

Observation of Medication Errors Made by Diabetic Patients in the Home

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SUMMARY

Observations for accuracy in carrying out prescribed medication regimens were made at home on two groups of diabetic patients. The first group included sixty patients (all taking insulin and cared for in two university clinics), and the second 102 patients (fifty-five taking insulin and forty-seven taking oral hypoglycemic agents) cared for in two university clinics, a voluntary hospital clinic, and twenty-two different private practices.

Fifty-eight per cent of 115 patients taking insulin made dosage errors. "Potentially serious" errors, i.e., those in which the measured dose differed from the prescribed dosage by 15 per cent or more, occurred in 35 per cent. In the first group, seven of thirty-four patients (21 per cent) using the U40-U80 "convertible" syringe measured either half or twice the prescribed dose through use of the wrong scale. Rates of error were similar in clinic and in private patients. The frequency of insulin errors increased with duration of known diabetes.

Among forty-seven patients taking oral drugs, 23 per cent made "potentially serious" errors, and 26 per cent reported missing one dose or more per month.

The findings indicate the need for more extensive knowledge of what the diabetic patient does at home, for seeking the reasons for his behavior, and for finding ways to achieve sustained improved performance. *DIABETES* 16:882-85, December, 1967.

It is well known that patients with diabetes may make errors in medication. For example, Joslin commented in 1946: "The danger of confusion in measuring the dose of insulin is real. . . . In order to guard against errors it is well to verify the patient's dosage at each visit. Even a clergyman and a doctor make mistakes, and patients who have taken insulin over a period of years

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are quite as likely to be wrong in their reports as those just beginning. Partly for this reason, the simplest type of syringe is desirable. . . ."¹ This view is expressed also by other investigators in this and other countries.²⁻⁴

The fact that errors or omissions in self-administered medications may be more frequent and potentially more serious than is generally recognized has been demonstrated by observations made in other diseases and conditions.⁵⁻⁸ We are not aware, however, of studies conducted to estimate the extent of medication errors made by patients with diabetes. Therefore, we have carried out by home interview and observation an investigation for such errors. The findings revealed a high frequency of errors. Part of the data have been reported in summary elsewhere.⁹

METHODS

1. Patients

Data were obtained on 162 patients with diabetes. One hundred and fifteen were taking insulin, and forty-seven oral hypoglycemic drugs. Of those taking insulin, 73 per cent were white, 60 per cent were women, and 28 per cent had an education of high school level or above. Only 23 per cent were judged to be in good or fair diabetic control according to criteria previously published.¹⁰ All of the forty-seven patients taking oral hypoglycemic drugs were white, 64 per cent were women, and 19 per cent had an education of high school level or above. Sixty-two per cent of the patients on oral agents were judged to be in good or fair diabetic control.

The patient sample for study was derived from two separate groups.

Group I. Part of the sample was drawn from a population of patients attending two university metabolic clinics.⁹ It consisted of patients taking insulin who were of sixteen years of age or more. They were seen during a four-month period, and information was obtained for rating diabetic control. Although seventy-five patients

were available for observation, complete information could be obtained from only sixty (80 per cent).

Group II. The remainder of the sample was drawn from three clinics and twenty-two private practices existing within a fifty mile radius of the study site.¹¹ This group was selected primarily to study the effect of family relationships. The patients were white, and all were married (living with spouse). They were receiving either insulin or oral agents. Of 106 patients meeting the criteria, complete information was obtained on 102 (96 per cent). Fifty-five were taking insulin, and forty-seven oral drugs.

2. *Interviews*

Interviews were conducted by three public health nurses and a medical student. Each patient was visited in his home by one of the interviewers who, following a structured protocol, obtained information from the patient about his diabetic regimen. As a part of the inquiry, each patient was asked the following:

- (a) To state the medication and dosage (insulin or oral hypoglycemic drug) last prescribed by his physician.
- (b) To state the dosage he was taking at the time of the interview.
- (c) To show the interviewer the insulin and syringe he was currently using, and to measure the insulin dosage he was taking (if taking insulin).
- (d) To show the interviewer the number of tablets he was currently taking, and to state how often he missed taking a dose (if taking oral hypoglycemic drugs).

