Drugs in Hospital

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Many factors have produced the present crisis of confidence in the handling of drugs in hospital but the main one is the 'pharmaceutical revolution'. The relatively poor efficacy and lack of toxicity of the drugs used in the past have left us with an inheritance of a casual and inefficient approach to drug handling only partly met by the regulations laid down in the Dangerous Drugs Act (DDA). The vast numbers of pharmacologically active, therapeutically effective, and potentially toxic drugs made available by the pharmaceutical industry, many not classified under DDA or even as Schedule 1 poisons, has resulted in a breakdown of the traditional systems of drug handling in hospital.

Other factors that have added to our difficulties are:

1. The failure of communication between the various components of the hospital team, especially doctor and nurse (how many doctors have ever accompanied a nurse on a medicine round?).
2. The medical profession's reluctance to accept managerial as well as clinical responsibility.
3. Staff shortages in all sections of the hospital team, doctors, nurses, and pharmacists.
4. The rising work load produced by the increasing complexity of medicine.

THE PRESCRIPTION OF A DRUG

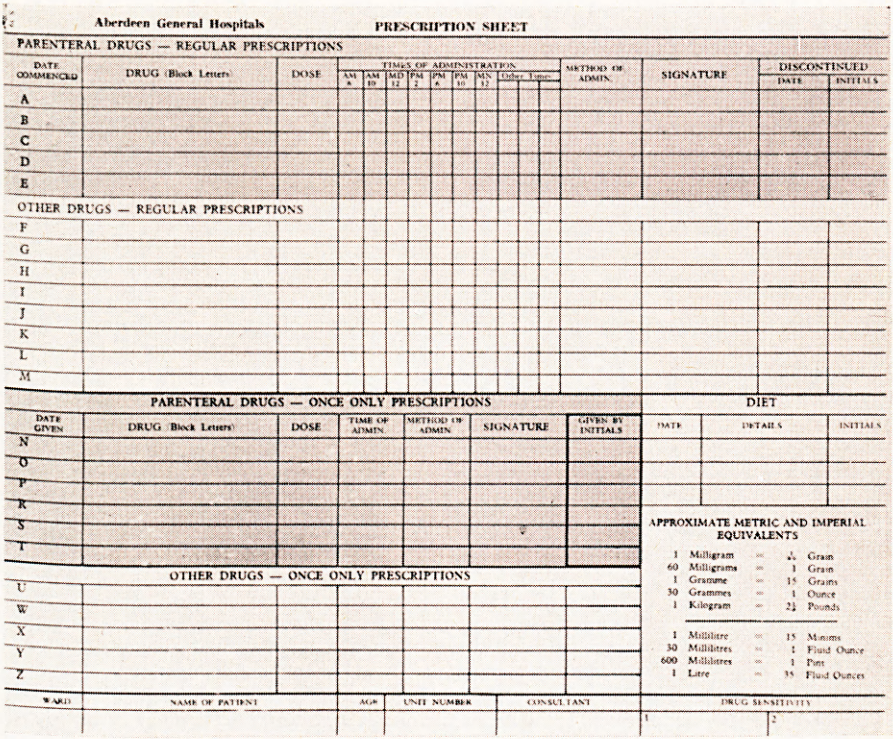
It is an interesting phenomenon of human behaviour that many problems apparently do not exist until they are revealed by one dramatic event, and subsequently investigated. This is what happened in the Aberdeen General Hospitals Group in 1964 when a discrepancy between the prescription and administration of a single drug led to an enquiry into the sequence of operations initiated by writing a prescription in hospital. A most remarkable variation was found within the various units of the hospital group, the only common factors being a treatment chart, on which the prescription was written, and a medicine list of variable form, separated by a number of

transcribing procedures carried out by the nursing staff. A Central Health Services Council report of 1958 had already expressed anxiety about the use of medicine lists because of the risk of transcribing errors inherent in the procedure and it was therefore decided to investigate locally the extent of these errors. Accordingly 400 prescriptions were taken at random and discrepancies between the prescription and medicine lists were found on 20 per cent of occasions. This finding was confirmed in a similar study in Belfast, where additional evidence obtained directly from the patients suggested a further 6 per cent discrepancy in the drugs actually administered (Wallace, 1965). Further evidence on this point has been published by Barker and McConnell (1962), Vere (1965), and Fogg (1965).

