intuition that a unit with only 72% occupancy and an average length of stay of 21 days could not possibly have an average waiting time of 84 days. I regret that the results given by him in the second example and in the table are also incorrect.

There are two other points worth making. The first is that despite Dr Marjot's assertion the expediency of borrowing beds between firms does indeed reduce waiting times provided the overall occupancy is less than 100%. To take an extreme example, consider two units, each with only one bed, and each with a 50% occupancy. If you want to admit a patient to one unit the probability of finding the bed full is 0.5. However, if you can admit the patient to either bed then the probability of finding both beds full is only about 0.25 (not exactly because the two situations are not truly independent). The more beds available, the more they can absorb the fluctuations in admission demand which produce queues.

The second point concerns the limitations of mathematical models in general. In reality there is no clear distinction between patients who need admission and those who do not, perhaps especially in psychiatry. Every trainee knows that they are more likely to admit patients when there are plenty of empty beds than when there are only one or two. This kind of feedback loop is not really possibly to incorporate adequately in a model. Patients in a queue do not remain there indefinitely. Some get better, some go elsewhere, some die. The length of time spent waiting may influence the length of admission, for example in surgery for malignancy. These considerations and others should mean that we take with a pinch of salt any mathematical model which purports to predict reality, especially if its predictions fail to match with common sense.

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REFERENCES

[1]SINGH, J. (1968) *Operations Research*. Harmondsworth: Penguin
[2]KAUFMAN, A. (1963) *Methods and Models of Operations Research*. Hemel Hempstead: Prentice Hall.

DEAR SIRS

I am sorry that Dr Curtis has rendered my (very amateur) maths invalid. I will try and resolve the blow to my ego!

Nonetheless I was delighted that he could propose a model to allow us to see more clearly the effects of demand on our services and the resulting queues. He has given us a more valid tool.

An example I gave, and which Dr Curtis has reworked, was that average bed occupancy would be 82%, i.e. 23 beds occupied on average out of 28. Yet managements can and do argue that you should therefore cut your service by five beds. I think Dr Curtis will agree that this would make a great difference to queues and admissions.

I agree that trainees (and consultants) are more likely to admit when there are plenty of beds. If we cannot incorporate this kind of feed-back into models, we are in trouble. It is a subject that needs further study in its own right.

I also share the opinion that we must take with very large pinches of salt any mathematical model that purports to predict reality (including rating scales and double blind controlled trials).

However my errors do not invalidate the need for more objective ways of discussing our resource needs with management. Rationing health care can be done in three ways. The first is by making the patient pay at the point of delivery of the service, out of income or capital which may be anticipated expenditure if insurance is used. The second way is to determine your use to the community, whether this be by the value of your survival or the cost of keeping you alive in any given state of health. Quality of life units and casualty triage are examples. Lastly you can ration by queue which is the way favoured by the NHS at present.

It is necessary for us to understand the mechanics of queueing in order to have rational services in the NHS and so I took tentative steps towards this end.

With Körner data sets and computerised management information systems about to run amok in the NHS it behoves us to get to grips with the theory and practice of these systems, including their very real limitations.

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DEAR SIRS

Dr Marjot, in his letter (*Bulletin*, December 1987) is quite correct to emphasise the point made by Prof Priest (*Bulletin*, November 1986) that in calculating the number of beds a unit needs, it is important to remember that 100% occupancy is not compatible with the functions of an acute ward. However, it is a shame that, like the recent College Working Party on bed norms, his study of the literature seems to have overlooked the contribution of by far the most original theoretician in this area, the late J. A. Baldwin.

In a paper published in 1963 Baldwin[1] noted the importance of the issues that Marjot discussed but he went on to make a further important point which Marjot seems to have missed. The overall number of beds in a unit influences the proportion of beds which need to be vacant to buffer normal fluctuations in the admission rate.

This is pretty obvious intuitively but it can be demonstrated by reference to poisson distributions. If a unit of 30 beds admits on average three patients a day, then in order to reduce the likelihood of having to turn away a patient on any single day to below 1%, eight empty beds will be required (26.7% of the total). By contrast a unit of 150 beds admitting, on average, 15 patients per day can achieve the same level of confidence in its capacity to admit as required by freeing only 25 beds (16.7%).

Unfortunately the language in which these issues are usually discussed emphasises the physical facilities (the bed). The staff implications are in practice likely to be more tricky. The point is that if in-patient psychiatric practice is to move to smaller units, it becomes much more important