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Commentary

A review of medication errors and compliance in ambulant patients

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One assumes that patients will follow the physician's directions and benefit from his diagnostic and therapeutic acumen. While these assumptions seem reasonable, prospective studies have indicated that patients frequently do not comply with the physician's directions. These studies have disclosed an alarming rate of medication errors and noncompliance with regard to drug taking by patient populations. This paper reviews studies conducted to determine medication errors and compliance in ambulant populations. The study of medication errors and compliance in outpatients is difficult. However, the desire of health professionals to have follow-up information has led to several investigations in the past 2 decades.

Medication error studies (Table I)

The methods used to conduct these studies were generally of 3 types. One method

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consisted of an initial interview with the patient at the time medications were dispensed followed by an interview in the patient's home a few days later.^{5, 9, 12, 18} Watkins and associates²¹ observed their patients for accuracy in carrying out prescribed medication regimens at home. A third method consisted of structured medication interviews with the patients at the time of their visits to a chronic care clinic.¹⁹

The percentage of patients making errors in the self-administration of prescribed medications, with few exceptions, has ranged between 25 and 59 per cent. In the institutions in which these studies were conducted there were variations in the definition of medication error and investigational methods. One investigator¹⁹ considered it an error if the patient did not have an understanding of the purpose of the prescribed medication, while another¹⁰ identified a medication error only if the patient had failed to take a dose. In addition, 4 to 35 per cent of the patients were misusing their medications in such a manner as to pose serious threats to health.^{9, 19, 21}

Table I. Medication error studies

<i>Authors</i>	<i>Patient type (diagnosis)</i>	<i>No. of patients monitored</i>	<i>Per cent of patients making errors</i>	<i>Drug studied</i>	<i>Type of institution</i>	<i>Economic classification of patient</i>
Schwartz ¹⁹	Mixed	178	59 26, serious errors	Mixed	General medical clinic, New York hospital	Not stated
Malahy ¹²	Mixed	40	36 to 90	Mixed	University (outpatient clinic)	Not stated
Watkins et al. ²¹	Diabetes mellitus	115	58	Insulin	Two university metabolic clinics	Not stated
		47	26	Oral hypogly- cemic		
Clinite and Kabat ⁵	Mixed	30	25.1	Mixed	Veterans hospital	Veteran
Latiolais and Berry ⁹	Eye, ear, nose and throat General medical Circulatory Surgical Obstetrics- gynecology Psychiatry	180	42.8	Mixed	University clinics	Indigent
Libow and Mehl ¹⁰	Mixed	20	25	Placebo	Mt. Sinai hospital	Elderly

In one study of diabetic patients, 7 of 34 patients measured either half or double the prescribed dose of insulin through the use of the wrong scale on the U40-U80 syringe.²¹

Factors affecting the occurrence of medication errors are summarized in Table II. The tendency to make errors in self-administration of medications does not consistently correlate with any factors although aging seems to be one. When patients understand the purpose or know the names of their medications things seem to be better. One investigator¹⁹ found fewer single and married patients making medication errors than patients who were widowed, divorced, or separated. In another study⁹ marital status had no significant relationship.

Medication compliance studies (Table III)

Many methods have been used to determine whether patients follow the physicians' directions and take medication which has been prescribed. One method was to measure the amount of medication remaining in the prescription bottle.^{11, 13, 14, 18} Another method used to determine compliance was to test the patient's urine for the presence of the drug.^{3, 6, 7, 16, 22} Some used² both pill count and urine sample methods. One study¹⁵ employed a take-home medication dispenser that included radioactive material and photographic film to record the regularity with which patients removed medication packets and, in addition, the administration of regular urine tests. Renton and associates¹⁷ ob-

Table II. Factors having an effect on the occurrence of medication errors

Authors	Increased age	Sex	Number of medications	Increased education	Knowledge of medication, purpose, or name
Schwartz ¹⁹	I	0	0	D	—
Malahy ¹²	0	—	I	0	D
Clinite and Kabat ⁵	0	—	I	—	—
Latiolais and Berry ⁹	I	0	I	0	D

I = increased occurrence of errors; D = decreased; 0 = no effect.

tained their information by follow-up interviews of schizophrenic patients in the home. In addition to the patient, a key informant who had close connection with the patient was also contacted.

The percentage of patients failing to take their medication as directed, with few exceptions, ranged from 20 to 82 per cent. In one study¹⁵ individuals judged to be very unreliable were excluded from the test group and only "reliable" patients were included. Even with this restriction, 31 per cent of the reliable patients took less than 70 per cent of their medication.

Few characteristics have been identified which will allow one to predict the reliability of patients concerning the use of their medication. In a study of antacid use Roth¹⁸ found no correlation between the amount of antacid prescribed and the amount taken or with the duration of the patient's ulcer illness or his age. One study¹⁶ found that an income above \$8,000 per year correlated with better medication consumption. In a study of neurotic patients,¹¹ the more severely ill patient from lower socioeconomic background was the more likely to deviate from the prescribed drug program.

Discussion and perspective

In 1962, Barker and McConnell¹ published a study of hospital medication errors which revealed that the average nurse made one error for every 6 medications given. The results of this study had tremendous impact and eventually stimulated a revolution in drug distribution systems in American hospitals.

