

chosen should be the one on which there is the best observer agreement; here the fifth phase seems to win. When the fifth phase cannot be determined the fourth phase should be recorded, with a note to this effect, or a question mark placed against the diastolic reading. Until the issue is resolved both fourth and fifth phases should be recorded—for example, 140/80-70 mm Hg or 140/80-80 mm Hg or 140/80-?40 mm Hg. This is in line with the recommendation of the Expert Committee of the World Health Organisation,¹⁰ which has been re-emphasised by Kirkendall *et al.*⁸ If only one figure is given for the diastolic pressure and the phase is not stated, a margin of uncertainty of at least 5 mm Hg must be accepted. It should be assumed that the recording is made on the right arm unless otherwise stated, since patients are routinely examined from the right side.

References

- ¹ *British Heart Journal*, 1939, **1**, 261.
- ² Bordley, J, *et al*, *Circulation*, 1951, **4**, 503.
- ³ *Build and Blood Pressure Study*. Chicago, Chicago Society of Actuaries, 1959.
- ⁴ Veterans Administration Co-operative Study Group, *Journal of the American Medical Association*, 1970, **213**, 1143.
- ⁵ Kannel, W B, and Dawber, T R, *British Journal of Hospital Medicine*, 1974, **11**, 508.
- ⁶ Kirkendall, W M, *et al*, *Circulation*, 1967, **36**, 980.
- ⁷ Stamler, R, *et al*, *Lancet*, 1975, **2**, 1227.
- ⁸ Peart, W S, and Miall, W E, *British Medical Journal*, 1975, **4**, 578.
- ⁹ Hawthorne, V M, *et al*, *British Medical Journal*, 1974, **3**, 600.
- ¹⁰ World Health Organisation, *Arterial Hypertension and Ischaemic Heart Disease: Preventive Aspects*, Technical Report Series No 231. Geneva, WHO, 1962.

Hospital Topics

Deviation from prescribed drug treatment after discharge from hospital

D M PARKIN, C R HENNEY, J QUIRK, J CROOKS

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Summary

A study of 130 patients discharged from four hospital wards dealing mainly with acute medical cases showed that 66 deviated from the drug regimen prescribed on discharge. Of the patients, 46 did not have a clear understanding of the regimen (non-comprehension) and 20 of the remaining 84 patients understood the prescribed regimen but did not follow the instructions (non-compliance). The prescribing of complex drug regimens, and the availability of medicines prescribed before admission to hospital appeared to be the two main factors influencing non-comprehension and non-compliance.

Introduction

General medical wards are dealing increasingly with acute episodes of chronic diseases. Hence many patients are discharged

receiving treatment for the chronic disease as well as for any aftermath of the acute episode. Some patients, however, fail to take the prescribed treatment correctly or default from it.^{1 2} We report the extent to which patients discharged from four general medical wards deviated from their prescribed drug treatment and try to identify the main factors responsible.

Patients and methods

Altogether 169 patients were considered for inclusion in the study. They had been discharged, during a four-month period, from two men's and two women's general medical wards of a teaching hospital that also serves as a district general hospital. The criterion for inclusion was that one or more drugs had been prescribed at the time of discharge and had to be taken regularly for more than 14 days. Permission to visit the patients at home 10 days after leaving hospital was sought both from the patients and from their general practitioners. At the time of discharge each patient was given a supply of drugs to last exactly 14 days. The general practitioner gave information on changes to the regimen together with details of additional drugs prescribed. Such changes were taken into account when assessing the degree of deviation from the prescribed regimen.

At the home visit a standard interview schedule was used. The patients were asked to state what medicines they were taking, what their dosage and times of administration were, and whether they were prescribed at hospital or by the general practitioner or were self-prescribed. Each patient's description of his regimen was compared with the regimen prescribed by the hospital or as modified by the general practitioner. Any discrepancies between them were defined as being due to non-comprehension.

After interview the patients were asked to produce all the medicines they were taking. In the studies of non-compliance the quantities and dates of issue of the drugs were known, so that by checking the amounts remaining we could estimate how much of each the patient was likely to have taken. The discrepancy between that amount and the amount prescribed for an individual drug was expressed as a percentage of the correct dose and described as the "percentage deviation" for that drug. Estimates of patients' compliance with treatment were derived by taking the percentage deviation score for each of the drugs prescribed

Scottish Home and Health Department, Edinburgh

D M PARKIN, MRCP, DIP SOC MED, fellow in community medicine (present address: Royal College of Physicians, Edinburgh)

Medicines Evaluation and Monitoring Group, Ninewells Hospital and Medical School, Dundee DD2 1UD

C R HENNEY, RGN, SCM, research nursing officer
J QUIRK, SRN, research nurse

University Pharmacology and Therapeutics Department, Ninewells Hospital and Medical School, Dundee DD2 1UD

J CROOKS, MD, FRCP, head of department

and calculating the mean. This was described as the mean percentage deviation (MPD) score.

