An Integrated Medical Record and Data System for Primary Care Part 3: The Diagnostic Index Manual and Computer Methods and Applications

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Manual and computer versions of the diagnostic index-E-Book are described. Methods for establishment and maintenance of both indexes are given and the relative merits of each are delineated. Uses of diagnostic indexes are presented which are appropriate to solo and group practices. The role of the diagnostic index in curriculum development within a family practice training setting is also illustrated.

The diagnostic index is a compilation of lists of patients who have received the same diagnosis. Morbidity index, problem index, E-Book, and disease index are synonymous terms. Format of the index is determined by the particular classification of diseases or health problems in use. Indexes may be maintained by either manual recording or computer storage.

The practice of disease indexing was introduced into the hospital setting over 150 years ago. Massachusetts General Hospital first instituted an index of inpatient morbidity in 1820 using an alphabetic scheme. Several other hospitals devised their own classification systems, but lack of uniformity prevented interhospital comparison of morbidity data. The Standard Classification of Diseases and Operations (SNODO) was first published in 1932,[1] and gradually gained wide acceptance as the basis for indexing morbidity in United States hospitals. The International Classification of Diseases (ICD) had been established prior to 1900 as a means for compiling mortality information, but it was not until 1948 that the Sixth Edition (ICD-6)[2] added causes of morbidity to the list of causes of death. Columbia Presbyterian Hospital in New York City was one of the first to convert from SNODO to ICD-6. Impetus for more widespread change derived from a multicentered collaborative study comparing the efficacy of the two systems.[3] Results established that ICD-6 was superior to SNODO in that it was more consistent, efficient, and reliable. In addition, ICD was found to be better suited than SNODO to information retrieval since a larger, more accurate set of recorded data on any given subject could be collected. Despite this, according to a written communication from M. Converse, March 1977, a March 1964 American Hospital Association survey of over 6,500 nonfederal hospitals showed that only 27.8 percent were indexing by the American Adaptation of the 7th Revision of ICD (ICDA-7), while 59.2 percent remained with SNODO.

The Professional Activity Study (PAS), a computer-oriented indexing of pooled hospital data, was established in 1953 by the Commission on Professional and Hospital Activities (CPHA).[4] Although ICD was initially used, PAS introduced the hospital adaption of ICDA (H-ICDA) in 1968.[5] According to a written communication from M. Converse, March 1977, an April 1974 American Hospital Association survey of 5,961 nonfederal hospitals indicated that approximately 58 percent indexed by ICDA-8, 39 percent by H-ICDA, and only 3 percent by SNODO.

In 1960, a diagnostic index suitable for primary care morbidity enumeration was introduced in Great Britain by Eimerl.[6] Designated the "E-Book" in honor of its developer, the index has persisted despite modifications and adaptations in other countries. Two British physicians, Wood and Metcalfe, were instrumental in its introduction into the United States. From 1972 to 1976 the University of Rochester Family Medicine Training Program printed and distributed E-Books compatible with the United States version of the Royal College of General Practitioners Classification of Diseases. The E-Book morbidity index for use with the currently recognized International Classification of Health Problems in Primary Care (ICHPPC) is now available from Health Care Systems.*

Both the manual and computer E-Book indexing processes for ambulatory health problems comprise the remainder of this report. Procedures and applications currently in operation at the University of Rochester Family Medicine Training Program are given as illustrative examples of the E-Book's use in both private practice and a teaching milieu.

