DEVELOPMENT OF A COMPUTERIZED DRUG INTERACTION DATABASE (MEDICOMsm) FOR USE IN A PATIENT SPECIFIC ENVIRONMENT

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Drug Interactions are a clearly defined problem that we as health professionals must deal with on a day-by-day basis. It is by far the area of health care that demands more attention today and tomorrow than was possible in the past. The amount of reference sources and text material of drug interactions is growing at such a rate that it is almost impossible to recall essential information in a reasonable time frame. If the practitioner is to continue with an uninterrupted work flow and still maintain the best possible service for the patient, an immediate and accurate method is needed in the hands of the user . . . a computerized drug interaction database. The community health care standards would be ultimately raised to a level never before attainable and efficiency would continue with full utilization of professional practice. Combine then, drug interaction data with ancillary benefits such as cost containment, third party accounting, inventory control, and a multitude of other operational functions into a computerized database and the end product results in an enhanced, controlled, professional operation.

Key Words: Drug interaction database; Computerized database; MEDICOMsm; Professional Drug Systems

IN 1976 Professional Drug Systems, Inc, a subsidiary of Medicare-Glaser Corporation, began the project of developing a computerized pharmacy system. During

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assumed that collecting patient prescription profile information and not reviewing it for certain interactions would be a great waste of a pharmacist's talent and drug information resources. It was therefore determined that prescription drug-to-allergy, prescription drug-to-food, prescription drug-to-over the counter (OTC) drug, and prescription drug-to-prescription drug interactions should be evaluated prior to filling each prescription.

The search was then initiated to identify and evaluate the different drug interaction systems that were available at that time. There were three inherent problems with each system that was evaluated:

1. The systems were based on a philosophy that the more information on each interaction the better, ie, quantity, but not necessarily quality.
2. The databases were reviewed and updated by staff which were generally changing on a regular basis and the ongoing integrity of the system at times was in question.
3. None of the systems were developed to work as an online system to be used in an active practice environment in a retail pharmacy setting.

To overcome these shortcomings, Medicare-Glaser Corporation created a permanent consulting group and developed an interaction database to meet the following goals:

1. Improve patient care
2. Improve professional image
3. Supply interaction information on a chemical ingredient basis
4. Update the information on a regular basis
5. Gear the use of the system to the busy professional

The key to the MEDICOM℠ system is that the information is set up for use by the busy professionals. For example, the health

rent prescriptions in the patient's profile. Interaction messages give the specific chemical ingredients that are interacting, and a corresponding significance code and recommended action code.

Table 1 gives the significance codes of the system. A code of *1* is for the rare, seldom occurring interaction, whereas a *9* is for an interaction that occurs regularly and predictably. The system also includes action codes that range from an *A* which means "Do not dispense — contact prescriber," to a *Z* for those involving nonsignificant interactions. Although an action code is a recommendation, the practitioner still uses professional judgment in the final utilization of the system's information. These two codes (significance and action) allow a health professional to rate each individual

TABLE 1
Significance Codes

Code	Definition
1	These interactions seldom occur and are considered not to be significant at this time.
3	These interactions have been reported to occur 20 to 30% of the time. Although not frequent, they may be significant for a small number of patients. Interactions classified as a *3* may not have adequate documentation and may require further study.
5	These interactions can occur often enough in the population to regard them as being potentially significant. Patient's physical condition and other therapy may enhance the significance.
7	These interactions have been documented in the medical literature, can be expected to occur frequently, and are to be regarded as potentially serious. A review of the patient's therapy may be advisable.
9	These interactions occur regularly (almost in every patient), have substantial documentation, and are to be regarded as being highly significant. Change in choice of drug(s) or drug(s) dose is highly advisable.

interaction and to react where appropriate regardless of the minute by minute primary health care activity.

Along with the significance and action codes, the reference source of the interaction information and the corresponding page number in that reference are displayed. There are three reference sources used in MEDICOM^sm: *Evaluations of Drug Interactions (EDI)*,[1] *EDI's Supplement*, and the *Medicom Drug Interaction Manual*. This *Medicom Drug Interaction Manual* is designed specifically for the MEDICOM^sm system and was written and is updated regularly by the MEDICOM^sm Consulting Group. The manual contains the monographs of new interactions appearing in the primary literature since the publication of *EDI* and the *EDI Supplement*, or more recent information on interactions already reported in *EDI* or its supplement. The manual monograph summarizes the currently available medical literature in readable format and language. Citations of the literature sources used in the monograph preparation are also given in the monograph.

In a practice environment each patient becomes part of the MEDICOM^sm system by filling out a Patient Information Sheet. This sheet contains basic demographic information (name, gender, birthdate, and so on) and relevant medical information needed to screen prescriptions prior to filling such as allergies, disease states, and frequently taken over-the-counter medications.

When a new prescription order is entered into the MEDICOM^sm system, each chemical item in each drug is identified by the system and compared to the chemical item(s) in the prescription drugs currently active in the patient's profile. If a particular chemical combination is identified in the interaction database, a message appears on the CRT and in hard copy, notifying the health professional of the interacting chemicals, the significance and action codes, and reference and page number. In addition,

available for health professionals' review if required. Simultaneously, if the patient is allergic to the particular chemical(s), the system will provide a message of this situation.