3. *Errors of medication*

The findings at interview were compared to the actual medication order obtained either from the patient's medical record or from his physician. When differences were found, they were classified as errors in medication in the following manner:

- (a) *Communication errors:* Those in which the patient's statement of his insulin prescription differed from the order written in the medical record;
- (b) *Measurement errors:* Those in which the patient's measurement of his insulin dosage or statement of oral hypoglycemic drug schedule differed from his statement of the dose he was taking;
- (c) *Over-all errors:* Those in which the insulin dose measured, or oral dose demonstrated, by the patient differed from the dose actually prescribed by the physician. The degree of this type of error was estimated as follows:

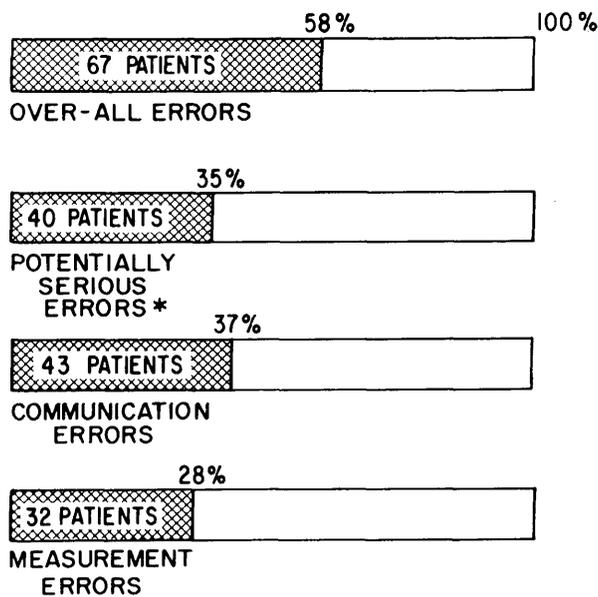
$$\frac{\text{dosage error}}{\text{dosage prescribed}} \times 100 = \text{per cent medication error.}$$

Over-all errors ranged from 5 to more than 100 per cent. If the prepared dose differed from that prescribed by 15 per cent or more, the error was called "potentially serious."

RESULTS

1. *Insulin errors.* The patients taking insulin in both groups were pooled in estimating insulin errors inasmuch as differences in selected characteristics of the group, thought to have possible differential associations with medication behaviors, were found to be statistically nonsignificant. In figure 1 are summarized the percentages of patients making errors. There was an unexpectedly high frequency of improper dosage, i.e., sixty-seven patients (58 per cent) making one or both types of error. In forty-three patients (37 per cent) the error arose from faulty communication, and in thirty-two (28 per cent) the patient failed to measure the correct amount of insulin in his syringe. The error was "potentially serious" in forty patients (35 per cent). In table 1 are listed the communication and measurement errors derived in Group I. The fact that seven of the forty-one patients used the wrong scale on the U40-U80 conver-

115 DIABETIC PATIENTS ON INSULIN



* (15% - 100% ERROR)

FIGURE 1

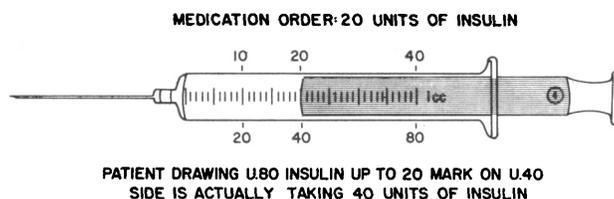


FIGURE 2

tible-type syringe points up hazard in its use (figure 2).

Certain variables were examined for their relations to errors in insulin dosage. Groups I and II were pooled in regards to effects of age, sex, and duration of known diabetes. No statistically significant relationship of age, race and sex to error was found. There was, however, a relation with duration (table 2). Those who had known diabetes of fifteen or more years' duration made more errors. There was suggestion of an increase in error in those with the least education in Group II, but the difference was not significant.

The patients of Group II were questioned as to satisfaction with medical care. Those who professed to be very satisfied were less likely to make errors in insulin dosage (table 3). The conditions under which the patient was receiving the care—whether in a private physician's office or in a clinic—made no difference in error making.

2. *Oral hypoglycemic agent errors.* Among forty-seven patients on hypoglycemic agent regimens, twelve (26 per cent) made medication errors. In eleven instances the errors were of the communication type; the patient's statement of his dosage differed from the physician's medication order in the medical record. One patient made a measurement error in that he was taking a dosage different from that which he said he was taking. Eleven made errors of 15 per cent or more. The frequency of errors found is comparable to reports on patients taking other oral medications.⁵⁻⁸

Thirty-one patients stated that they never missed a dose. Four said they occasionally missed a dose, e.g., once every three or four months. Twelve patients (26 per cent) reported omitting a dose once a month or more often, half stating that they missed a dose at least once a week. In contrast, the patients in the second group taking insulin stated that they rarely missed a dose, only 4 per cent reporting they omitted an injection as often as once a month.