Because of these disturbing facts a system of drug prescribing and administration was devised for the Aberdeen General Hospitals Group based on a number of principles which, if observed, would eliminate transcribing errors and minimise errors of interpretation and execution. These principles are as follows:

1. No drug was to be administered without a prescription signed by a doctor, except in unusual circumstances. No exceptions were to be made even in the case of aperients, mild analgesics, or alkalis.
2. The signed prescription was to be recorded on a standard form (prescription sheet) which was also to be used as a medicine list to avoid transcription errors. Different sections of the prescription sheet were reserved for drugs that were to be given regularly at stipulated times and for drugs that were to be given 'once only'. Prescriptions for drugs to be administered parenterally were separated from other prescriptions on the sheet, which accordingly contained four sections.
3. No abbreviations were to be used. To this end, the prescription sheet was specially designed so that the times of administration of drugs could be precisely indicated.
4. Provision was made for prescribing drugs presenting special problems such as frequent change of dose, e.g. insulin and anticoagulants.
5. A standard method of drug administration, based on the Central Health Services Council Report (1958) was to be adopted.
6. Prescription sheets were to be kept together in a suitable holder for each convenient block of patients within a ward unit.

The investigation that led to the development of the Aberdeen prescribing system has been described in detail by Crooks *et al.* (1965) and was basically a continuous process of experimentation in document design and operational



Aberdeen General Hospitals — PRESCRIPTION SHEET

PARENTERAL DRUGS — REGULAR PRESCRIPTIONS

DATE COMMENCED	DRUG (Block Letters)	DOSE	TIMES OF ADMINISTRATION: AM 8	AM 10	MD 12	PM 2	PM 6	PM 10	MN 12	Other Times	METHOD OF ADMIN.	SIGNATURE	DISCONTINUED: DATE	INITIALS
A														
B														
C														
D														
E														

OTHER DRUGS — REGULAR PRESCRIPTIONS

F														
G														
H														
I														
J														
K														
L														
M														

PARENTERAL DRUGS — ONCE ONLY PRESCRIPTIONS

DATE GIVEN	DRUG (Block Letters)	DOSE	TIME OF ADMIN.	METHOD OF ADMIN.	SIGNATURE	GIVEN BY INITIALS
N						
O						
P						
R						
S						
T						

OTHER DRUGS — ONCE ONLY PRESCRIPTIONS

U						
W						
X						
Y						
Z						

DIET

DATE	DETAILS	INITIALS

APPROXIMATE METRIC AND IMPERIAL EQUIVALENTS

1 Milligram	=	$\frac{1}{60}$ Grain
60 Milligrams	=	1 Grain
1 Gramme	=	15 Grains
30 Grammes	=	1 Ounce
1 Kilogram	=	2$\frac{1}{2}$ Pounds
1 Millilitre	=	15 Minims
30 Millilitres	=	1 Fluid Ounce
600 Millilitres	=	1 Pint
1 Litre	=	35 Fluid Ounces

WARD	NAME OF PATIENT	AGE	UNIT NUMBER	CONSULTANT	DRUG SENSITIVITY: 1	2

Fig. 1. Prescription Sheet

procedures concerning drug handling. The data provided by the trial enabled a form of prescription sheet (cum medicine list) to be designed (Fig. 1) which eliminated transcribing by replacing all documents previously used (Fig. 2).

In addition to designing the prescription sheet the investigation allowed a series of detailed recommendations to be made for inclusion in the teaching manual used by the Nursing School and in a pamphlet for the guidance of medical staff, thus presenting the hospital group with a ward procedure that eliminated transcribing errors, fulfilled legal obligations, produced standardisation (valuable because of inter-ward and inter-hospital movement of staff and patients), flexibility, and the production of a good drug record. All hospitals in the group adopted the scheme and, as a bonus, the nursing time devoted to drug handling was reduced by one half because of the reduction in the number of operations.

