An On-line Clinical Information System in Family Practice

Mark L. Braunstein, MD, Stanley H. Schuman, MD, and Hiram B. Curry, MD
Charleston, South Carolina

An interactive on-line clinical information system is in operation within the residency program of the Department of Family Practice at the Medical University of South Carolina in Charleston. This approach eliminates some of the traditional sources of error in collecting clinical information. Particular attention is given to flexibility of data presentation: data may be segregated by time, by disease entity, by age and sex of the patient, by physician, by year of residency, and by disease class. The responsiveness of this on-line technology allows the production of complete, up-to-date practice reports within 24 hours of a request.

Previous studies of morbidity and physician/patient encounters within academic and clinical family practice have relied upon a form or daily log separate from the actual clinical record.[1-5] It has been suggested that data collection from such a separate encounter form introduces a significant loss rate into the information system. Dickie and his group, in a recently published article, studied 108 charts to determine the accuracy of information transfer onto the encounter form. He determined that fewer problems appeared on the encounter form than were recorded in the clinical note with exact matching occurring in 85 percent of the cases.[6] In an earlier study

by Bentsen when family practice residents were observed by experienced physicians during patient encounters the results showed that only 60 percent of problems addressed at each encounter were recorded on an encounter form. Pairs of observers differed among themselves as to the main problem dealt with in 15 percent of the cases.[7]

An additional concern in data collection is the issue of morbidity coding. Previous studies have often relied upon support personnel or secretarial help to accomplish problem coding.[1-3] Dickie noted that coding by support personnel was accurate to the level of particular disease in only 84 percent of the cases, but was accurate within the broader limits of disease class 95 percent of the time.[6] An earlier study by Gruer noted that even with experienced paraprofessionals performing the coding an error rate of one to three percent could be expected.[3]

A final concern in major large-scale studies of the clinical content of family practice is variability of coding convention among the different medical practices and practitioners included in such studies. Thus an approach to standardized coding in the multi-physician environment is needed.

System of Data Collection

The present study relies upon a sophisticated on-line computer-based system of data collection, correction, and analysis. The computer, a PDP-15/75 (Digital Equipment Corporation, Maynard, Massachusetts) is located within our Family Practice Center. A MIIS operating system (Medical Information Technology, Cambridge, Massachusetts) is used. Terminals are disseminated throughout the clinic and in allied clinics and medical practices at six locations in South Carolina.* While the clinical information system presented here is

*While the present paper will be confined to the data collection procedures and results at the Charleston Family Practice Clinic, similar procedures are in use at the other six sites and identical data presentations are available from each of these clinics.

fully integrated with an on-line billing system, this discussion will be limited to clinical information only.

Residents within the Family Practice Clinic dictate problem-oriented progress notes which are routed to a central transcription station. The tapes are transcribed directly into cathode-ray-tube computer terminals (CRT) by a team of data entry operators with training in medical terminology. Each newly transcribed note is printed on the day of transcription in rough draft form which is then forwarded to the original physician for correction. Corrections are made directly on the computer printout and corrected notes are returned to the original typist. The corrected transcription is then available for inclusion in the patient's chart prior to the next scheduled visit to the clinic.

Key data such as physician identity, problem or problems seen, date of visit, drugs prescribed, and procedures performed are captured by the computer from the dictated progress note and are stored and kept on-line for long-term study. The "free text" information contained within the remainder of each progress note is retained on file for a period of six months to a year (depending on disc storage requirements) and is then purged to an off-line archival disc file for use as needed.

Problems are entered into the computer exactly as dictated by the physician. A distinction is made between new problems and follow-up visits for old problems. These problems are "looked up" in a computer-stored table which contains the International Classification of Health Problems in Primary Care (ICHPPC)[8] and a set of synonyms to the ICHPPC rubrics which have been defined and agreed upon within the clinic. Using this system, approximately 70 percent of new diagnoses are coded by the computer. It is still necessary for approximately 30 percent of new diagnoses to be manually coded. Here again the computer has a role to play. A worksheet of non-coded new problems is produced on demand by the computer in the medical records library. Each problem is listed by physician and patient. The medical records librarian codes those entities which were rejected by the machine because of superfluous descriptive text or other clearly defined errors and presents the

remaining uncoded problems to the physician for coding.

