

Automation of a Patient Medical Profile from Insurance Claims Data: A Possible First Step in Automating Ambulatory Medical Records on a National Scale

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This report describes how a detailed patient medical profile can be produced by the systematic collection and linkage of claims data in a state-wide Medicaid program. Extension of this system nationally could provide automated medical profiles for more than 20,000,000 people at a small increment in cost. The possibility that this cost could be offset by reduction of duplicated services currently provided deserves serious consideration by health care planners and administrators. The ability of the profile to portray a patient's clinical status accurately hinges on both the determination of health care administrators to adopt sensitive and precise diagnostic codes and on the adoption of improved data acquisition techniques. The deficiencies of the database are described, and methods of overcoming these problems are suggested.

It is axiomatic that so long as we have a fee-for-service medical system, physicians will be required to submit billing documents to insurance carriers. Rather than ameliorating this annoying problem, universal health insurance will probably make further demands on the time spent by physicians, pharmacists, and other providers of health care in satisfying the demands of accountability. While the primary intent of the billing procedures is to document the medical necessity for services performed, claims data provide other potentially useful clinical information. In this report we present a prototype automated patient medical profile based on claims data from a state-wide comprehensive health program.

The model's technical feasibility stems from the nearly universal conversion of claims data into a machine-processible form. The model's operational feasibility is limited primarily by the involved parties' ingenuity and determination to improve the codes that describe the components of medical practice and secondarily by inaccuracies in source data collection. While other experiments in

progress manipulate claims data to determine the medical necessity of services performed (United States Department of Health, Education, and Welfare [HEW], 1973a), our model provides the patient's physician with a medically useful document derived from submitted claims. This automated profile is not intended to substitute for the ideal medical record: a full and detailed description of a patient's diagnosis and therapy; rather, it is intended to aid the physician in reviewing a patient's history of diagnosis and therapy.

University of Alabama in Birmingham— Medicaid Information System (UAB-MIS)

The Clinical Information Systems Group at the University of Alabama in Birmingham (UAB) and the Medical Services Administration (MSA) of the State Department of Public Health entered into a contract in April 1970. UAB agreed to provide administrative computing services to the program and to collate the separate files of machine-processible medical information being generated by the carriers in the program into complete patient profiles. The result was a multidimensional database which can be examined efficiently. This system was designed independently of the Medicaid Management Information System (MMIS) (HEW, 1972) developed by the Medical Services Administration of the Social and Rehabilitation Services of HEW. In October 1972, MSA transferred operations to the agency's computer center in Montgomery.

Scope

Barnett (1971) emphasizes that it is important to make the distinction between the "future present" tense and the "real present" tense when describing computer systems. The record system that is described in this report covers all encounters among the more than 400,000 persons who were eligible for medical services under the Medicaid program and the 2,500 physicians, 900 retail and institutional pharmacies, 129 hospitals, and 158 nursing homes scattered throughout the state from the inception of the program in January 1970 to October 1972. The individuals on whom the skeletal medical record are available represent more than 10 percent of the population of the state of Alabama. It is not the intention to present here a detailed technical description of how the data are

collected from the various sources and merged into individual patient records, but rather to describe how transactions were linked, and to indicate how this information might be used in aid of ambulatory care.

Record Linkage

A fundamental goal of UAB-MIS was the unambiguous and continuous identification of beneficiaries of the program despite the decentralized issuance of residence-dependent (county) Medicaid recipient numbers. Since recipients in the program often moved from one county to another, or changed beneficiary category, approximately 20 percent had more than two recipient numbers during their tenure in the program. To resolve the multiple recipient number problem each person in the program was assigned a unique patient identification number (PIN) in UAB-MIS.

From the beginning UAB-MIS files were designed to segregate administrative and medical data. We reasoned that the security and confidentiality of patient medical information would be greatly enhanced if such information were only accessible by an internal reference number such as the PIN. Within the UAB-MIS files both administrative and medical records are ordered in PIN sequence. The cross-reference file linking the PIN to the patient's present and past recipient numbers is kept only in the administrative files, which is on a physically separate set of tapes. Thus the medical file is potentially available for research purposes, since patient identification is not revealed.