In operational research in hospital or elsewhere it is not sufficient to recom-

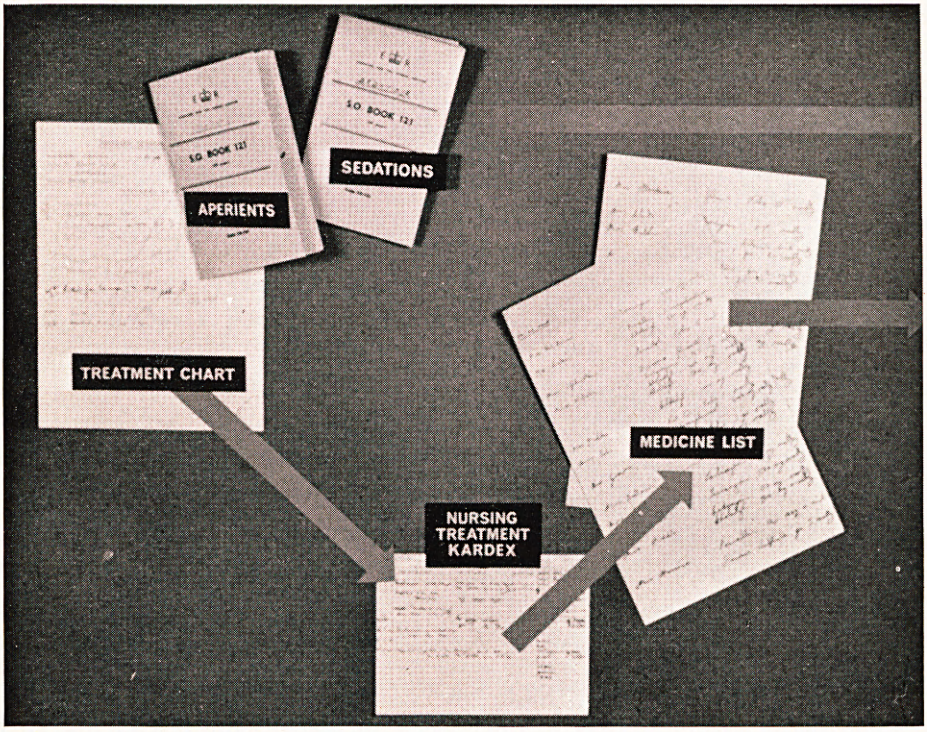


Fig. 2. Documents replaced by the Prescription Sheet

mend a procedure on the basis of trial conditions over a short period without evaluating the way in which the procedure is carried out in practice over a long period and to remedy deficiencies or introduce further improvements based on this evaluation. This has been achieved in Aberdeen by the formation of a permanent technical committee charged with supervision and development of the specific field of drug usage and given channels of communication designed to produce executive action. Such an evaluation of the prescribing system has been carried out and comprised retrieving and analysing a 1 in 10 sample of all prescription sheets of in-patients of the Aberdeen General Hospitals Group over an 18 month period (Crooks *et al*, 1967). An example of the type of information obtained was the finding that there was an overall rise with time in the frequency of printed prescriptions (reaching 70 per cent in the last 6 months) and a general improvement in legibility. Fogg (1965) has pointed out, and few would disagree, that illegible handwriting is the commonest source of misunderstanding in the interpretation of a prescription. It was also found that a prediction based on the

original trial, that the number of lines on the prescription sheet would be adequate, was correct. The information obtained in this analysis also allowed the production of a new set of recommendations concerning the operation of the system (Pharmaceutical Services Committee, Aberdeen General Hospitals, 1967) and provided the material for a programmed learning booklet for nurse training. It has confirmed that the prescription sheet in its present form is satisfactory apart from a minor modification to allow the recording of the administration of 'once only' drugs, which is described below and incorporated in Fig. 1.

The benefits that have followed from the introduction of the prescribing system fall into two categories.