System Output

In this section a discussion of four printouts will be presented which represent an important part of the output of the system described in this paper. The on-line nature of the system allows data to be current at the time printouts are produced. All of the analyses presented are available to residents and attending faculty of the clinic for their own teaching, evaluation, and research purposes.

The Periodic Morbidity Analysis

A number of investigators have recognized the importance of defining the content of family practice. Within a training program such as this one it is particularly important to analyze the morbidity which accounts for the bulk of the residents' clinical experience. The periodic morbidity analysis (Figure 1) presents each entity within the ICHPPC coding system ranked according to the rate (per 1,000 patients) at which that entity appears on problem lists. Obviously, many acute diseases are common and thus may rank high on such a list but, unlike rarer chronic diseases requiring frequent physician/patient encounters, may account for a relatively smaller percent of the physician's time. For this reason the diseases are also ranked according to the percent of visits to the clinic accounted for by each dis-

ease. The most common causes for visits to the clinic (Figure 2) differ considerably from the most common problems found on individual problem lists. For example, diabetes mellitus ranks 29th as a problem on individual problem lists (with a rate of 24 per 1,000 patients) and does not appear in Figure 1 which presents only the first 23 problems ranked according to frequency on problem lists; however, diabetes mellitus ranks sixth as a problem seen during an encounter (diabetes is addressed in 30 of 1,000 encounters) and can be found ranked in that position in Figure 2, reasons for visits to the clinic.

Certain auxiliary data (Figure 3) are computed when the morbidity analysis is run, and these allow correction of rates, as desired, for inactive patients, for inactive problems, and for patients with incomplete demographic profiles. These adjustments are essential to provide accurate denominators for computing appropriate problem and visit rates as emphasized by Bass.[9]

Individual Disease Statistics

The data on each disease entity extend into the individual practices of each of the residents and clinical attendings. This analysis (Figure 4) allows each physician to compare the rates for selected diseases within his/her practice to those of the peer group within the clinic. Physicians can also compare their rate of visits for each disease entity to the rates of their peer group within the clinic. These disease statistics by physician and by practice subgroup are available on request for each of the rubrics within the ICHPPC system, a service which encourages comparison of practice statistics among physicians as has been endorsed by most investigators in the field.[4,10]