DISCUSSION

A disturbingly high prevalence of error-making in both insulin dosage and in taking oral medications was

TABLE 1
Insulin errors by type (Group I)

Communication errors	Number
a. Number of units stated by patient different from number of units prescribed by physician	14
b. Dosage patient taking different from dosage prescribed by physician	3
c. Type of insulin patient used different from type prescribed by physician	2
Measurement errors	
d. Drawing up to the wrong calibration on syringe	8
e. Using wrong scale on "convertible" syringe	7
f. Attempting to measure more than syringe would hold	3
g. Incorrect mixing of long- and short-acting insulin	3
h. Measuring U-80 insulin in U-40 syringe	1
Total	41*

*Thirty-one of sixty patients made forty-one errors. Nine patients made more than one error.

TABLE 2

Patients making insulin errors according to duration of known diabetes (Groups I and II)

Years' duration	No errors	Errors of <15%	Errors of ≥15%	Total
14 or less	36(51%)	16(23%)	18(26%)	70(100%)
15 or more	12(27%)	11(25%)	22(49%)	45(100%)
Total	48(42%)	27(23%)	40(35%)	115(100%)

$\chi^2 = 8.26, p < .025, 2 \text{ d.f.}$

TABLE 3

Patients making insulin errors according to degree of satisfaction with medical care (Group II)

Satisfaction	No errors	Errors	Total
Very satisfied	16(47%)	18(53%)	34(100%)
Fairly satisfied, or not satisfied	3(16%)	16(84%)	19(100%)
Total	19(36%)	34(64%)	53(100%)

$\chi^2 = 3.89, p < .05, 1 \text{ d.f.}$

found in the patients observed. It is possible that the presence of an interviewer may have affected the patient's measurement of his insulin dosage, for better or worse.

In a subsequent re-evaluation, twelve to eighteen months later, of a stratified random sample of twenty-three of the patients originally included in Group I of this study, it was found that only 20 per cent were mak-

ing fewer errors in insulin dosage whereas 48 per cent were making more errors.¹² Thus a second observation on the same patients tended to show poorer rather than better performance. This finding also is consistent with the above data relating to the duration of disease.

The findings indicate the need for improvement of self-medication habits among diabetic patients—certainly in the populations observed. These errors call attention to the following needs:

1. *Improved communication technics.* One cannot always rely upon word-of-mouth transmission between physicians and patient. In most cases the patient should receive written instructions about kind, dose, and time of medication. The concentration of insulin should be specified. Instructions should be dated and signed by a physician so that anyone who assists the patient (family member, public health nurse, visiting nurse) is fully cognizant of the treatment plans. Where insulin and syringe are dispensed without prescription it may be advisable for the patient to show the written instructions to the pharmacist.

2. *Simplified medications and equipment.* The use of only one concentration of insulin and one type of syringe would be very helpful. Indeed, the confusing and dangerous "convertible" syringe should be eliminated. Patients should be taught enough about differences in types and concentrations of insulin and types of syringes to be selective and accurate when obtaining supplies. If such instructions are not appropriate for certain patients, their selection of equipment should be supervised by responsible persons.

3. *Further study in regard to omissions of oral medications.* More information is needed about why patients omit doses. Inasmuch as forgetfulness is probably a factor in omissions, a calendar, with check marks, similar in principle to that used for oral contraceptives, could be adapted to oral hypoglycemic therapy. Lack of money could be another reason for omissions, although in this study patients using insulin apparently were able to obtain their medications. The omission of an oral drug may not seem as important psychologically to the patient as omission of the more dramatic injection of insulin.

4. *Continuing education.* The fact that errors in insulin dosage appeared to increase with duration of diabetes indicates a need for continuing supervision of the patient's management of the disorder. Too often emphasis on education is given only at the time of diagnosis. There should be not only a close, but also a continuing relationship with medical personnel (physicians and

nurses, including visiting nurses).¹⁰ Continuing education should be based on knowledge of what the patient is actually doing in the home. Such information can be obtained by periodic assessments. In certain instances the patient should bring his own insulin and syringe (or bottle of tablets) to the clinic or doctor's office to be certain that both the doctor and patient have the same understanding of the medication being taken. In addition, attention should be given to side factors, e.g., failing vision, which could influence the patient's measurement of insulin or testing of urines.

Finally, errors in medication can affect control of diabetes. Most investigations of degrees of control in different diabetic populations have commented on the high prevalence of unsatisfactory control found. Poor comprehension by the patient of treatment with resulting improper dosage of medication may contribute in part to poor control.

ACKNOWLEDGMENT

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