1. *Immediate*

(*a*) Improved patient care—transcribing errors avoided, interpretative errors reduced.

(*b*) Economy in nursing time.

(*c*) The production of a good drug record.

2. *Potential*

(*a*) Development of a recording system for drug administration.

(*b*) The incorporation of the pharmacist into the ward team.

(*c*) The good drug record allows investigation of many aspects of drug usage in hospital by techniques of data processing and linkage.

THE ADMINISTRATION OF A DRUG

Many opportunities for errors occur during the act of administering a drug, and even when the prescription is legible and the directions are clear mistakes can happen. Vere (1965), for example, showed that there is a correlation between the error rate and the numbers of drugs a patient is receiving, and inferred that the work load is a factor. While the 'Aberdeen' prescribing system had eliminated transcribing errors it was not possible to detect errors in administration since, apart from DDA drugs, there was no record. This absence of a drug administration record is almost universal in Scottish Hospitals. In contrast, many hospitals in England, particularly the London teaching hospitals, keep detailed records of all drugs administered, but they are so unsuitable in form and frequently so voluminous that their value as a check is diminished. Further, the 'London' system is unacceptably wasteful in nursing time. It was resolved, therefore, that to be effective a drug recording system must be simple, accurate and economical in time. The method by

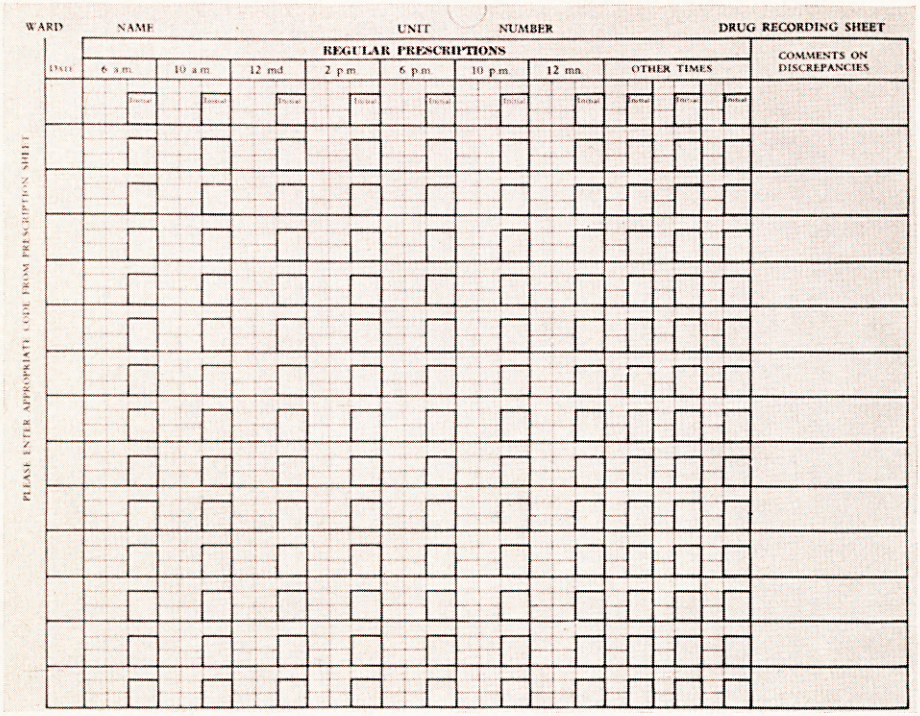


Fig. 3. Recording sheet

which this was achieved has been described in detail elsewhere (Crooks *et al.*, 1967) but the basis of the scheme is as follows. Each line of the section of the prescription sheet dealing with 'regular' drugs is given a code letter (Fig. 1). Without any effort on the part of the prescriber it is possible to represent an entire prescription by a single letter, which can then be used to record individual doses of that prescription. A similar sequence of pilot study, analysis and modification used in the evolution of the prescription sheet led to the development of a recording sheet with times of administration along the top and dates of administration down the side, as shown in Fig. 3. The intersection of time and date represents a specific medicine round with provision for the recording of a number of doses and, in addition, the initials of the nurse responsible. 'Once only' drugs were recorded as having been administered by drawing a line through the prescription and initialling in a column provided (Fig. 1). Although ward sisters were initially apprehensive about the system they found it to be economic in time and to be of value in the day-to-day management of their wards. Using this system discrepancies between

the prescription and recording sheets have fallen from 11 to 4 per cent over a 10-month period and we have evidence to suggest that less than half the latter figure is in fact errors of recording only.