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Methods

Manual

The manual version of the diagnostic index-E-Book is a loose-leaf notebook containing 3 × 5-inch sheets filed in an overlapping or shingled manner (Figure 1). Following each patient visit the physician determines the diagnosis(es) and records the corresponding code number on an encounter (visit) form. Information is then entered by the clerical staff onto the index sheets corresponding to the diagnostic code numbers indicated on the encounter form. Specific information entered onto E-Book slips (Figure 2) is given in Table 1. If a patient presents with more than one problem and multiple diagnoses are made, the information given in Table 1 is recorded on each diagnostic list in the E-Book. Thus, these data represent episodes of illness and include each episode of recurrent conditions such as sinusitis or otitis media; however, chronic conditions (ie, diabetes or hypertension) are recorded only once. Recheck or return visits for a continuing problem are recorded on separate diagnostic slips (Figure 3) but include only minimal data (indicated on Table 1). Return visit slips differ from episode slips in that they allow 40 rather than 10 entries per side. By convention, males are recorded on the front and females on the reverse side of both types of slip. When the number of entries becomes so great that the original loose-leaf E-Book binder is unwieldy, slips are removed and placed in a holding binder (Figure 4). Another, less expensive form of the E-Book, the E-Box, has recently been described.[7]

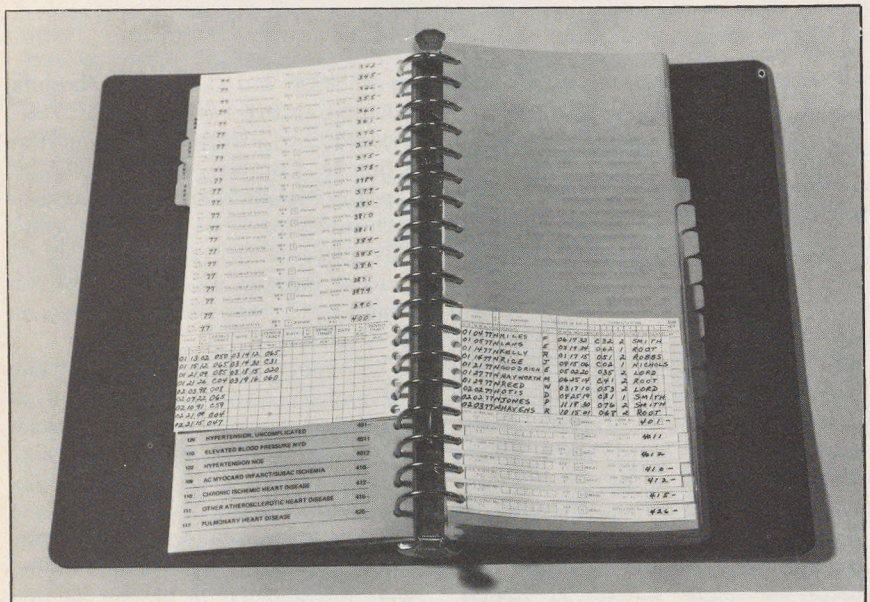

Figure 1. Diagnostic Index — E-Book (Simulated Data)

DATE	E.T.	SURNAME	Initials	DATE OF BIRTH	CONSULTATIONS 1	2	3	4	5	6
12-13 14-15 16-17	18	19 20 21	22	23-24 25-26 27-28	29 30 31	32 33 34	35 36	37 38	39 40	41
07 02 76	N	BROWN	C	08 13 21	C43	1	R00T			
07 03 76	N	SMITH	R	11 23 30	067	1	SMITH			
07 03 76	N	MARVIN	L	07 25 98	C20	1	NICHOLS			
07 10 76	N	ASTER	D	03 21 15	074	2	NICHOLS			
07 11 76	N	LUKE	E	06 02 12	C40	1	LORD			
07 12 76	0	MARION	D	12 28 30	069	1	ROOT			
07 18 76	N	SERVATI	A	05 03 10	004	2	ROBBS			
07 18 76	N	CUSTER	P	06 27 34	C10	2	NICHOLS			
07 21 76	N	COONS	J	03 23 21	C43	1	SMITH			
07 22 76	N	EDWARDS	M	01 21 23	080	2	LORD			

DR'S. CODE No. 1-7 | SEX 8 | 0 (MALE) | DIG. CODE No. 9-11 | 401 1

Figure 2. E-Book Slip — Episode Type (Simulated Data)

