We completely agree with Dr Voss that audit by computer needs much planning and practice before its usefulness can be assessed.

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SIR,—As the author of the Cambridge audit system (Dunnfile) I agree with Ms C Lyons and Mr R Gumpert that there are difficulties in ensuring that audit data are complete.¹ During 1982-4 I and other workers collected data into two parallel systems—a computer and a diary.² This helped us to recognise where the problems lay and to improve data collection. This has nothing to do with the design of the program or the computer. The computer makes data collection easier but it cannot ensure that it is complete. It is often convenient to blame the software or the hardware for deficiencies, but these are almost always due to human error. That our measures were effective was shown by the fact that Dunnfile had recorded 20-25% more admissions than were collected by the Cambridge patient administration system.³ The administration system therefore provided no kind of standard and complete data collection will not be achieved by linking the audit software to this system as Ms Lyons and Mr Gumpert suggest.

The measures we now take to achieve more complete data collection are:

(1) A handwritten register of admissions is kept and updated each day from the various ward registers. This is used to check off each patient being entered on the computer and as the discharge summary is sent out. This register is checked occasionally by the consultant.

(2) Constant reminders are issued to staff that forms must not leave the ward with the notes. This tends to happen particularly if the patient dies or is transferred to another unit.

(3) The consultant must insist that forms are completed for patients who are being treated in outlying wards and make regular checks that this is being done.

(4) Weekly audit validation meetings held by the consultants are helpful in keeping the overall standard of audit, including data collection, high.

These extra disciplinary measures take very little time each day and are easily covered by the time saved by the program itself.⁴ As regular audit meetings and annual analyses become the norm and errors are fed back to the staff for correction the quality of the data and the completeness of the audit steadily improve. Ms Lyons and Mr Gumpert may be encouraged to hear that once working practices have been modified the audit seems to be easier to run successfully.

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- 3 Dunn DC, Dale RF. Combined computer generated discharge documents and surgical audit. *Br Med J* 1986;292:816-8.
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Improving the care of patients with major trauma

SIR,—In his letter about our study¹ Professor D W Yates comments correctly that the two respiratory rates corresponding to coded values of 4 and 3 in the table referring to the revised trauma score have been transposed.² This was due to a printing error that was not picked up at the proof reading stage.

The other inaccuracies he notes, however, are perhaps due to the fact that the description of the scoring systems given was not meant to be a comprehensive summary of their application but rather a short description to clarify their usage.

In referring to the revised trauma score in the article we used this term to mean the triage version of the score defined by Champion *et al* as "T-RTS."³ The weighted sum of the revised trauma score variables that Professor Yates refers to is used in the prediction of outcome using the trauma related injuries scoring system.⁴ The validity of this method for evaluating trauma care is well recognised, but it is a tool for retrospective analysis rather than initial assessment—the function we were seeking. Any mention we made of the revised trauma score referred to its use in the triage form rather than in any form of later analysis.

In reply to the comment on the injury severity score the example was given purely to show how the figure was calculated, and the numbers were chosen for this purpose rather than as an actual coding exercise. The paragraph in fact states that an "accurate and complete knowledge of all the patient's injuries" is required, and we would stress the importance of not only accurate recording but also accurate coding of injuries.

We agree about the importance of a distinction between the use of scoring systems in triage and audit but suggest that both uses are valid in improving trauma care.

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Simulation in surgical training

SIR,—Our leading article on the role of simulation in training in surgery¹ seems to have been misunderstood by Mr B A Taylor and colleagues.² We did not suggest or even imply that training should be removed from the operating theatre. The use of simulation must be seen as an adjunct to, rather than a replacement for, training in the operating theatre. The aim is to increase the level of skill of the trainee before he or she performs procedures under supervision in the theatre. This will have potential benefits for the patient, the trainee, and the supervising surgeon as well as reducing the time spent on the operation. We must recognise, however, that there are increasing pressures on theatre time that must affect surgical training and cannot be ignored.

Mr Taylor and colleagues emphasise the limited role of anastomosis workshops in training. We accept that until recently workshops have been restricted to teaching anastomotic technique by using simple jigs, but already more complex models that simulate the problems of surgical access in low colorectal, endoanal, and oesophago-gastric anastomoses have been developed. Seeing the role of simulation in general surgical training solely in terms of anastomosis workshops takes no cognisance of recent developments in simulation. A sophisticated prototype simulator consisting of an endoscope linked to a personal computer that produces simulated endoscopic images has been designed for teaching colonoscopy and endoscopic retrograde cholangiopancreatography.³ Workshops for training surgeons in the new technique of laparoscopic cholecystectomy make use of simulators. Although simulation of dissection is still at a rudimentary stage, we prefer to be

optimistic rather than defeatist about its potential. It is important that developments in simulation should be seen not as a threat to trainees and trained surgeons but rather as an opportunity to improve technical skills.

We expect that in the future surgeons will be introduced to certain operative procedures by using simulators before practising them in the operating theatre for the same reasons that aircraft pilots are currently introduced to instrumental skills and techniques on simulators before being entrusted with human lives.

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- 1 Macintyre IMC, Munro A. Simulation in surgical training. *Br Med J* 1990;300:1088-9. (28 April.)
- 2 Taylor BA, Harrison BJ, Cawthorn SJ. Simulation in surgical training. *Br Med J* 1990;300:1524. (9 June.)
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SIR,—The views of Mr B A Taylor and colleagues on the case for simulation in surgical training, which was properly highlighted by Messrs I M C Macintyre and A Munro,² seem curiously naive and negative. Naive because the authors seem to be unaware of the enormous progress already made and still being made in simulation as applied to surgical training and its increasing acceptance. Clearly they are not familiar with the rapidly expanding range of successful devices available.

Nor have they been able to make any analogies between the vital part played by simulators in the training of pilots, particularly of heavy and complex aeroplanes, and their role in surgical training. This analogy is compelling, and I say that both as a surgeon who has taught clinical surgery as well as microsurgery courses over many years and as a current pilot.

My organisation has already developed a successful and realistic lung model which is used for training in diagnostic and operative bronchoscopy and last week was awarded a substantial grant from the National Institutes of Health for the development of new simulators for specific surgical procedures. Clearly this national body sees a future for surgical simulation, and particularly for diminishing the number of animals used for surgical research and teaching.

The views of Mr Taylor and colleagues seem negative because no one is pretending that simulators will become a universal panacea for the honing of skills in operative surgery. But the defensive attitude they express smacks of a fear of progress and change. There is a world of difference too between flying a 747 aeroplane with one engine on fire through a thunderstorm on an unfamiliar instrument approach on the simulator and doing the same thing with 450 people on board 9000 m up in the clouds. But almost all the training for those circumstances is done by using simulators. The problem to date has been that surgical simulators, unlike flying simulators, have mostly lacked convincing realism. That is the problem that we and others are now addressing in our work. The materials technology is already there to solve it.

Mr D A S Pearce, in his response to the paper by Messrs Macintyre and Munro, was correct in drawing attention to the place of computer simulations. There seems little doubt that computer technology will play an increasing part; indeed it already plays a formidable part. Computer simulations using information from computed tomograms and other sources, combined with new, realistic surgical simulators, will lead to a lot of basic surgical technique being taught outside the operating theatre. Dentists have