The prescribing and recording system as devised is dependent upon a drug supply system that is basically unsatisfactory (Crooks, 1964; Calder, 1965; Fogg, 1966), that of ward stocks. It became necessary therefore to reconsider the methods by which drugs were supplied to wards from the pharmacy and the place of the pharmacist in the ward team.

THE SUPPLY OF A DRUG

The distribution of drugs in hospital has become a serious problem with the increase in the variety of drugs available. Three basic methods are currently used:

1. Total dependence on a complete ward stock.
2. Individual dispensing from the main pharmacy department.
3. A compromise between these two methods.

In Scotland the first method is that most commonly used. Prescriptions are interpreted and dispensed from the ward stock by nurses, and stocks are replenished by bulk requisition on the pharmacy. This situation is not wholly satisfactory. It leads to large quantities of drugs being accumulated in wards, much of the stock later becoming unusable. Under this system it is paradoxical that a nurse in hospital is made responsible for certain aspects of drug handling for which she has had minimal training, while the pharmacist's special training is not utilised.

The second method of complete individual dispensing from the main pharmacy does not merit serious consideration since it is not a practical proposition and there is no hospital of significant size in this country that distributes drugs by this procedure. In England and Wales the compromise method is most frequently used. A basic stock of 'standard' drugs is held on the ward together with other drugs obtained from the pharmacy department on prescription for individual patients. Under this system ward stocks still accumulate.

As a fresh approach the prescribing system evolved in Aberdeen stimulated an investigation into the methods by which the pharmacist could be incorporated into the ward team while retaining the advantage of one document for the prescribing and administration of drugs. The 'Aberdeen' system, which is evolving, is a compromise system with a basic difference from previous compromises in that the pharmacist has full control of ward stocks. He provides drugs in pre-packed units as per prescription sheet for a specified

patient and does so at ward level. The prescription sheet is the only requisition for drugs. This basic procedure is supplemented by the provision of stand-by stocks which are held at ward level. The replenishment of these stocks is the responsibility of the pharmacy team and not the nurse. Using this procedure it has been estimated that one pharmacist, assisted by pharmacy technicians, could be responsible for 200 to 300 beds. At each medicine round the nurse administers to the patient the required drug from the pre-packed unit in her medicine trolley (prepared by the pharmacist to cover at least a 24 hour period) according to the instructions on the prescription sheet, and records the administration of the drug. In a pilot study the distribution of all drugs, except, at the present stage those covered by the DDA, are handled in this way. It is, however, possible that the prescription sheet, together with the properly completed recording document will be the only dangerous drug records required at ward level and will thus eliminate the cumbersome DDA register.

It has been said that individual dispensing is the ultimate and desirable aim. However, it has been discovered that there is a large degree of individual dispensing in this bulk dispensing technique. In the pilot study at least 50 per cent of all the drugs supplied to a medical ward in any day were, in fact, for the use of only one patient, and the average over a period was 75 per cent