Patients interviewed in the last month of the study were revisited four weeks later and MPD scores calculated for both periods, the same drugs being used in each. All the patients interviewed were followed up six months after their discharge from hospital and deaths and readmission recorded.

Results

Of the 169 patients, 11 refused to participate, 20 could not be traced, and four were too ill to be interviewed. The remaining 134 patients were interviewed successfully 10-14 days after being discharged. Altogether 54 were men and 80 women, and their mean age was 66.2 ± SD/10.78 years. Twenty-four of these patients lived alone, and 103 (including 54 with ischaemic heart disease and 23 with congestive cardiac failure) had chronic disorders of the cardiovascular system; 114 (85%) had been on regular medication at the time of admission.

At the time of interview 373 drugs needing regular administration had been prescribed for the group, over half of them being digoxin, diuretics, and mineral supplements (mainly potassium). Some 43% of the drugs prescribed on discharge were being taken by the patients immediately before their admission. Only five patients were not taking any of the drugs prescribed by the hospital—two diuretics, an anti-depressant, a hypnotic, and an oestrogen preparation.

NON-COMPREHENSION

Four patients relied entirely on relatives or friends to give them their drugs. A total of 367 drugs had been prescribed for the others, and 84 of these patients (64.6%) correctly described their regimens. The 46 patients (35.4%) who did not included 26 who were either omitting one of their drugs or taking one or more in incorrect dosage. Most of these patients were unsure of the correct dosage or took their medicines only when they felt they were necessary. Some had reverted to dosages that they had been taking before admission and had ignored modifications made by the hospital. In this group of 26 patients there was a strong association ($P < 0.01$) between making such errors and having taken one or more of the drugs before admission. Furthermore, the proportion of patients who made such errors was associated with the number of drugs prescribed ($P < 0.001$) (table I). Similarly, the greater the number of daily doses of drugs prescribed the more likely the patient was to mistake the correct dosage ($P < 0.025$) (table II).

Of the 46 patients showing non-comprehension, 26 (a different group from that referred to above) were taking, at least once daily, drugs that were not part of their scheduled regimen. Only five were "over-the-counter" medicines; the remaining drugs had been prescribed at some time in the past and had been restarted on the patients' own initiative after discharge. These were mostly sedatives, tranquillisers, and hypnotics but also included thyroxine, ampicillin, iron, and aminophylline suppositories.

TABLE I—Presence and absence of errors of dosage and numbers of drugs prescribed. Figures are numbers of patients

Errors with dosage	No of drugs prescribed				Total
	1	2	3	≥4	
Present	14	4	6	15	26
Absent	1	44	26	20	104
Total	15	48	32	35	130

TABLE II—Numbers of drugs with which errors of dosage were and were not made and numbers of daily doses prescribed

	No of daily doses				Total
	≤1	2	3	≥4	
Errors	12	4	11	8	35
No errors	143	52	114	23	332
Total	155	56	125	31	367

$\chi^2 = 10.51$; $DF = 3$; $P < 0.025$.

Age, sex, social class, education, and social isolation of the patients did not influence non-comprehension. Their level of knowledge about their illnesses and of the names and purposes of their medicines and their degree of satisfaction with the amount of information received while in hospital were also unrelated. Some classes of drug—notably those acting on the central nervous system, such as sedatives, tranquillisers and hypnotics—were more likely to be taken in incorrect dosage than drugs acting on the cardiovascular system—an effect not due to differing frequency of doses.

NON-COMPLIANCE

We estimated compliance only when the correct dosage for each drug in the scheduled regimen was clearly understood by individual patients. Thus 116 MPD scores were available; 30 scores deviated by 15% or more, and if this arbitrary level of deviation is taken as indicating non-compliance then the non-compliance rate was 25.9%. For eight drug regimens the MPD scores were 30% or more.