The Patient Medical Profile

Figures 1 and 2 illustrate two formats of the patient minirecord; the first is in the form of a patient status summary, and the second a chronological patient profile. The patient status summary is not unlike that produced by other computerized medical record systems (Brunjes, 1971; Garratt, 1972; Grossman et al., 1973; and Vallbona et al., 1973). The patient status summary provides a clear snapshot of the patient's past medical problems coupled with precise information on the medications currently and previously taken by the patient and the various laboratory and radiological examinations performed. Such profiles enhance communication among physicians and lessen the time required for a physician to acquaint himself with the problems of a new patient, and to follow the

Fig. 1. Profile of a 19-year old black woman with Down's Syndrome. Diagnoses are in ascending order of ICDA code. Column labeled # OF OCCUR is the number of occurrences of each diagnosis. If encoding accuracy is 50 percent, and a diagnosis occurs seven times, the probability is (1/2) or one chance in 128 that it is not correctly encoded. If encoding is 75 percent accurate, then four occurrences (1/4) are sufficient to change the probability to one chance in 256. Note that ICDA code 753.9 occurs once and probably is a transposition error in keypunching 759.3, which occurs six times. A + in the HOSPZN column indicates that the diagnosis appeared on a claim for inpatient services at least once. UNITS in the MEDICATION section refer to the number of units of medication dispensed. A DCI is the Alabama Drug Code Index number. PROC# is the carrier's procedure code.

UAB-MEDICAID INFORMATION SYSTEM		PATIENT MEDICAL PROFILE		MEDICAID #1 (NUMBER DELETED)		DATE: 04/03/73	
PATIENT NAME: (NAME DELETED)		SEX: F		RACE: B		BIRTH: 07/07/53	
AGE: 19							
DIAGNOSES	ICDA CODE	FIRST DATE	LAST DATE	# OF OCCUR	HOSPZN		
ILL-DEFINED HEART DISEASE	429	18 JUN 71	20 AUG 71	12	+		
ACUTE UPPER RESP INFECTION	465	11 JAN 71	31 JAN 71	4			
INFLUENZA, UNQUALIFIED	470	10 MAR 70	17 MAR 70	2			
PULMONARY CONGESTION & HYPOSTASIS	514	23 AUG 71	27 AUG 71	2			
NEPHROTIC SYNDROME	581	20 JUL 71	20 JUL 71	1	+		
INFECTIONS OF KIDNEY	590	2 SEP 71	2 SEP 71	1			
OTHER DISEASES OF KIDNEY	593.2	18 JUN 71	26 JUN 71	8	+		
CYSTITIS	595	18 JUN 71	18 JUN 71	1	+		
DISEASES OF PARAMETRIUM & PELVIC PERITONEUM	616	14 JUN 71	16 JUN 71	4	+		
DISEASES OF MENSTRUATION, EXCESSIVE	626.2	13 MAY 71	13 MAY 71	2			
CONDUIT PROLAPSES OF URINARY SYSTEM	753.9	20 JUN 71	28 JUL 71	1	+		
DOWN'S SYNDROME	759.3	24 JUN 71	17 AUG 71	6	+		
ADVERSE EFFECT-MEDICATION	977	25 DEC 70	25 DEC 70	1	+		
MEDICATION	ADCI	FIRST DATE	LAST DATE	UNITS			
PREDNISOLONE	1711243	28 JUL 71	23 AUG 71	450			
PREDNISOLONE	1712466	12 JUL 71	12 JUL 71	100			
OVRAL	0080026	20 NOV 70	20 NOV 70	93			
CONAR-A	0291720	23 JAN 71	23 JAN 71	30			
ACHROCIDIN	0054817	16 JUN 71	16 JUN 71	24			
V-CILLIN K	0020329	12 JUL 71	12 JUL 71	12			
BUTIBEL ELIXIR	0650044	12 JUL 71	12 JUL 71	8			
NOVAHISTINE DH	1831002	10 MAR 70	10 MAR 70	3			
LABORATORY	PROC#	FIRST DATE	LAST DATE	# TIMES			
CEC	8628	11 JAN 71	17 JUL 71	4			
ACETONE, SERUM	8790	31 JAN 71	31 JAN 71	1			
URINALYSIS ROUTINE, COMPLETE	8934	14 JUN 71	17 JUL 71	3			
CHORIONIC-GONADOTROPIN PREGNANCY-TEST RABBIT	8961	13 MAY 71	13 MAY 71	1			
X-RAY	PROC#	FIRST DATE	LAST DATE	UNITS			
SKULL, COMPLETE	7060	26 JUN 71	26 JUN 71	1			
CHEST, SINGLE VIEW	7101	18 JUN 71	18 JUN 71	1			
CHEST, COMPLETE	7103	19 JUN 71	19 JUN 71	1			
GASTROINTESTINAL TRACT, UPPER	7338	25 JUN 71	25 JUN 71	1			
COLON, BARIUM ENEMA	7344	21 JUN 71	21 JUN 71	1			
UROGRAPHY EXCRETORY, IVP	7363	21 JUN 71	21 JUN 71	1			