DEPARTMENT OF FAMILY PRACTICE - MEDICAL UNIVERSITY OF SOUTH CAROLINA

PERIODIC MORBIDITY ANALYSIS
FOR PATIENTS 0 & OVER
FOR CLINIC

DATE RUN: JAN 13,1977
FROM: JAN 01,1976 TO: DEC 31,1976
PAGE 1

===PATIENTS===			===VISITS====			ICHPPC	PROBLEM
#	RANK	RATE	#	RANK	PCT		
5074	1	.603	2924	1	.133	Y00	MEDICAL EXAM, NO DISEASE DETECTED
2245	2	.266	808	5	.036	460	ACUTE UPPER RESPIR TRACT INFECTION
2238	3	.266	850	4	.038	7889	SIGN, SYMPTOM, ILL DEFINED COND NEC
1061	4	.126	1239	2	.056	Y009	DENTAL PREVENTIVE PROGRAM
795	5	.094	355	11	.016	520	TEETH & SUPPORT STRUCTURE DISEASES
730	6	.086	595	7	.027	277	OBESITY
706	7	.083	466	8	.021	7855	ABDOMINAL PAIN
642	8	.076	311	13	.014	3810	ACUTE OTITIS MEDIA
569	9	.067	319	12	.014	595	CYSTITIS & URINARY INFECTION NOS
514	10	.061	1055	3	.048	4012	HYPERTENSION NOS
450	11	.053	231	16	.010	791	HEADACHE
376	12	.044	174	19	.007	6221	VAGINITIS NOS
366	13	.043	210	17	.009	7289	LOW BACK PAIN WO RADIATING SYMPTOMS
355	14	.042	131	27	.005	692	CONTACT & OTHER DERMATITIS NEC
346	15	.041	233	15	.010	3000	ANXIETY NEUROSIS
343	16	.040	424	9	.019	Y60	DIAGNOSING PREGNANCY
		.040	139	25	.006	507	HAY FEVER
330	17	.039	374	10	.017	3004	DEPRESSIVE NEUROSIS
328	18	.038	280	14	.012	Y43	OTHER CONTRACEPTIVE METHODS
316	19	.037	88	45	.004	929	BRUISE, CONTUSION, CRUSHING
298	20	.035	126	29	.005	110	DERMATOPHYTOSIS & DERMATOMYCOSIS
289	21	.034	159	21	.007	7820	CHEST PAIN
272	22	.032	125	30	.005	7873	PAIN IN JOINT
258	23	.030	105	35	.004	889	LACERAT/OPEN WOUND/TRAUM AMPUTATN

Figure 1. Periodic morbidity analysis ranked by frequency of problem definition

All figures (except Figure 3) are computer printouts compiling data from the actual patient records of the Family Practice Clinic, Medical University of South Carolina. The periodic morbidity analysis presents the ICHPPC rubrics ranked according to their frequency of use in individual problem lists. Thus obesity, with a rank of 6, is the 6th most frequently used rubric and occurs on the problem lists of 86 of each 1,000 patients. A total of 730 of the 8,415 active patients (at the time this analysis was run) had this problem on their problem list. These same data, here compiled for the entire practice and for all patient visits in 1976, can also be compiled for the practice of any particular physician and covering any time period. Patients of any age grouping can be considered separately.

DEPARTMENT OF FAMILY PRACTICE - MEDICAL UNIVERSITY OF SOUTH CAROLINA

PERIODIC MORBIDITY ANALYSIS   DATE RUN: JAN 13,1977
FOR PATIENTS 0 & OVER   FROM: JAN 01,1976 TO: DEC 31,1976
FOR CLINIC   PAGE 1

====VISITS====			====PATIENTS===			ICHPPC	PROBLEM
#	RANK	PCT	#	RANK	RATE		
2924	1	.133	5074	1	.603	Y00	MEDICAL EXAM, NO DISEASE DETECTED
1239	2	.056	1061	4	.126	Y009	DENTAL PREVENTIVE PROGRAM
1055	3	.048	514	10	.061	4012	HYPERTENSION NOS
850	4	.038	2238	3	.266	7889	SIGN, SYMPTOM, ILL DEFINED COND NEC
808	5	.036	2245	2	.266	460	ACUTE UPPER RESPIR TRACT INFECTION
669	6	.030	206	29	.024	250	DIABETES MELLITUS
595	7	.027	730	6	.086	277	OBESITY
466	8	.021	706	7	.083	7855	ABDOMINAL PAIN
424	9	.019	343	16	.040	Y60	DIAGNOSING PREGNANCY
374	10	.017	330	17	.039	3004	DEPRESSIVE NEUROSIS
355	11	.016	795	5	.094	520	TEETH & SUPPORT STRUCTURE DISEASES
319	12	.014	569	9	.067	595	CYSTITIS & URINARY INFECTION NOS
311	13	.014	642	8	.076	3810	ACUTE OTITIS MEDIA
280	14	.012	328	18	.038	Y43	OTHER CONTRACEPTIVE METHODS
233	15	.010	346	15	.041	3000	ANXIETY NEUROSIS
231	16	.010	450	11	.053	791	HEADACHE
210	17	.009	366	13	.043	7289	LOW BACK PAIN WO RADIATING SYMPTOMS
191	18	.008	203	30	.024	Y41	ORAL CONTRACEPTIVES
174	19	.007	376	12	.044	6221	VAGINITIS NOS
167	20	.007	82	75	.009	412	CHRONIC ISCHEMIC HEART DISEASE
159	21	.007	289	21	.034	7820	CHEST PAIN
		.007	121	55	.014	4011	ELEVATED BLOOD PRESSURE NYD
152	22	.006	202	31	.024	6269	POSTMENOPAUS & INTERMENSTR BLEEDING
149	23	.006	179	37	.021	0791	WARTS, ALL SITES