Non-compliance, like non-comprehension, was significantly related to the number of drugs prescribed ($P < 0.025$) (table III). Age, sex, and social isolation were unrelated to compliance, and associations with social class ($P < 0.1$) and education ($P < 0.2$) were not statistically significant. The patients' understanding of their illnesses and the treatment prescribed was unrelated to compliance. Difficulty or unpleasantness of administration was not associated with compliance, and percentage deviation scores were unrelated to the class of drug or number of daily doses.

TABLE III—Numbers of individual drug regimens with which patients did or did not comply according to the total number of drugs prescribed to the patient

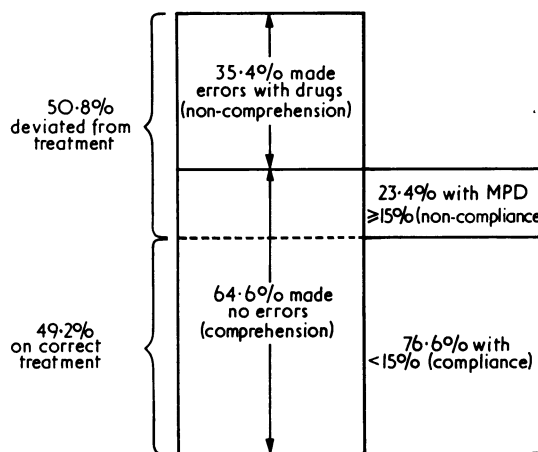
MPD score	No of drugs prescribed				Total
	1	2	3	≥4	
≥15%	1	7	12	10	30
<15%	13	35	15	23	86
Total	14	42	27	33	116

MPD = Mean percentage deviation.

MPD scores of the patients in whom they were measured twice after discharge—once at the initial interview 10 days afterwards and again 28 days later—did not differ significantly in individual patients between the two periods ($P = 0.28$; Wilcoxon's test for pair differences).

DEVIATION FROM TOTAL DRUG REGIMENS

The figure shows the proportion of patients who deviated from total drug regimens because of non-comprehension and non-compliance. Overall 66 patients (50.8%) did not take the drugs prescribed for them



Deviation from total drug regimens in 130 patients. MPD = Mean percentage deviation.

or took additional drugs. Altogether 46 patients (35.4%) made one or more errors with their drugs due to non-comprehension, and of the 84 (64.6%) who did not, 20 (23.4%) had MPD scores of 15% or more for non-compliance.

CLINICAL SIGNIFICANCE OF DEVIATION FROM TREATMENT

No attempt was made to categorise the drugs prescribed by their degree of value or necessity to the patient. It is therefore difficult to estimate the importance of drug defaulting in this group, although clearly some deviations from treatment—for example, omitting diuretics—are likely to be more serious than, for example, taking 80% of the correct dose of a hypnotic. The patients made fewer mistakes of dosage with drugs such as digoxin, anticoagulants, and steroids, and more than average with psychotropic drugs and mineral supplements, such as potassium and calcium. The differences, however, were not statistically significant.

Because of the heterogeneous nature of the patient group in respect of diagnosis and severity of illness, assessment of outcome in relation to deviation from treatment was not possible. At follow-up six months after discharge 42 of the patients had died or been readmitted to hospital, but this group did not significantly differ from the others in respect of the degree of non-comprehension or non-compliance found at the time of interview.

Discussion

Deviation from prescribed drug treatment may be due to failure to understand the nature of the regimen (non-comprehension) or lack of adherence to it even when the correct regimen is known (non-compliance). Interviewing patients can determine which of them do not know what drugs to take or when,^{3 4} but patients who are non-compliant may not admit the fact on interview.^{5 6} Compliance can be assessed only by objective tests; pill-counting has been widely used to achieve this when the regimens consisted of several different drugs.^{7 8}

The patients studied were elderly; most had chronic diseases and had been receiving drug treatment before hospital admission. Half of them were found to be deviating from prescribed treatment because of either non-comprehension or non-compliance, or both. Although some studies have shown that the elderly⁹ and those living alone⁸ are more prone to drug-defaulting, none of the sociodemographic variables we examined, such as age and social isolation, were helpful in predicting which patients would deviate from treatment. It has been reported that teaching patients about their illnesses and the treatment prescribed does not affect the number of mistakes that they make with their drugs⁹ or increase their compliance.^{10 11} Certainly we were unable to show any association between drug-defaulting and level of knowledge.