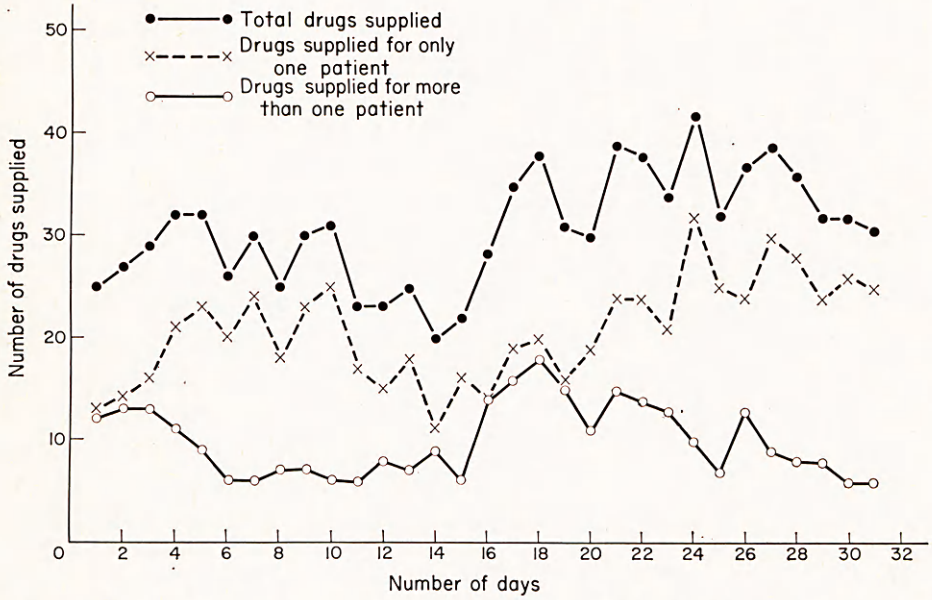


Fig. 4. Drugs supplied to a medical ward by ward pharmacist, showing by days the total number, the proportion for one patient only, and the proportion for more than one patient

(Fig. 4.). The system is being developed on the following lines. The time spent by the ward pharmacist and his assistants in providing a pharmaceutical service to wards is being ascertained on work study principles. The optimum design and utilisation of 'pharmacy trolleys' is being studied together with the type of professional advice the pharmacist can give to medical and nursing staff in respect of formulations etc., and to the way he can contribute to the detection and recording of adverse reactions to drugs.

It is already clear that a ward pharmacist can be of assistance in guiding a quality control section in the main pharmacy in respect of the effects of storage in a ward on the potency of medicaments. This concept of a ward pharmacist implies a redefinition of duties, the number and type of staff of the central pharmacy, together with the production of better documentation for all transactions. There is no doubt that, under the proposed 'Aberdeen' system, greater use will be made of the pharmacist's expert knowledge by ward nursing and medical staff. It has already been welcomed by nursing staff and an undoubted factor in this is the large saving in nursing time.

THE RECORD OF A DRUG

If information is not used and is not seen to be used then the point of collecting it is not clear and the chances of accurate recording become progressively less. As has been described in earlier sections of this paper, a new and accurate prescribing system has been introduced and a recording sheet, to determine whether or not the patient received a particular drug, has been devised. With the control of these two previously formidable unknowns it appeared worthwhile to attempt not only the routine analysis of the data already recorded but, in addition, to investigate the collection of information concerning potential side-effects of drugs.

Initially the aims and needs were modest; hand-punch cards were used, the patients and their diseases were described, the drugs prescribed and administered were listed, and any potential adverse effects recorded. In the pilot study an adverse effect was defined as any symptom or sign recorded in the progress notes by a doctor or nurse. Note was made of the actual description of the adverse effect which was then classified, for analysis, into one of 14 groups and thereafter referred to as an event.

Eventually the hand-sorted cards became inadequate and the data on prescription and recording sheets had to be coded on to machine cards and linked with diagnostic data for meaningful analysis (Crooks *et al.*, 1967). An experiment is being carried out to find the type and form of information that can be sent routinely to medical and nursing staff. Long tabular lists only bewilder the recipients and, to be successful, the presentation must be

informative and, though provocative on occasion, must avoid value judgements. In respect of the effectiveness of the procedure for drug administration the selection of the information to be fed back to the wards is relatively straightforward. This ought to include a statement of the records upon which the report is based and the reasons why certain records had to be excluded. There might then follow, for a sample of drugs only, an account of the total number of doses ordered and the total number recorded as having been administered. The discrepancy between the two figures, most conveniently expressed as a percentage, can then be compared for the ward receiving the report and for all wards participating in the scheme (Fig. 5). Such information is of immediate practical value, calling attention to difficulties in the

ABERDEEN GENERAL HOSPITALS

Pharmaceutical Services Committee

Report for period: 3rd July–27th August, 1966.
Ward/s: A.R.I. 24 male and A.R.I. 24 female.

