I hoped to discuss some of the experiences of myself, colleagues and patients, as we are presently unable to do in this country, to gain the understanding and advice of our colleagues in Britain, and to present new information of potentially significant value in other countries.

When I arrived in Britain for the meeting, I received a very curiously worded letter from the President, telling me that my two papers had been withdrawn from the programme, and I was not to talk at the College meeting.

No proper explanation of this extraordinary and unethical behaviour has ever been given to me. Reference was made to a recent College resolution: yet that resolution specifically and expressly insisted that NO academic boycott should occur, and that Members and speakers from South Africa should NOT be barred from speaking at College meetings. Though that resolution was properly passed by the formal processes of the College after due discussion, and should be binding on the President and officers of the College, they acted in direct contravention of its meaning and intent.

This was, I believe, the first time that a British Royal College has excluded one of its senior members from participation in a meeting, for base political reasons. It is unethical and improper action, even in breach of basic Hippocratic rather than hippocritic principles.

No public announcement was ever made about this cowardly act, and members were never told what their President and College had done. People were widely puzzled about why I never appeared at the podium to speak; and my professional and academic reputation (as a significant speaker, who has never yet failed to attend and speak when expected) was damaged.

My feelings were ignored. Apart from shifty, muttered, embarrassed, brief comments by some of those responsible for what happened, I never received a proper apology or the chance to discuss the situation.

Since my return, I have received many messages of support from all sections of our people, who have asked me to convey to you their disgust at the way I was treated. Representatives of noted major democratic organisations of South Africa have assured me that no one in any way authorised to speak on behalf of any respectable South African representative group approached the College to have my invitation withdrawn: rather, they would want me to have been heard.

We are concerned as to the true source of the pressures to which the College gave in, to prevent any chance of critical discussion of mental health problems in South Africa. We note that the College has given hospitality to pro-Government Professors of Psychiatry from South Africa: though such contacts are more likely to be in breach of the College's recent resolution, as by such means support and encouragement is given to those responsible for providing seriously sub-standard psychiatric and medical care to the majority of our people.

We note that several senior Fellows of the College have had no scruples whatsoever about earning generous honoraria from drug companies for visiting South Africa,

often repeatedly, and giving largely undistinguished presentations of information already readily available to us, and usually irrelevant to our real professional problems. Those in the College concerned with censoring me, in their shabby exercise in academic apartheid, should take more interest in such visits.

What the College did was to shamelessly surrender to a tiny group who titillate themselves by meddling in affairs they do not understand, in victimising the victims, in their self-glorifying roles as self-appointed spokesmen for those they never listen to.

I write because I believe that an indiscriminate, decerebrate, academic boycott such as the College exercised is immoral, professionally unethical, and an unwarranted threat to the health and well-being of already underprivileged people. I do not accept that the President was right to act as he did, or to try to sneak through such a dishonourable breach of formal College policy, behind the scenes, without proper debate by the Membership, to whom he is answerable.

I look forward to being enabled to address the College properly at a major College meeting at some early opportunity. Perhaps, though, my address on such an occasion could include the material the President banned me from presenting in 1987; it could be a more formal presentation on issues of academic freedom, and the responsibility of psychiatrists in situations such as ours.

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Dr Birley replies

I understand Professor Simpson's indignation at the withdrawal of his two papers, and I am sorry that he felt that my attempts at explanation, in my "curiously worded letter" and in our conversations, were inadequate.

The interpretation of our Council Resolution is clearly a matter for debate, but the views expressed to me, in protest at Professor Simpson's speaking, were strong and articulate and from a wide variety of well-informed sources. They felt that a speaker from an apartheid university was not acceptable and would give an unfortunate impression to the ethnic minorities in this country who already view psychiatry with some alarm and suspicion.

Professor Simpson does not mention that the original invitation from the College was for him to have the opportunity to speak about his experiences to the College's Unethical Practices Committee. This Committee heard from Dr Koryagin in the morning and, after lunch, when both were our guests, we heard from Professor Simpson.

DR J. L. T. BIRLEY
President

Estimating hospital bed numbers

DEAR SIRS

I am afraid that Dr Marjot's letter on Estimating Hospital Bed Numbers (*Bulletin*, December 1987) contains an error which renders his conclusions invalid.