Computer

Entry of diagnostic information into the computer requires preliminary codification of all data items included in Table 1. Patients are identified by a five-digit family number, plus two additional digits to indicate position within that family (or household) (see Table 2B). Episode type by the manual system (new (N) and old (0) diagnoses) is expanded to include volume of patient contacts generated by initial diagnoses. Each provider is given a three-digit code number, as shown in Table 2A. Information beyond that recorded in the manual system includes patient race, marital status, and family constellation (Table 2B). As noted by M. O. Wagenfeld (written communication entitled, Calculation of Socioeconomic Areas of Rochester and Monroe County, New York, March 1966), census tract is translated into socioeconomic status (SES) by a conversion program based upon a five-part index. Implications of filing by census tract and by family information will be covered in subsequent articles of this series.

All data entry is made via WYLBUR keypunch terminal using an 80-column format. A validation program checks patient identification, diagnostic and provider code numbers. Rejected input is first reviewed by data entry personnel for keypunch error. If necessary, the encounter form from which data input has been generated, is returned to the provider for correction and subsequent re-entry.

Table 1. E-Book Slips
Recorded Information and Entry*

**Date of visit	Day/month/year
Patient name	Surname, 1st initial
**Birth date	Day/month/year
**Census tract of residence	Tract number
Episode – code:	
New diagnosis at present visit	N
Diagnosis made previously by another physician, problem still present	O
Disposition – code:	
Discharge (dismissed)	1
Return check to:	
Doctor	2
Nurse	3
Nurse practitioner	10
Referral	4
Admit to:	
Acute hospital	5
Extended care facility	6
Nursing home	7
Elsewhere	8
Consultation (within program)	9
Provider name	Surname, 1st initial

*All listed information entered on episode slips.

**Included on return visit slips (birth date listed only as year of birth).

Comparison of Manual and Computer E-Books

Realistic comparison of the two versions of the E-Book can be made only with full consideration of the practice setting, economic constraints, and ultimate goals of the involved provider(s). The manual version is obviously simpler, less expensive, and more readily accessible than its computer counterpart. It is eminently suited to private practice where computer tie-in is not readily available. The manual version provides useful information relative to practice management considerations, disease incidence, outreach, and immunization measures.

The computer version is a sophisticated one which, by linkage techniques, can provide information on large numbers of associated parameters. It is particularly useful in a training situation or large group practice.

An additional possibility is that E-Book data generated by an individual physician may be incorporated into the data systems of a group with routine computer access. Information retrieval on this individual provider's practice would still be maintained, and comparative data would be available, but cost would be minimized.

Uses of the Diagnostic Index

All applications of the manual E-Book may be accomplished by the computer version and will not be repeated.

Manual

Practice Oriented

1. *Office management* – Indexing of patients with common conditions and of total workload generated by specific conditions is of use in such managerial decisions as:

A. which patients may be appropriately assigned to shared care with midlevel providers such as

YR. 16-17 76 FOLLOW-UP VISITS SEX 8 1 (Female) DIG. CODE No. 9-11 401 -

DATE		Yr. of Birth	CENSUS TRACT	DATE		Yr. of Birth	CENSUS TRACT	DATE		Yr. of Birth	CENSUS TRACT	DATE		Yr. of Birth	CENSUS TRACT
12-13	14-15	27-28	45-47	12-13	14-15	27-28	45-47	12-13	14-15	27-28	45-47	12-13	14-15	27-28	45-47
10	06	24	C31	11	08	33	078	11	25	17	C06	12	03	27	066
10	22	15	060	11	11	09	C38	11	26	03	032	12	05	16	C45
10	27	30	034	11	11	26	C43	11	26	10	C39	12	10	08	032
11	01	45	C31	11	13	21	047	11	27	24	C41	12	10	25	C31
11	01	25	064	11	14	08	058	11	28	14	067	12	11	08	027
11	04	25	070	11	14	07	074	12	01	94	071	12	14	19	016
11	05	09	C16	11	18	15	C45	12	02	21	015	12	20	24	025
11	05	20	C31	11	19	08	074	12	03	27	069	12	21	05	071
11	06	33	C40	11	21	60	C40	12	03	14	C50	12	22	37	008
11	07	40	037	11	22	17	C25	12	03	20	C45	12	28	40	C40