UAB-MEDICAL INFORMATION SYSTEM										
PATIENT MEDICAL PROFILE										
DATE: 06/03/73										
MEDICAL # : (NUMBER DELETED)										
PACIENT NAME: (NAME DELETED)										
AGE: 19										
DATE	DIAGNOSIS	SER: P	TYPE	PROCEDURE	RACE: B	PLACE	DRUG	BIRTH: 07/07/53	LAB	XRAY
2 SEP 71	INFECTIONS OF KIDNEY		H			OUT				
27 AUG 71	PULMONARY CONGESTION		P	OFFICE VISIT		OFF				
23 AUG 71	PULMONARY CONGESTION		P	OFFICE VISIT		OFF				
20 AUG 71	ILL-DEFINED HEART DISEASE		H	ER VISIT		OUT	PREDNISON			
20 AUG 71	DONN'S SYNDROME		P	ELECTROCARDIOGRAM		OFF				
17 AUG 71	DONN'S SYNDROME		P	OFFICE VISIT		OFF				
7 AUG 71	DONN'S SYNDROME		D	RX		OFF				
28 JUL 71	NEPHROTIC SYNDROME		H	RX		INP	PREDNISON			
20 JUL 71	DONN'S SYNDROME		H	HOSPITAL VISIT		INP				
20 JUL 71	DONN'S SYNDROME		P	OFFICE VISIT		OFF				
20 JUL 71	DONN'S SYNDROME		P	ELECTROCARDIOGRAM		INP				
20 JUL 71	CONGENITAL ANOM UINARY TRACT		P	HOSPITAL VISIT		INP				
17 JUL 71	ILL-DEFINED HEART DISEASE		P	LAB TEST		OFF		CBC		
17 JUL 71	ILL-DEFINED HEART DISEASE		P	LAB TEST		OFF		URINALYSIS		
17 JUL 71	ILL-DEFINED HEART DISEASE		P	OFFICE VISIT		OFF				
16 JUL 71	ILL-DEFINED HEART DISEASE		D	RX		OFF				
16 JUL 71	ILL-DEFINED HEART DISEASE		D	RX		OFF				
12 JUL 71	ILL-DEFINED HEART DISEASE		D	RX		OFF				
11 JUL 71	ILL-DEFINED HEART DISEASE		D	HOSPITAL VISIT		INP				
25 JUN 71	DISEASES OF KIDNEY		P	XRAY		INP				GASTROINTESTINAL TRACT
25 JUN 71	DISEASES OF KIDNEY		P	XRAY		INP				
25 JUN 71	DONN'S SYNDROME		P	HOSPITAL VISIT		INP				
25 JUN 71	DONN'S SYNDROME		P	ELECTROCARDIOGRAM		INP				
24 JUN 71	DONN'S SYNDROME		P	CONSULTATION		INP				
24 JUN 71	OTHER DISEASES OF KIDNEY		P	XRAY		INP				
21 JUN 71	OTHER DISEASES OF KIDNEY		P	XRAY		INP				SKULL, COMPLETE