He asks us to use a variable which he calls the utilisation factor

$$P = \frac{\text{average stay of a patient} \times \text{gap between consecutive admissions}}{\text{bed numbers} \times \text{days in the year}}$$

He then states: 'The probability of finding a free bed is $1 - P$'. In fact, this is the probability of finding one specific bed free at any particular time. The probability of finding at least one of the beds free is very much greater than this.

He quotes from Singh[1] the formula for the average queue size as being $P/(1-P)$. In fact, this simple formula is only applicable in the situation where there is 'only one bed', a point which Singh himself seems to have failed to understand. As soon as one considers a unit with more than one bed one is obliged to use very much more complex mathematical formulae to calculate the average queue length. Such a model is called in queuing theory a 'Multi-Server Model'. An example of formulae to calculate the expected queue length, v, is given below, where X is the number of beds on the unit.[2] It is obviously rather impractical to use this for any reasonably large X.

$$P_0 = \frac{1}{\dfrac{P^x}{X!(1-P/X)} + 1 + \dfrac{P}{1} + \dfrac{P^2}{2!} + \dfrac{P^3}{3!} + \ldots + \dfrac{P^{x-1}}{(X-1)!}}$$

$$v = \frac{P^{x+1}}{X.X!(1-P/X)^2} P_0$$

It is also fallacious to obtain the average waiting time by multiplying the average queue length by the average length of stay. In fact, the average time each person has to wait is obtained by multiplying the average queue length by the number of days in the year and then dividing by the total number of patients needing admission in that year. This is the number of 'man-days queuing per admission', or average waiting time experienced by each patient.

Although it is not possible to perform a simple calculation to arrive at an average queue size, it is a very straightforward exercise to write a short computer program which will simulate the unit with a waiting list and from which such factors as waiting times can be measured directly. I have done this and can forward a copy of the program to interested readers—it is written in Locomotive Basic and can easily be modified to run on any computer. The program uses a Poisson function to produce at random the correct number of people requiring admission each day, and they are added to the waiting list. Each day people are taken off the waiting list into any free beds which are available, and they then stay in hospital for the average length of stay.

I have used the same parameters in the program as Dr Marjot:

P = utilisation factor
B = length of stay
A = average gap between the admission of consecutive patients

D = number of days in the year
G = number of admissions required each year
X = number of beds in unit

I have assigned to these parameters the values he uses in his first example:

B = 21
G = 400
D = 365
X = 28

The typical output from the program for one year is shown in Figure 1. If the program is run ten times and the results averaged then the following results are obtained:

Patients treated in 10 years: 4022   (Expected: 4000)
Average:
   Beds occupied: 23.1   (Expected: 23.0)
   Queue length: 1.18
   Occupancy: 82.6%   (Expected: 82%)
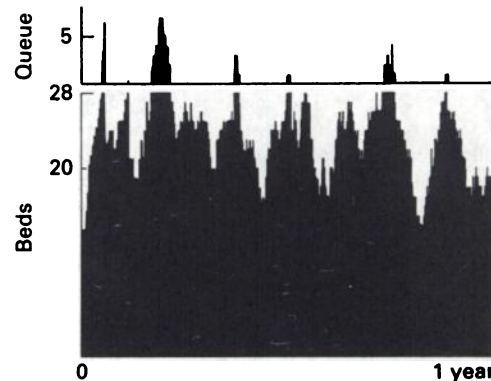   Waiting time: 1.08

FIG. 1. Number of patients occupying beds and queueing for beds.

Patients treated: 395

Average:
Beds occupied:	22.8
Queue length:	0.30
Occupancy:	81.7%
Waiting time:	0.27

The actual results obtained from the random probability function match closely to the expected results, confirming that the simulation works well. They are however radically different to those of Dr Marjot. The average queue length is only 1.18 instead of 4, and the average waiting time is 1.08 days instead of 84. All the patients can be comfortably taken care of so there is no need to reduce the actual number of admissions from the ideal number, and the average bed occupancy remains at the expected 82% and does not need to be reduced to 72%. Thus the simulation confirms our

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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[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