Total number of patients discharged 162
„ number of completed records 141
„ Missing or incomplete { prescription sheets 5; recording sheets 8
„ Record folders "not available" 17

	Total number of doses Prescribed	Recorded	Percentage discrepancy	Percentage for all wards
DDA orders	22	20	9·0	7·3
Amylobarbitone	443	427	3·6	4·7
Other barbiturates	176	159	9·6	8·4
Tetracycline	196	185	5·6	6·4
Other antibiotics	180	172	4·4	5·1
'Once only' prescriptions	216	209	3·5	2·6

Fig. 5. Sample report for 'feed-back' to nursing staff

provision of records and providing a comparative index of performance in respect of a nursing function. The presentation of similar data, derived from the record of prescriptions, to medical staff is not so easily chosen, and a second experiment is being undertaken in the analysis of the distribution of diagnostic categories and the associated prescribing practices of the clinical

teams. One of the objectives of this development is to test the assumption that the feed-back of information to those creating records will influence performance and, if confirmed, might have much wider application in the hospital service.

FUTURE DEVELOPMENTS

The first development is concerned with the prescription and recording sheets. Now that a satisfactory form of recording has been achieved the next step is the automation of prescribing and drug administration. The aim would be that the act of prescribing a drug would automatically create a record that could be handled by a machine, without any further writing, copying or transcribing. Using such a system individual dispensing may become practical and also simplify accounting.

The recording of potential adverse effects has revealed a number of problems. How well are these effects ascertained? What is the significance of the words used to describe a possible drug reaction? Is a nurse likely to record an event calling for action on her part—is diarrhoea more likely to be recorded than a skin rash? The next step is not merely to investigate the frequency with which events occur and the proportion routinely detected but the reasons why doctors and nurses record certain events and the extent to which they are being selective.

Although the achievement of good drug records increased the possibility of successful drug monitoring in hospital it soon became apparent that this could not be realised without a similar improvement in other medical records, particularly summaries of medical and nursing notes. The key to the recovery and optimum utilisation of the information in case records appears to lie in standardised case summaries, and the benefits and improvements following carefully developed standardisation cannot be better exemplified than by the prescription sheet now used in Aberdeen. All members of the hospital team must recognise that they have a responsibility to record information concerning patients in a form that will facilitate its utilisation for immediately improving the quality of patient management and for adding to the medical knowledge on which the continued improvement of that management depends.

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Prescribing Systems in Hospital

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The systems that worked well in British hospitals twenty years ago can no longer contain the force of the 'therapeutic explosion'. Signs of strain appear in the pharmacy, where the burden of increasing work is made heavier by staff shortages. Pharmacists turn increasingly to industry and retail pharmacy, where work is more remunerative or on occasion more intellectually stimulating. The nursing work load also increases in volume and complexity; drug administration now occupies too high a proportion of the skilled nursing time available for the care of the patient. But nurses and pharmacists are by nature and calling uncomplaining people who soldier on, earning administrative praise for splendid efforts in impossible situations. Their efforts are not rewarded by or a justification of a laissez-faire policy.

Some of the grosser defects of British systems were exposed many years ago. The dangers of transcribed 'drug lists' were pointed out in 1959 (Trillwood) and emphasised in the Aitken Report (1958). Despite these recommendations some hospitals persist in ancient and highly risky systems. An anuric patient, recently transferred to the author's care, was accompanied by a mass of notes in which prescriptions occurred among the house physician's clinical findings. Among them was a script for a sulphonamide, but enquiry revealed that it had been written by a registrar and not given by the nurses. Recently, statistical evidence has appeared to amplify these impressions. Mistakes in recording or transcribing have been found in 5–20 per cent of drug administrations at various centres (Crooks *et al.*, 1965; Vere, 1965; Wallace, 1965).