21 JUN 71	OTHER DISEASES OF KIDNEY		P	XRAY		INP				IVP
21 JUN 71	OTHER DISEASES OF KIDNEY		P	XRAY		INP				COLON, BARIUM ENEMA
19 JUN 71	OTHER DISEASES OF KIDNEY		P	XRAY		INP				CHEST, COMPLETE
19 JUN 71	ILL-DEFINED HEART DISEASE		P	HOSPITAL VISIT		INP				
19 JUN 71	ILL-DEFINED HEART DISEASE		P	LAB TEST		OFF			CBC	
18 JUN 71	CYSTITIS		H	HOSPITAL VISIT		INP				
18 JUN 71	ILL-DEFINED HEART DISEASE		H	HOSPITAL VISIT		INP				CHEST, SINGLE VIEW
18 JUN 71	ILL-DEFINED HEART DISEASE		H	HOSPITAL VISIT		INP				
18 JUN 71	ILL-DEFINED HEART DISEASE		H	XRAY		OFF				
18 JUN 71	ILL-DEFINED HEART DISEASE		H	LAB TEST		OFF				
18 JUN 71	ILL-DEFINED HEART DISEASE		H	LAB TEST		OFF				
18 JUN 71	DISEASES OF KIDNEY		P	ELECTROCARDIOGRAM		INP			URINALYSIS	
14 JUN 71	DISEASES OF PARAMETRIUM		P	INJECTION		OFF			URINALYSIS	
14 JUN 71	DISEASES OF PARAMETRIUM		P	LAB TEST		OFF				
14 JUN 71	DISEASES OF PARAMETRIUM		P	LAB TEST		OFF			CBC	
13 MAY 71	DISORDERS OF MENSTRUATION		P	OFFICE VISIT		OFF				
13 MAY 71	DISORDERS OF MENSTRUATION		P	OFFICE VISIT		OFF				
31 MAY 71	DISORDERS OF MENSTRUATION		P	LAB TEST		OFF			CHORO	
31 JAN 71	ACUTE UPPER RESP INFECTION		P	LAB TEST		OFF			ACETONE	
25 JAN 71	ACUTE UPPER RESP INFECTION		P	INJECTION		OFF				
25 JAN 71	ACUTE UPPER RESP INFECTION		D	RX		OFF	ACNUCICIN			
25 JAN 71	ACUTE UPPER RESP INFECTION		D	RX		OFF	COMAR-A			
11 JAN 71	ACUTE UPPER RESP INFECTION		P	LAB TEST		OFF			CBC	
11 JAN 71	ACUTE UPPER RESP INFECTION		P	OFFICE VISIT		OFF				
25 DEC 70	ADVERSE EFFECT-MEDICATION		H	HOSPITAL VISIT		INP				
20 NOV 70	ADVERSE EFFECT-MEDICATION		P	INJECTION		OFF				
10 MAR 70	INFLUENZA, UNQUALIFIED		P	INJECTION		OFF				
10 MAR 70	INFLUENZA, UNQUALIFIED		P	OFFICE VISIT		OFF				
10 MAR 70	INFLUENZA, UNQUALIFIED		D	RX		OFF	NOVARISTINE DH			