Figure 2. Periodic morbidity analysis ranked by frequency of patient visits

This data presentation is similar to that of Figure 1; however, the rubrics are ranked according to the rate at which problems are addressed during patient encounters. Thus headache is the 16th most commonly seen problem because it was addressed (either alone or in combination with other problems) as part of 231 patient encounters. It represented 10 of each 1,000 problems addressed. (Note: The denominator used in computing this percentage was computed by considering all problems encountered for which coding into ICHPPC was accomplished. At any time approximately 5 percent of our morbidity is uncoded, a factor which accounts for a difference between the denominator here (23,100) and the total number of problems seen as presented in Figure 3).

Figure 3. Selected Practice Statistics

This figure is a compilation taken from auxiliary data which are computed along with several of the reports presented in the other figures as well as some data computed by reporting programs not presented in this paper. In compiling these data the term "patient encounter" is used to indicate actual patient visits to the clinic. The term "different problems" is used to indicate individual problems each counted only once irrespective of the number of times it was addressed in 1976. It is noteworthy that the average number of problems seen per encounter agrees closely with the figure of 1.5 reported by Bentsen.[7] When the ratio of patients with a given number of encounters to patients with one less encounter (as suggested by Bass[9]) is computed an average ratio of .72 is obtained which agrees reasonably with the .65 average reported by Bass. This figure excludes the ratio of the "one encounter" group to the "zero encounter" group which in this case was .38. If the "zero encounter" group is corrected for patients with no defined problems (eg, presumably these patients have *never* visited the clinic despite being registered along with the other members of their families) a ratio of .78 for the "one encounter" group to the "zero encounter" group and an overall average ratio of .72 is obtained.

The following data are for active patients of the Family Practice Clinic as of January 13, 1977. Visits to the clinic are summarized for the period from January 1, 1976 through December 31, 1976.

Total active patients	8,535
Total patient encounters	18,799

Patient Visits in 1976	Number of Patients	% of Patients
0	3,565	41.7
1	1,351	15.8
2	1,011	11.8
3	674	7.8
4	511	5.9
5	341	3.9
6	281	3.2
7	220	2.5
8	148	1.7
9	113	1.3
10	65	0.7
More than 10	255	3.0

Total different problems seen in 1976	17,425
Total new problems in 1976	13,246
Total problems seen in 1976	27,095
Average problems per encounter	1.44

Patient Visits in 1976	Number of Problems	% of Problems
0	27,695	61.3
1	12,308	27.2
2	3,068	6.7
3	1,062	2.3
4	449	0.9
5	199	0.4
6	132	0.2
7	68	0.1
More than 7	139	0.3

Total patients with no defined problems	1,831
Total patients with no sex on file	21
Total patients with no birthdate on file	213

