Training Anaesthetists to cope with an Emergency in the Operating Theatre: 
the Use of the Microcomputer 

BY 
B. Richards, M.E. Dodson, B.R.H. Doran, C. Jeffery, R. Longbottom, 
A. Poyser and P. Stellar. 
° University of Manchester Institute of Science and Technology 
# Department of Anaesthetics, University of Manchester 

SUMMARY

A program has been written which indicates the best courses of action to 
be taken during a crisis in a real or simulated operation. In the early hours 
of the morning, it is often the lot of less experienced anaesthetists to take 
charge of the patient about to undergo an emergency operation. Usually everything 
will go well but, on sufficient occasions for it not to be a rarity, the un-
expected will happen and an emergency will occur whilst the patient is undergoing the 
operation. The patient may have a cardiac arrest and then a life threatening situation 
presents itself. Less dramatic, but nevertheless, still of great importance, the 
patient may become cyanosed (turn blue) and be in danger of oxygen starvation to the 
brain. Likewise, the dangers to the patient from high or low Blood Pressure, high 
or low Central Venous Pressure, high or low Heart Rate, or abnormal heart rhythms 
(heart block or ectopics) must not be diminished. In situations like these the 
anaesthetist would like to have his consultant at his side but, alas, the latter 
may be many miles away. The authors have put the expertise of several consultants 
in a desk-top micro and the computer can now cope with almost every type of patient 
emergency. The usefulness of such a program from the training point of view is 
enormous. Junior staff can now simulate crisis situations in the computer and test 
their own reactions to such situations. They can decide on what they would do 
at each critical point and then press the button and see what the team of consultants 
would have done in those same circumstances.

INTRODUCTION

Computer models of physiological processes have been in existence for some time, 
one of the best known being the 'MacPuf' model of human respiratory structures and 
functions [1],[2]. However, apart from these two projects cited, very little has 
been published. At present these models are used particularly in the field of 
education and this is one of the major uses of the program described here for coping 
with an emergency in the operating theatre.

It is possible for many potentially dangerous conditions to arise during an 
operation, such as abnormal heart rhythms, hypotension or hypovolaemia and action 
needs to be taken quickly to stabilise the patient. In an emergency situation like
this, the Anaesthetist, who is the person responsible for maintaining the physiological condition of the patient, will sometimes require experienced help, especially if still only a junior member of staff.

The program can run interactively on a microcomputer sited in the operating theatre. The program indicates the best course of action to be taken, according to the conditions prevailing, to stabilise the patient. The courses of action suggested are based on the experience of a group of consultants. Conversely, the program can be used in a teaching environment by the lecturer or even by an individual who would wish to test his own responses to a crisis situation in theatre.

The program runs on a Commodore Pet Microcomputer equipped with a floppy disk drive and a printer. This computer is easily available at many hospitals, takes up little space, and is relatively simple to use. The program is stored on a diskette and so is readily portable.

**METHOD**

The program is loaded into the computer at the beginning of the operation, either simulated or real, and basic details concerning the patient are requested. These include the name, sex, age, weight, height and clinical condition present on admission to theatre, allergies, temperature, blood pressure and blood sugar level of the patient. The blood pressure is checked to see if it is within the range of normality for the patient's age. The values for weight and height are used in the calculation of blood volume and body surface area if necessary. A clock is integrated into the program and the date and time on the twenty four hour clock are indicated at the start. The program then waits for help to be requested, if an emergency occurs.

Once the computer has been asked for help, an instruction is immediately given to increase the inspired oxygen, then a 'master' or 'control' program asks questions to assess the nature of the emergency. On the basis of the answers given, one of three subprograms is brought into operation, which asks further questions and indicates actions to be taken.

In addition to controlling the routes in and out of the subprograms, the master program also sets up a database containing current values of variables and details of drugs that can be administered. Some of the variable values will have been set pre-operatively, but others will not be assigned a value until the appropriate subprogram requests it. Any unknown variable is set to the value -1 in the database. Hence a subprogram that requires a value will check back to the database to see if -1 is present and if it is it will ask for a value to be entered. Every variable entry is paired with the time at which it was recorded.

Only certain values will change due to a change in status of the patient; a subprogram assesses which ones might have changed and asks for new values. Those