Fig. 2. Chronologic format of the same patient's profile as in Fig. 1. TYPE column refers to type of service: D = drug, P = physician, H = hospital. PLACE column indicates place of service: OFF = office, INP = inpatient, OUT = outpatient hospital. Some terms are truncated because of space limitations.

TABLE 1

List of Medications Dispensed To One Patient
(May 1970-July 1972)

<i>Medication</i>	<i>First Rx</i>			<i>Last Rx</i>			<i>Units Dispensed</i>
Oxymetazoline Hydrochloride	21	Feb	70	12	Jul	72	3363
Digoxin	20	Jan	71	4	Dec	71	630
*Actifed	2	Dec	70	27	Jun	72	558
*Dilor-G	17	Dec	71	21	Jun	72	348
*Fero-Folic-500	19	Nov	70	14	Mar	71	300
*Kinesed Tab 100	11	Feb	72	25	May	72	300
*Salutensin	4	Jun	71	13	Oct	71	270
Oxazepam	3	Nov	70	26	Feb	71	200
Phenobarbital	21	Feb	70	28	May	70	200
Pseudoephedrine Hydrochloride	22	Nov	71	12	Jul	72	186
*Neosporin	5	Aug	70	17	Aug	70	186
*Butazolidin Alka	19	Dec	71	2	May	72	168
*Dialose Plus	3	Sep	70	28	Apr	71	156
Indomethacin	20	Jan	71	22	Apr	71	150
*Urised	23	Jan	71	18	Apr	71	144
*Donnatal	20	Jan	71	8	Jun	71	144
*Modane Mild	22	Jun	70	14	Mar	71	130
Ampicillin	19	Dec	70	4	Dec	71	130
Prednisone	4	Jun	71	13	Oct	71	120
*Naldecon	6	May	71	4	Oct	71	120
*Azo Gantrisin	8	May	72	7	Jul	72	120
*Darvon Compound-65	28	Jul	70	11	Aug	70	108
Allopurinol	27	Jun	72	27	Jun	72	100
*Gelusil	16	Jan	70	16	Jan	70	100
Phenylephrine Hydrochloride	15	Sep	71	24	Apr	72	95

This is a list of the 25 most heavily prescribed medications for a 64-year-old man who received 56 drugs from May 1970 to July 1972. His list of diagnoses include arthritis, congestive heart failure, chronic bronchitis, acute upper respiratory infection, influenza, sinusitis, prostatic hypertrophy, and cystitis.

*indicates combination drug product.

progress of an old patient. Since the profile contains information from all sources of care, duplication of services becomes immediately apparent. For example, multiple prescriptions for generically similar drugs can be readily detected. If a patient receives a prescription for a cardiac glycoside from more than one physician, this would be immediately apparent to both physicians in the chronologically arranged record. Table 1 lists medications dispensed to an elderly patient during the previous two and a half years. The list is presented to underscore the large number of drugs prescribed for one patient and to question the probability that any

of the physicians who were treating this patient had medication histories as detailed as this in their office records. The possibility that many of this patient's symptoms were related to drug therapy will not make excessive demands on the reader's imagination (Smith et al., 1966).

Discussion

The structure and content of hospital records in the United States are mandated by state laws and by accrediting agencies such as the Joint Commission on the Accreditation of Hospitals. In contrast, the content of ambulatory patient records is almost completely unregulated. References to the content of medical records at the primary care level are anecdotal (Fry, 1973; and Dreyfus et al., 1971). Our own casual inspection of records kept by practicing physicians confirms observations by others that the content of ambulatory records is often confined to a presenting symptom or a diagnosis and the medication or other treatment prescribed. We have been unable to find any systematic description of the contents of the records of medical practitioners drawn from a representative sample of primary care physicians. More importantly, we have not been able to link the traditional contents of medical records with a clear demonstration that the desired patient outcomes have been achieved. Since we lack evidence to establish a definite relationship between the structure and content of medical records and the outcomes for the patient (Fessel and Van Brunt, 1972), we would suggest that, until such a conclusion is supportable, the conventional wisdom of the primary care physician who records data parsimoniously ought to be regarded with greater tolerance.

Large amounts of money have been spent by government agencies and indeed even by private practitioners in developing computerized medical record systems (American Medical Association, 1974; and Schmidt et al., 1974). All of these efforts are based on the assumption that the medical record has some intrinsic value in caring for patients. To date, this premise has not been adequately evaluated and validated. We would all agree that "knowing is better than not knowing," but the question that remains in developing these systems is whether the cost can be justified by demonstrated benefits.

A minimum basic data set has been proposed (Murnaghan, 1973) for collecting ambulatory care data. The intent of the

minimum basic data set, Murnaghan explains, is not to restructure the medical record, but to encourage the incorporation of certain basic data in the record so that they will be available for reporting and analysis as needed by the health care provider himself or external agencies. Of the 15 data elements recommended for inclusion in the minimum basic data set, only two, the patient's presenting complaint and the disposition of the patient, are missing in the claims data. It would be relatively easy to modify the present system to collect these items routinely. The participants at the Conference on Ambulatory Care Data recognized that as part of a more comprehensive system, encounter data could be consolidated to provide useful patient summaries or profiles. What we have demonstrated in this project is that machine-processible data collected for insurance purposes can be linked to produce essentially complete profiles for a sizable fraction of our population now.