PRACTICE ANALYSIS PART 4: STATISTICS FOR HYPERTENSION NOS   SEP 13, 1976

	YEAR	TOTAL PATIENTS	TOTAL FAMILIES	MALE	FF	TOTAL	MALE	FEM	TOTAL	PT'S MD	OTHER	PTS W/O VST 1 YR	VISITS PER PT LAST YR
C	3	224	70	5	.	13	.05	.07	.05	31	1	2	2.81
C	3	217	71	4	7	11	.04	.06	.05	24	0	3	3.00
C	3	222	76	5	7	12	.04	.06	.05	26	2	2	2.60
C	2	223	66	2	13	15	.01	.12	.06	26	0	3	2.16
C	2	221	64	5	7	12	.05	.05	.05	11	8	6	1.83
H	2	237	76	3	12	15	.03	.09	.06	10	1	4	.90
B	1	58	20	0	1	1	.00	.03	.01	1	0		1.00
L	1	93	21	0	2	2	.00	.04	.02	2	0	1	2.00
T	1	61	19	2	3	5	.07	.09	.08	5	14		1.00
F	F	11	5	0	0	0	.00	.00	.00	0	0		.00
S	F	72	27	0	4	4	.00	.11	.05	10	5	1	3.33
GROUP A SUBTOTALS		1639	515	26	64	90	.02	.06	.04	146	31	22	2.06
C	3	228	66	7	13	20	.06	.10	.08	48	0	5	3.20
D	3	265	82	3	9	12	.02	.06	.04	13	1	7	2.60
G	3	224	68	3	8	11	.03	.06	.04	18	0	5	3.00
A	2	127	45	3	10	13	.05	.14	.10	22	1	5	2.75
G	2	159	46	4	2	6	.05	.02	.03	7	0	4	3.50
M	2	147	41	3	8	11	.04	.11	.07	14	0	4	2.00
J	1	69	21	1	2	3	.03	.06	.04	1	4	1	.50
S	1	53	18	3	2	5	.12	.07	.09	1	11	1	.25
R	1	67	22	1	2	3	.03	.05	.04	0	22		.00
H	F	30	18	0	1	1	.00	.05	.03	2	0		2.00
F	F	203	59	4	10	14	.04	.09	.06	3	1	9	.60
S	F	1	1	0	0	0	.00	.00	.00	0	0		.00
GROUP B SUBTOTALS		1573	487	32	67	99	.04	.07	.06	129	40	41	2.04
H	3	212	72	4	9	13	.04	.08	.06	11	0	7	1.83
H	3	251	80	5	9	14	.04	.07	.05	26	8	3	2.36
K	3	247	74	5	7	12	.04	.05	.04	11	4	5	1.57
D	2	246	76	6	10	16	.05	.07	.06	5	6	10	.83
M	2	233	65	11	12	23	.09	.11	.09	15	17	7	.93
S	2	237	67	12	7	19	.10	.06	.08	48	6	9	4.80
R	1	65	21	1	4	5	.02	.13	.07	3	3	1	.75
F	1	69	21	0	6	6	.00	.16	.08	3	3	1	.60
R	1	60	21	1	2	3	.03	.06	.05	2	13		.66
H	F	66	29	0	0	0	.00	.00	.00	0	0		.00
H	F	76	10	0	0	0	.00	.00	.00	0	0		.00
GROUP C SUBTOTALS		1712	536	45	66	111	.04	.07	.05	124	60	43	1.59
L	3	266	79	5	16	21	.04	.12	.07	52	0	4	3.05
M	3	218	74	5	8	13	.05	.06	.05	22	1	4	2.44
W	3	226	71	11	11	22	.11	.08	.09	53	0	9	4.07
H	2	173	50	5	8	13	.06	.08	.07	16	1	3	1.60
S	2	152	45	6	7	13	.07	.09	.08	23	1	8	4.60
W	2	157	47	4	7	11	.05	.08	.07	6	8	4	.85
L	1	63	21	4	2	6	.17	.05	.09	2	0	3	.66
H	1	88	25	0	5	5	.00	.10	.05	3	1	2	1.00
C	1	81	24	3	4	7	.08	.09	.08	3	1	3	.75
G	F	81	31	0	0	0	.00	.00	.00	0	0		.00
R	F			0	0	0				0	0		.00
GROUP D SUBTOTALS		1505	467	43	68	111	.05	.07	.06	180	13	40	2.11
W	3	248	75	3	8	11	.02	.06	.04	25	0	3	3.12
Z	3	216	71	3	9	12	.03	.08	.05	16	0	5	2.28
S	3	220	66	6	6	12	.06	.05	.05	6	1	8	1.50
S	2	265	77	8	12	20	.06	.09	.07	13	36	4	.81
W	2	269	80	7	10	17	.05	.06	.06	10	22	9	1.25
M	1	74	24	1	3	4	.02	.08	.05	0	4		.00
K	1	71	20	1	3	4	.02	.09	.05	5	1	1	1.66
S	1	78	22	1	2	3	.03	.04	.03	3	6		1.00
B	F			0	0	0				0	0		.00
C	F	22	5	1	0	1	.09	.00	.04	1	0		1.00
GROUP E SUBTOTALS		1463	440	31	53	84	.04	.05	.04	79	70	30	1.40
GRAND TOTAL		7892	2445	177	318	495	.04	.07	.05	658	214	176	1.85