The studies reported in this review have

had little effect on our method of supplying drugs to patients, nevertheless they point to a major problem in our health care system that is in need of reappraisal. In our present health care system primary emphasis is placed on diagnosis and then the prescribing of a certain course of therapy for the patients. What happens from this point on has largely been a matter of chance. Whether the prescription is ever filled, whether the patient takes the medication as directed, or whether he is also taking other medication that may interact, has been open to speculation.

It has been observed that 5 per cent of patients have a drug-induced disease on admission to the hospital.^{8, 20} At Johns Hopkins Hospital adverse drug reactions were the seventh most common cause for admission to one of the medical services.²⁰ At the University of Florida a high percentage of patients are admitted to the medical service with adverse drug reactions resulting, not from the inherent toxic property or an idiosyncratic reaction, but from improper use of the drug.* In a recent study¹ patients were interviewed to determine if they were taking prescribed medication. It was found that 92 per cent had continued the use of digoxin, 83 per cent had continued hydrochlorothiazide, while only 60 per cent had continued to use potassium chloride. From these results it is easy to see why the hospital continues to admit patients with severe hypokalemia.

Presently, patients usually receive their prescriptions for discharge medications shortly before going home. Often the physi-

*Cluff, L. E., and Stewart, R. B.: Unpublished data.

Table III. Compliance studies

Authors	Patient type (diagnosis)	No. of patients monitored	Per cent of patients making errors	Drug studied	Type of institution	Economic classification of patient
Roth and Berger ¹⁸	Gastrointestinal disease	160	Ulcer patients took \approx 42% of prescribed medication; non-ulcer patients took \approx 63% of prescribed antacid	Antacid	Veterans hospital	Veteran
Berry et al. ³	Tuberculosis	26	90% of patients were taking INH at least half the time	Isoniazid, PAS	Tuberculosis hospital	Not specified
Moulding et al. ¹⁵	Tuberculosis	122	31% of patients took less than 70% of medication	INH	National Jewish Hospital Clinic and Denver Disease Central Clinic	Mixed
Bergman and Werner ²	Streptococcal infections	59	Antibiotic prescribed for 10 days; 56% terminated therapy by Day 3, 71% by Day 6, and 82% by Day 9	Penicillin	Pediatric Clinic, Syracuse Dispensary, Emergency room, Syracuse Memorial Hospital	Lower socioeconomic class
Fox ⁷	Tuberculosis	79	Of 58 patients completing a year of treatment 20% gave at least one negative result each month from an average of 5 urine tests for PAS	PAS, isoniaid	Tuberculosis center	Not stated
Mohler et al. ¹³	Streptococcal infections	245	Penicillin prescribed for 7 days; 34.3% admitted taking less than prescribed amount; 19% took for less than 5 days	Penicillin	Home Medical Service of Massachusetts Memorial Hospital	Lower socioeconomic
Willcox et al. ²²	Psychiatric	125	33 to 59% of patients failed to take drugs as prescribed	Chlorpromazine, imipramine	Psychiatric outpatient clinic	Not stated
Pitman et al. ¹⁶	Tuberculosis	61	48% of patients admitted taking their medication irregularly or not at all	PAS	Chest clinic	Not stated
Renton et al. ¹⁷	Schizophrenic	124	46% patients did not take medication prescribed at the time of discharge	Mixed	Royal Edinburgh Hospital	Not stated
Lipman et al. ¹¹	Neurotics	254	43% patients deviated from the prescribed regimen by taking less than 75% of the medication	Placebo, meprobamate	Psychiatric clinics of university and general hospital	Mixed
Dixon et al. ⁶	Tuberculosis	151	Only 50% gave positive reaction for PAS in urine	PAS	Chest clinic	Not stated

INH = isonicotinic acid hydrazide; PAS = para-amino-salicylic acid.

cian has time only for some hasty directions but reassures the patient that all needed directions will appear on the label. Unfortunately it is also in these last few hours prior to discharge that the patient receives diet instructions, information concerning his disease, advice of future limitations, while he is primarily concerned with his hospital bill and how he will pay it. In view of the results of the studies reviewed in this paper, new methods should be evaluated to increase compliance and decrease medication errors. Several suggested approaches can be offered:

1. The responsibility for self-medication by patients prior to discharge should be encouraged. Although this is not encouraged presently it would provide an opportunity for patients to accept partial responsibility for their care and also serve as a learning experience. Patients could receive instruction prior to discharge concerning when and how to take their medication and be given the opportunity to practice. They would also have the opportunity to experience some of the side effects of the medication in an environment where adequate medical supervision and reassurance can be given.

2. Patients should receive more complete instructions concerning the proper use of medication. In our society, better instructions are provided when purchasing a new camera or automobile than when the patient receives a lifesaving antibiotic or cardiac drug. The hospital provides an excellent setting for teaching patients about the use of prescription and non-prescription drugs. This teaching could be done either by the physician, nurse, or pharmacist. With the availability of audiovisual instructional aids much of the teaching could be accomplished without consuming the time of health professionals.

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