The two factors found to be associated with non-comprehension and non-compliance in discharged hospital patients were the complexity of the prescribed regimen and the drug treatment that had been taken before admission. Both non-comprehension and non-compliance occurred more often than expected in patients on regimens comprising several different drugs. This finding has been reported by others.^{4 12} In addition, mistakes in the dosage of drugs were significantly more common for those drugs prescribed in several daily doses. It follows that adherence to drug treatment is unlikely to be improved unless doctors attempt to make their patients' regimens as simple as possible; in this context the use of combined drug preparations may have benefits that outweigh their theoretical disadvantages.¹³

Many patients appear to hoard old prescribed medicines.^{14 15} In this study common sources of error were using dosages that had been operative before hospital admission, and the reversion to old prescriptions after discharge. These mistakes are understandable when several supplies of the same drugs are available to patients with conflicting instructions on the labels. It is difficult to know how to prevent this, but more publicity could be given to the need to dispose of unwanted medicines,¹⁵ and

hospital patients might be induced to hand in all their old medicines at the time of admission (or before discharge) and given permission for their destruction.

Although the patient's knowledge of his diagnosis and of the names and purposes of his drugs does not correlate with the number of mistakes made, there seems to be scope for reducing non-comprehension by better communications between doctor and patient regarding drug treatment.¹⁶ Some reports have described programmes in which the patient was made responsible for the administration of his own drugs while under supervision in the ward.^{17 18} Trials of such systems seem to be worth while to see if deviation from treatment after discharge can be reduced. The development of methods of achieving more effective co-ordination of hospital and community medical care in the use of drugs would also contribute to the solution of the problems identified by this investigation.

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References

- 1 Marston, M V, *Nursing Research*, 1970, **19**, 312.
- 2 Stewart, R B, and Cluff, L E, *Clinical Pharmacology and Therapeutics*, 1972, **13**, 463.
- 3 Schwartz, D, *et al*, *American Journal of Public Health*, 1962, **52**, 2018.
- 4 Hulka, B S, *et al*, *Journal of Chronic Diseases*, 1975, **28**, 7.
- 5 Park, L C, and Lipman, R S, *Psychopharmacologia*, 1964, **6**, 299.
- 6 Gordis, L, Markowitz, M, and Lilienfeld, A M, *Medical Care*, 1969, **7**, 49.
- 7 Johnson, D A W, *British Medical Journal*, 1973, **2**, 18.
- 8 Porter, A M W, *British Medical Journal*, 1969, **1**, 218.
- 9 Malahy, B, *American Journal of Hospital Pharmacy*, 1968, **23**, 283.
- 10 Roth, H P, and Caron, H S, *Gastroenterology*, 1973, **64**, 840.
- 11 Sackett, D L, *et al*, *Lancet*, 1975, **1**, 1205.
- 12 Latiolais, C J, and Berry, C C, *Drug Intelligence and Clinical Pharmacy*, 1969, **3**, 270.
- 13 Dollery, C T, *Prescribers' Journal*, 1968, **8**, 7.
- 14 Dunnell, K, and Cartwright, A, *Medicine Takers, Prescribers and Hoarders*. London, Routledge and Kegan Paul, 1972.
- 15 Law, R, and Chalmers, C, *British Medical Journal*, 1976, **1**, 565.
- 16 Fletcher, C M, *Communications in Medicine*. London, Nuffield Provincial Hospitals Trust, 1973.
- 17 Buchanan, E C, Brooks, M R, and Greenwood, R B, *American Journal of Hospital Pharmacy*, 1972, **29**, 928.
- 18 Roberts, C J, and Miller, W A, *Drug Intelligence and Clinical Pharmacy*, 1972, **6**, 408.

How serious are the gastrointestinal side effects of lithium and why should these occur if the drug is soluble and is said to be completely absorbed in the stomach?

Lithium salts may cause nausea, vomiting, and diarrhoea in several ways. Nausea and vomiting may be caused by gastric irritation, for delayed release tablets do not release much of the salt in the acid environment of the stomach but do so when they encounter alkaline juices of the small intestine.¹ Some patients experience nausea from this cause when taking lithium on an empty stomach. They should take the salt with food. Nausea, vomiting, and diarrhoea may occur as centrally mediated toxic effects of lithium, and the appearance of these symptoms is dose-related. Lithium should not be blamed for such symptoms unless the serum lithium concentration rises above 1.5 mmol/l at some time during the 24 hours.¹ All these effects are reversible. Patients should be warned they may occur so that they can stop taking lithium, take plenty of fluids, and add extra common salt to their diet for 24 hours. They should seek medical advice before restarting lithium.

¹ Crammer, J L, Rosser, R M, and Crane, G, *British Medical Journal*, 1974, **3**, 650.