Figure 4. Individual disease statistics

This analysis is available for each of the ICHPPC rubrics. The size of each individual practice is presented along with the number of male and female patients in each practice with the selected diagnosis, the rate for each sex for that diagnosis, and the number of patient visits to the patient's own physician or to other practitioners at which that problem was addressed. Also presented is the number of patients with the selected problem who have had no note written in one year. Lastly, the number of patients with the problem who have had a note during the previous year is divided by the total number of visits to the physician by these patients to provide an index of the average number of patient visits requested each year for patients with this problem by each individual resident.

PRACTICE ANALYSIS PART 3

PROBLEM	YEAR 1 ====PATIENTS==== *MAX	AVG	MIN	TOP	====VISITS==== TOV	MAX	AVG	MIN	YEAR 2 ====PATIENTS==== *MAX	AVG	MIN	TOP	====VISITS==== TOV	MAX	AVG	MIN	YEAR 3 ====PATIENTS==== *MAX	AVG	MIN	TOP	====VISITS==== TOV	MAX	AVG	MIN
ENDOCR, NUTRIT, METABOL DISEAS																								
THYROTOXICOSIS W/WO GOITER	1	0	0	2	2	1	0	0	1	0	0	5	0	0	0	0	2	0	0	7	11	7	0	0
HYPOTHYROIDISM, MYXEDEMA, CRETINISM	1	0	0	3	0	0	0	0	3	0	0	13	6	2	0	0	5	1	0	19	14	9	0	0
DIABETES MELLITUS	5	1	0	22	17	4	1	0	12	5	2	77	121	28	8	0	13	6	2	94	291	65	19	1
GOUT & HYPERURICEMIA	1	0	0	1	0	0	0	0	2	0	0	9	3	2	0	0	2	0	0	10	10	6	0	0
AVITAMIN & NUTRITIONAL DISORDER NEC	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	0
LIPID METABOLISM DISORDERS	3	0	0	6	1	1	0	0	3	0	0	13	2	1	0	0	5	1	0	18	12	4	0	0
OTHER ENDOCR, NUTRITN, METABOL DISORD	0	0	0	0	0	0	0	0	3	0	0	10	3	1	0	0	3	0	0	12	10	5	0	0
OBESITY	10	6	1	96	50	8	3	0	30	19	9	267	98	11	7	3	35	20	14	310	235	27	15	5
ABNORMAL UNEXPLAINED BIOCHEM TEST	3	1	0	16	0	0	0	0	10	5	2	74	17	4	1	0	19	6	1	91	38	15	2	0
FEEDING PROBLEM IN BABY	1	0	0	1	0	0	0	0	1	0	0	3	0	0	0	0	1	0	0	2	0	0	0	0
NONTOXIC GOITER & NODULE	2	0	0	6	2	2	0	0	8	2	0	40	11	8	0	0	6	2	0	30	34	12	2	0
INFECTIVE AND PARASITIC DISEASES																								
CHICKENPOX	2	0	0	7	0	0	0	0	5	1	0	20	0	0	0	0	3	1	0	16	4	2	0	0
DERMATOPHYTOSIS & DERMATOMYCOSIS	7	2	0	30	4	2	0	0	17	9	1	127	30	6	2	0	17	6	3	100	41	9	2	0
PRESUMED INFECTIOUS INTESTIN DISEAS	4	1	0	27	1	1	0	0	16	6	1	90	9	3	0	0	11	5	1	84	12	3	0	0
HERPES ZOSTER	1	0	0	1	0	0	0	0	3	0	0	4	0	0	0	0	3	0	0	14	2	1	0	0