In addition to the prescription drug-to-prescription drug and prescription drug-to-allergy interaction matrices in the MEDICOM^sm Computerized System, the system contains prescription drug-to-food and prescription drug-to-OTC drug warning information.

The presence of food can change the absorption and/or bioavailability of some drugs. If this interaction is possible with the chemical(s) in the prescription, a three digit prescription drug-to-food warning code appears on the CRT display. The three digit code simultaneously gives the health professional the manual page number of the appropriate monograph which documents the interaction, and whether the absorption and/or bioavailability of the chemical is increased, decreased, delayed, or otherwise unaltered by the food.

The prescription drug-to-OTC drug warning code directs the health professional to the OTC section of the manual. This section contains the prescription chemical matched to the chemicals that are known to interact with over-the-counter products. Also available in the listing are the significance and action codes as well as the reference and page number. The health professional can then caution the patient on which over-the-counter products should be avoided while taking this particular prescription medication.

The MEDICOM^sm System was monitored for one calendar year (April 30, 1981 through May 1, 1982) to determine the number of prescription drug-to-prescription drug interactions detected by the database. Four pharmacies in the Medicare-Glaser Corporation that have been on the system for a year were selected. These stores are in different geographical areas with very different clientele.

Table 2 shows the total number of pa-

TABLE 2
MEDICOM^{sm} Drug Interaction Study From 4-30-81 Thru 5-1-82

Sample Store	Number of Patients	Number of Prescriptions	Number of Drug Interactions
#1	4,978	21,786	3,759
#2	10,270	40,462	6,632
#3	4,071	14,235	2,124
#4	4,258	19,390	4,065
TOTAL	23,577	95,873	16,580

entered into the system, and the number of prescription drug-to-prescription drug interactions recorded during the study period. The number of original prescriptions included those prescriptions entered into the system but not filled due to the interaction(s) detected.

The distribution of the prescription drug interactions by their significance code is shown in Table 3. In these four store samples, 33% of the interactions detected were highly significant and were usually expected to occur in patients (codes 7 and 9). Over 50% of the interactions detected were either significant or highly significant (codes 5, 7, and 9).

When the number of interactions detected was related to the number of patients having prescriptions entered into the system (see Table 4), 23.2% of all patients had an interaction of significance code 7 or 9 regardless of how many prescriptions they had entered. Considering the number of interactions detected versus the number of original prescriptions entered in the system,

17.3% of all prescriptions were expected to have some type of interaction, and 5.7% of those interactions had a significance code of 7 or 9.

Table 5 shows the number of original prescriptions entered in the system for each patient. 37.2% of the patients had only one prescription entered, which accounted for 8,759 of the 95,873 prescriptions entered during the study. These prescriptions would not produce a prescription drug interaction entry because only one prescription is involved. Therefore, only 14,818 patients would have the situation of a prescription drug interaction because they had more than one prescription entered into the system. Also, there would be only 87,114 prescriptions entered for these 14,818 patients and these produced 16,580 interactions. Table 6 shows the significance code distribution of the interactions based on these 14,818 patients and their prescriptions. The results suggest that for every patient having more than one prescription entered into the system, there were 1.12 prescription

TABLE 3
Interaction Percent Distribution by Significance Code

Sample Store	Significance Code (See Table 1)				
	01	03	05	07	09
#1	14.3	29.2	18.8	30.7	7.0
#2	17.3	31.8	19.3	25.6	6.0
#3	16.1	30.9	19.8	26.0	7.2
#4	13.5	36.9	18.9	25.1	5.6
Study Average	15.5	32.3	19.2	26.7	6.3

TABLE 4
Interactions as a Percent of Patients and Prescriptions
by Significance Distribution

	Total	Number of Interactions	Total %	Significance Code (See Table 1)				
				1 (%)	3 (%)	5 (%)	7 (%)	9 (%)
Number of Patients	23,577	16,580	70.3	10.9	22.7	13.5	18.8	4.4
Number of Prescriptions	95,873	16,580	17.3	2.7	5.6	3.3	4.6	1.1

TABLE 5
Distribution of Number of Prescriptions Per Patient

	Number of Prescriptions per Patient				
	1 Rx	2 Rx	3 Rx	4 Rx	5 Rx or more
Number of Patients	8,759	5,300	2,896	1,937	4,685
Percent of Patients	37.2%	22.5%	12.3%	8.1%	19.9%

TABLE 6
Interactions as a Percent of Patients and Prescriptions
by Significance Distribution

	Total	Number of Interactions	Total %	Significance Code (See Table 1)				
				1 (%)	3 (%)	5 (%)	7 (%)	9 (%)
Number of Patients	14,818	16,580	111.9	17.3	36.1	21.5	29.9	7.0
Number of Prescriptions	87,114	16,580	19.0	2.9	6.1	3.6	5.1	1.2

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