Patient status profiles are produced by most operational automated ambulatory medical record systems. The Health-Illness Profile designed by Vallbona et al. (1973) and the profile used in the Harvard Community Health Program (HCHP) (Grossman et al., 1973) are only two examples of continually updated profiles within the context of larger information systems. In another computer-assisted information system developed by Garratt (1972) at the Indian Health Service research facility in Tucson, Arizona, the encounter form, which remains in the supplemental manual record as the "progress note," bears a strong resemblance to an insurance claim form. We have also observed several practices where an insurance claim form is used as the primary office record of a visit.

Sensitivity and Precision

We next address ourselves to the issues of sensitivity and precision of the medical profile content. Here sensitivity is defined as the ability of the various coding systems to handle the wide variety of clinical situations encountered in practice. Precision refers to the accuracy of encoding of words (text) into numbers.

Diagnosis

Clinical acceptability of the patient status profile drawn from claims data hinges on how accurately the diagnosis submitted conforms to the diagnosis carried in the office record, how accurately

the diagnosis is encoded by personnel employed by carriers, and the number of diagnoses carried in the carrier's computer record of a transaction. These issues are the most critical limiting factors to this model's successful implementation. The first issue is an outgrowth of the differences in perspective between physicians and fiscal intermediaries. The former, if they utilize diagnostic coding in care evaluation studies or patient profiles, require codes that reflect the variety of clinical situations encountered in practice. The latter require only sufficient coding for processing claims; they rely almost exclusively on the International Classification of Diseases, Adapted (eighth revision), which is cluttered with vague, non-specific rubrics. Should third-party payers resolve to adopt more realistic standards for representing the medical events of their client populations, the secondary and technical issues of accurate source data collection and database manipulation have been demonstrated to be capable of satisfactory solutions.

Payment policies by fiscal intermediaries can affect the physician's representation of a patient's status. Anyone who has had even limited experience with third-party payers soon realizes that vague or minor symptoms stated as the "diagnosis" increase the probability that the claim will be rejected for payment. The extent to which this leads to making a presumptive diagnosis for claims purposes is unknown. But even a cursory examination of insurance claims submitted by physicians reveals that symptoms are rarely listed as the "diagnosis." Yet "patients do not seek help for categorically labelled diseases; they present themselves to physicians with symptoms, complaints, and problems. These are the language of disease, but they are not the diseases themselves" (White, 1973: 1182). The only remedy here is to educate carriers to appreciate that investigating vague symptoms requires expenditure of just as much time for those that remain minor as for those that may be early signs of serious disease.

The deficiencies of the major diagnostic coding system are recognized, yet the International Classification of Diseases continues to be used almost universally for coding all types of illness. Because this code is oriented primarily to severe disease and the associated pathologic anatomy and physiology seen primarily in hospital settings, a number of newer coding schemes (Cote, 1974; and Treat and Froom, 1974) are currently proposed or under test. To be compatible with an insurance program new codes for am-

bulatory care will have to be a part of an inclusive coding system. The ninth revision of ICDA is being developed with expansions to provide additional rubrics for primary care.

Our own measurements of encoding (Mesel and Wirtschafter, 1975) by carrier personnel showed that accuracy varies between 50 percent and 75 percent. This unhappy state of affairs is a reflection of the lack of performance standards in contracts for intermediary services and of the lack of perceived benefits that could be derived from improved accuracy by the carriers in carrying out their administrative goals. However, with increasing use of automation to scan claims for medical necessity, carriers will either be motivated to improve coding accuracy or their efforts will fail. Since there is a financial incentive to the carrier to streamline processing operations on contracts where a fixed fee is paid per claim processed, it can reasonably be expected that their performance in encoding diagnoses will improve. Moreover, as program directors use these data for evaluation and planning purposes, they will insist on higher-quality data.

Another problem is that most carrier systems carry only one diagnosis for each service (procedure) billed. This limits the information submitted by the physician by excluding useful data. It also encourages the coding clerk to select the diagnosis for which there is a code readily available rather than to code the less familiar, but primary, diagnosis.