* MAX=MAXIMUM   MIN=MIN OF SEEN   AVG=AVERAGE   TOP=TOTAL PATIENTS   TOV=TOTAL VISITS

Figure 5. Disease comparisons among years of residency

Each diagnostic group is presented with data segregated by individual diseases. The maximum, average, and minimum number of patients and patient visits for each disease is presented on a "per practice" basis. Thus, in the second year residency group, no practice had less than two or more than 12 diabetic patients with the average resident following 5 such patients. In a like manner, among the third year group, no resident saw a patient for obesity as part of fewer than 5 patient encounters or as part of more than 27 patient encounters with the average resident seeing patients for obesity as part of 15 patient encounters. Encounters have been compiled for a one year period.

SEPT. 13, 1976

PROBLEM CLASS PROBLEM	AGE:	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	TOTAL
INFECTIVE AND PARASITIC DISEASES												
CHICKENPOX												
MALE		1										1
FEMALE												
DERMATOPHYTOSIS & DERMATOMYCOSIS												
MALE		1		1/1								2/1
FEMALE			1/1	1	1			1				4/1
PRESUMED INFECTIOUS INTESTIN DISEAS												
MALE		1	1									2
FEMALE		2/1			1			1				4/1
HERPES ZOSTER												
MALE		1										1
FEMALE		1/1					1					2/1
OXYURIASIS, PINWORMS, HELMINTH NEC												
MALE												
FEMALE		2	1									3
SCABIES & OTHER ACARIASIS												
MALE												
FEMALE				1								1
SYPHILIS, ALL SITES & STAGES												
MALE							1/2					1/2
FEMALE						1/1	2/2					3/3
TUBERCULOSIS												
MALE				2/4	1		2	1/1				6/5
FEMALE												
WARTS, ALL SITES												
MALE		2/3		1	2/7		1/1					6/11
FEMALE				1	1							2
OTHER INFECT/PARASITIC DISEASES NEC												
MALE		1	1/1									2/1
FEMALE		2/1										2/1
VIRAL CONJUNCTIVITIS												
MALE			1	1			1/1					3/1
FEMALE		2/1			2/2							4/3
STREP THROAT, SCARLET FEV, ERYSIPELAS												
MALE		3										3
FEMALE		2/1	1	1								4/1
MONILIASIS EXCL UROGENITAL												
MALE												
FEMALE		1/1										1/1

NUMBER BEFORE "/"=PATIENTS   NUMBER AFTER "/"=VISITS IN LAST YEAR

NUMBER WITHOUT "/"=PATIENTS, BUT NO VISITS IN LAST YEAR

Figure 6. Age and sex distribution of practice morbidity

Diagnostic groups are presented with data divided by individual diseases and summarized (but not illustrated here) for each diagnostic group. The number of patients with each diagnosis and the number of patient visits for that diagnosis in the past year are presented according to the age and sex of the patients. Data have been compiled here for the practice of one third year resident.

Disease Comparisons among Years of Residency

An additional analysis presents disease statistics associated by diagnostic group and by year of residency within the program. This analysis (Figure 5) is particularly useful in analyzing changes in diagnostic practice by the residents as they proceed through the residency. It is utilized by the enrollment committee to identify practices which appear to be deficient in certain key diseases and, in conjunction with the particular statistics for those diseases, allows identification of specific residents whose experience may be inadequate. Conversely, residents whose practice rates for certain diseases are much higher than expected may be encouraged to review the appropriate diagnostic criteria.

