boundaries between financial years (and months of the year). In this sense annual totals of FCE's or annual average numbers of available beds will give a highly distorted picture of the underlying trends. It is only a daily or weekly basis which will give the desired clarity to any analysis of this or other 'problems'.

While this analysis applies to overall emergency admissions covering both the medical and surgical specialties it is of interest to look on an individual specialty basis.

This has been done for Elderly Care in the same hospital and the results are given in Figure Two. In this figure some changes in the allocation of patients between General Medicine and Elderly Care and the gradual closure of long stay beds have meant that the number of patients in a bed has had to be standardised against April in each year. Hence a ratio (Y-axis) of 1.3 means 1.3-times the number of patients in a bed relative to April in that financial year.

As in Figure One the onset of the Influenza A epidemic had a profound effect upon both the number of patients in a bed and upon the shape of the annual profile. What appears to have happened is that the magnitude of the peaks and troughs became accentuated. There has also been a gradual reduction in the magnitude of the winter peak over time. The less dramatic effect of the 1995 influenza B epidemic upon the elderly (Fig. 2) compared with all emergency admissions (i.e. the post-winter dip is seen for the elderly but not for all emergency admissions) is consistent with the low impact of this strain upon those over the age of 65 as reflected in GP consultations (1).

In this instance the average bed requirement across a year stayed relatively constant with an increase in winter bed requirements being offset by a reduction in the summer bed requirement. This type of shift presents a challenge to the allocation of beds between specialties in that large seasonal variation implies either that wards be shut over the summer months or that a flexible bed pool be allocated to cope with the large difference between minimum and maximum demand.

One can only speculate about the apparent correlation between the two influenza epidemics and the change in the requirement for beds. An in-depth review of the 1989, 1993 and 1995 influenza epidemics concluded that in the 1993 and 1995 epidemics there were other associated viral diseases (1).

Of further interest is the observation that particular Influenza epidemics can be associated with increased incidence of myocardial infarction (Influenza B) and cerebrovascular conditions (Influenza A) in addition to the more expected increase in

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pneumonia, bronchitis, otitis media, etc (1). One can only conclude that particular existing conditions can be exacerbated by Influenza and other related viral illnesses.

In conclusion, a method based on bed requirements rather than FCE's appears to indicate that the 'trend', or more correctly a step increase in increasing emergency admissions may have stabilized at a new level. Emergency admissions now appear to be characterised by the following:

- higher overall levels of patients in a bed (almost a step upward of 10%)

- higher peaks and lower troughs (almost the ultimate challenge to bed management) with around 15% of the entire bed stock needing to be switched from elective to emergency care.

- no apparent 'trend' upward other than the 'step' increase of around 10% more emergency beds required since the 1993 influenza epidemic.

It is suggested that the analysis of patients in a bed is a sounder basis for the forecasting of 'emergency' hospital bed requirements rather than the current method based upon 'access rates' (a fancy term for FCE's divided by the population size).

The results suggest that non-typical events such as influenza and viral epidemics can have uncharacteristic effects upon local (and national) bed requirements. The question of how many beds do we need thus becomes a question of what unusual events will happen in the future? The current method of contracting (including costing and pricing) based around the assumption of steady growth in FCE's may find this an uncomfortable reality and for hospitals the challenge is to switch around 15% of their capacity between summer elective and winter emergency work.

References:

(1) Fleming DM. The impact of three influenza epidemics on primary care in England and Wales. PharmacoEconomics 1996; **9(Suppl. 3)**, 38 - 45.

(2) Data supplied by the monitoring unit of The Royal College of General Practitioners, Birmingham.