That these defects can be remedied has been demonstrated in another project (Mesel and Wirtschafter, 1975) in which Medicaid claims data were entered directly into computer files by physicians' office personnel using a Touch Tone[®] phone with Card Dialer[®] as a remote terminal. This experiment demonstrated the ease, accuracy, and efficiency of source data collection and entry. Diagnostic coding errors were reduced to less than 1 percent with this system and multiple diagnoses could be submitted for each service item.

Services Provided (Procedures)

In primary care, 10 services account for 80 percent of all services provided to Medicaid patients (Mesel and Wirtschafter, 1975). Numerous other procedure codes are used by medical insurers and intermediaries. The third revision of the American Medical Association's Current Procedural Terminology (1973a) lists ap-

proximately 4,000 individual procedures and is the most extensive code developed to date. Unlike coding symptoms and complaints, there is no problem of sensitivity in coding physicians' services. Increasing use of paraprofessional medical practitioners has created pressure to expand procedure codes to allow billing for these services. A simple alternative would be to use a procedure prefix code (modifier) to designate the level of practitioner as currently employed by 1969 California Relative Value Scale (California Medical Association, 1969).

Since there is a direct link between the procedure code and the payment for services, one would intuitively expect that the physician's vital interest would lead to demands for accurate encoding of procedures by carriers. Unfortunately physicians are often not cognizant of the relationship between the description of a procedure and the setting of the allowable payment by the carrier. In the past much of this process has been hidden from view, but release of "allowable payment screens" by the Social Security Administration's Bureau of Health Insurance in the Medicare program should provide relief and lead to improvement in coding. Our estimates are that encoding of procedures are approximately 75 percent precise. Coding of procedures at the source of the data can reduce errors to an insignificant degree (Mesel and Wirtschafter, 1975). Berkanovic's experience (1974) with Medicaid data from Oregon indicates that these problems are not restricted to the Alabama program.

Medications

The Alabama Drug Code Index (State of Alabama, 1970), modeled after FDA's National Drug Code (HEW, 1971) allows encoding of more than 99 percent of drugs dispensed in the United States, so no problems of sensitivity are foreseen for encoding medications.

In Alabama, pharmacists encode the medication dispensed with a standard imprinter and a credit card type of embossed, plastic, patient ID card. Precision of encoding is checked by inspectors in MSA's pharmacy division and by the intermediary for the drug program. Because of extensive use of profiles of dispensing patterns, and because of adequate inspection, errors are minimal. These data are probably the most reliable in the profile and, moreover, provide one excellent measure of patient compliance: the fact that the patient got the prescription filled.

Other Uses of the Clinical Database Registry Function

Disease registers could easily be produced by sorting the data in UAB-MIS. In Scotland (Boyle, 1974) it has been demonstrated that periodic reassessment of patients given destructive therapy, radioactive iodine or ablative surgery, for thyrotoxicosis will uncover a considerable number (25 percent) of patients with significant residual dysfunction, either hypo- or hyperthyroidism, who are not being treated. We ourselves are currently investigating the possible causal relationship between rauwolfia compounds usage and breast cancer. The uses of the database for these purposes are limited only by the ability to formulate meaningful questions.

Clinical Audit Function

Although the PSRO legislation, P.L. 92603, currently mandates the review of inpatient care, it is clear that DHEW is also planning to examine ambulatory care at a later date. Efforts to implement these audit programs must be planned so that the effects on the outcomes of health care are constructive. If the results of laboratory tests were reported on claims forms, a much more complete profile would not only be available for direct patient care but would also be available for evaluating the processes and outcomes of care. On examination of those conditions which account for more than 50 percent of the diagnoses made by general practitioners we found that for most of the twenty (Mesel and Wirtschafter, 1975) claims data already can provide many answers to intermediate and long-term outcomes.

Potential Economic Impact

We have discussed how the profile can be used in direct patient care, the primary concern of the individual physician in the interest of the individual patient. We have also suggested how this information could support population-based health care activities. Of what benefit could this record be to program planners and managers, and to society in general?