Age and Sex Disease Distribution

This analysis presents the diagnostic groups represented within the practice of a resident. Patients and patient visits are divided into age and sex groupings for each disease represented in the practice (Figure 6). Comparisons are possible among the disease profiles in any resident's practice or between any resident's practice and independent, published data.

Discussion

This computer-based clinical information system operates within the Family Practice Clinic as a functional part of the clinic process. The "on-line" methodology utilized in this system depends upon the availability of computer terminals in various parts of the clinic for data entry on a day-to-day basis. The direct cost of this technology is higher than the traditional "batch" computer which accepts data in large groups from punch cards or prepared tapes. A recent estimate of the operating costs of this system (excluding support for ongoing research and development) was $.48 per patient per month. This figure includes computer and terminal operations and maintenance as well as personnel directly involved with entry of medical data. However, on-line technology does introduce advantages which have been found to be important.

A significant loss rate occurs when clinical data are collected on a secondary document (eg daily work log or encounter form) and are only then transformed into machine-readable form and entered into the computer. The system described in this paper obviates the necessity for an intermediate document since data are transcribed directly into the computer from the actual dictated progress note. All problems which are addressed in the dictation are entered so that the necessity of choosing one or more "main" problems is eliminated. In this way it is possible to obtain neat, legible computer printed progress notes as part of the same process which captures important clinical data.

The use of a computer-stored table of ICHPPC rubrics and synonyms greatly increases the consistency of problem coding. The computerized table is easily updated to incorporate synonyms commonly noted on the worksheet of uncoded problems. The authors believe that this automated system of problem coding represents a standard of accuracy and consistency which would not be obtainable with a totally manual system.

Data can be presented which is collated according to a number of important factors such as diagnostic groups, individual diseases, individual physicians, peer groups of physicians, and demographic subgroupings of patients. Such flexibility allows an information system such as this one to become a functional partner in the clinical, teaching, research, and peer review components of the family practice residency.[11,12] This partnership relationship is further enhanced when a responsive on-line system adapts easily to the changing perceptions of its users on a time scale which is acceptable to their work habits. The location of the computer and its support personnel physically within the clinic has greatly facilitated the development of this responsiveness. Typically, any of the analyses illustrated in this paper (along with numerous additional analyses not presented here) can be produced, based upon current data, within 24 hours of a request.

References

1. Marsland DW, Wood M, Mayo F: A data bank for patient care, curriculum and research in family practice: 526, 196 patient problems. J Fam Pract 3:25, 1976
2. Newell JP, Dickie GL, Bass MJ: An information system for family practice — Part 3: Gathering encounter data. J Fam Pract 3:633, 1976
3. Gruer KT: Livingston New Town — Using a computer for general practice record. J R Coll Gen Pract 22:100, 1972
4. Froom J: Assessment of quality of care by profiles of physician morbidity data. J Fam Pract 3:301, 1976
5. Smith HT, Schroer BJ, Bynum JD: Combining medical information with a business data system. J Fam Pract 2:365, 1975
6. Dickie GL, Newell JP, Bass MJ: An information system for family practice — Part 4: Encounter data and their uses. J Fam Pract 3:636, 1976
7. Bentsen DG: The accuracy of recording patient problems in family practice. J Med Educ 51:311, 1976
8. WONCA Classification Committee: International Classification of Health Problems in Primary Care. Chicago, American Hospital Association, 1975
9. Bass M: Approaches to the denominator problem in primary care research. J Fam Pract 3:193, 1976
10. Tindall HL, Henderson RA, Cole AF: Evaluating family practice residents with a problem category index. J Fam Pract 2:353, 1975
11. Braunstein ML: The computer-based medical record in family practice. In Medalie JH (ed): Family Medicine: Principles and Applications. Baltimore, Williams and Wilkins, (in press)
12. Schuman SH: Life events, time flow, and family epidemiology. In Medalie JH (ed): Family Medicine: Principles and Applications. Baltimore, Williams and Wilkins, (in press)