Perhaps no other aspect of health services has received as much attention recently as the enormous increase in the cost of providing these services since the passage of Medicare and

Medicaid legislation. Continuing inflation currently jeopardizes the fiscal stability of Medicaid in many states. Alabama is among them. Program costs occupy the center of attention of administrators everywhere, and it is unlikely that the type of ambulatory care record system we propose will be implemented unless there is a reasonable expectation of cost effectiveness. Not only must we know the incremental cost of producing these profiles, but also we must establish that these costs can be justified by expected cost reductions elsewhere. The Alabama experience provides sufficient data to conclude that the incremental cost would be minimal, and that there are potential areas for rationally controlling services and costs without reducing access to care.

During the contract period with MSA, UAB-MIS expended a total of approximately \$200,000 on the design, implementation, and operation of the information system. Less than one third of this total was incurred for medical data collection; the larger fraction was allocated to the administrative data processing system. By the end of the contract period we amassed more than 12 million transactions (physician, hospital, nursing home, pharmacy) for services provided to more than 400,000 individuals. If we attribute half of the cost to the medical profiling system, on the average it cost less than one cent to accrete a transaction to UAB-MIS. The average expenditure per patient was \$.25 over a period of nearly three years. Of this amount more than half could be fairly attributed to system development costs rather than to operating costs. By any standard this is a trivial fraction of the combined cost of preparing and processing insurance claims in Medicaid and Medicare programs (Mesel and Wirtschafter, 1975; and HEW, 1973b), which range from \$3.60 to \$4.85 per claim. The more costly aspect would be to produce a paper copy of the profile and to mail it to the patient's physician. Even in small quantities, the production and mailing costs of a profile would be less than \$.35. If these were to be mailed with the "Explanation of Benefits" form that accompanies payments to physicians, the cost would be nearer to \$.25. This compares quite favorably with the estimated cost of \$1.30 per Health-Illness Profile at the Casa de Amigos Clinic in Houston, Texas (Vallbona et al., 1973). Since some physicians already subscribe to commercially available computer services in aid of office practice at a cost of nearly \$1.00 per patient visit for administrative purposes (billing and claims) and for clinical records

(American Medical Association, 1973b), it is reasonable to expect that this incremental cost could be shared by physicians and fiscal intermediaries.

Can profiles reduce program costs? Experience at the HCHP (Grossman et al., 1973) suggests that services can be regulated through internal peer-review activities made possible by computerized provider profiles and group norms. The San Joaquin Foundation for Medical Care has also shown that a peer-review system based on billing claims can influence practice patterns (Buck and White, 1974).

Privacy and Confidentiality of Information

No discussion of a medical database can ignore the sensitive issue of privacy and confidentiality. The patient has a right to keep his record hidden from a physician if he chooses. Therefore procedures must be found to obtain informed consent from the patient to release this information to another physician. On the other hand he should be offered the possibility of having his records freely available to any physician to whose care he has entrusted himself. Likewise each physician must have the option to remain anonymous and to deny his identity to "other" providers of care, where more than one physician looks after the patient.

Summary

Simplicity is essential in planning the implementation of automated ambulatory medical record systems on a wide scale. Perfectionist concerns about the content and structure of records in office practice reflect the conventional wisdom of medical teaching but may ignore the demands of patients for symptomatic care. Increasing the burden to record information for purposes of audit without a clear demonstration of cost reduction or improved patient outcomes could be disastrous if, as is likely, some form of universal health insurance is adopted nationally. The approach outlined in this report should increase the availability of useful data for direct patient care, population studies, and continuing education, as well as for planning and policy purposes.

The authors readily concede that billing information alone is not equivalent to a traditional record, but we suggest that an

automated patient profile can be produced quite easily because of the convergence of several factors. These include the physician's financial interest in recording these data, the administrative pressures on the physician to make these data accurate, and the carrier's need for systematically collecting, processing, and aggregating this information in an automated system.

The lack of clearly defined criteria for assessing quality and the minimal record systems utilized in actual practice suggest that the billing form is a reasonable starting point for data collection efforts. The administrative overhead for preparing insurance claims and for processing them for payment is so high that some overhead costs undoubtedly represent funds which could be put to more productive use for the benefit of the participants in the health care establishment, particularly for the benefit of the patient.

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