Figure 3. E-Book Slip — Workload Type (Simulated Data)

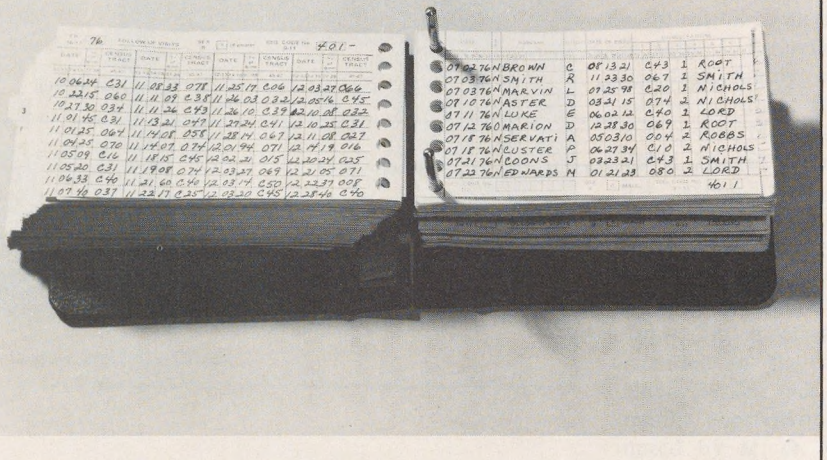

Figure 4. E-Book — Holding Binder (Simulated Data)

physician's assistants;

B. which patients might benefit from referral to ancillary health advisory personnel, ie, dietitian, physical therapist, social service worker, marriage counsellor;

C. whether expansion of physician and/or support staff is warranted, and, if warranted, what type of additional help is most consistent with practice needs.

2. *Continuing Education and Audit* — Postgraduate medical education is rationally directed to the physician's daily experience. The index provides entree to the charts of patients with troublesome and difficult conditions. Charts of perplexing patients can be reviewed by a visiting consultant or can be taken to a postgraduate medical course for further medical consultation. The E-Book permits identification of cohorts of patients' charts with similar diagnoses. Audits can be performed by either the recording physician or by one of his/her peers. Audits are ordinarily performed to assess quality of care but, if carefully performed, can give additional insights about the natural history of diseases and the responses to therapeutic interventions.

3. *Outreach* — The E-Book may be used to identify patients at risk for any particular disease or problem. An excellent example of its use would be the establishment of the "at risk" population for influenza immunization. Other outreach measures might be lists of individuals for whom childbirth education classes, obesity treatment groups, or smoking clinics would be of value.[8]

4. *Research* — Research into many aspects of patient morbidity may be initiated by use of the manual E-Book. Incidence of disease and sex ratio of occurrence can be tabulated, and relative workload generated by individual disorders may be established. Retrospective studies may be initiated by use of the diagnostic index with review of listed patients' charts providing additional information.

Table 2. Computer Entry and Codes

A. Provider	Code Number
Physicians:	
Faculty	001 - 029
Residents:*	
1st Year	101 - 199
2nd Year	201 - 299
3rd Year	301 - 399
Consultants and part-time faculty	901 - 969
Preceptors	970
Support Staff:	
Physician assistants and nurse practitioners	031 - 039
Nurses	090
Lab	091
B. Family (group of persons sharing a common household)	
Head of household (HOH)	01
Spouse	02
Children:	
first	03
second	04
subsequent	05 - 30
HOH's:	
Father	31
Mother	32
Spouse's:	
Father	33
Mother	34
Unrelated persons	35 - 40
Relatives (other than 31 - 34)	41 - 50
Reassigned:	
HOH	61 - 63
Spouse	64 - 66
Single visit patient not residing with Family but accompanying Family Medicine patient	99

*As residents progress from one training year to the next, they retain their last two identifying digits but the first digit is changed; thus, 1st year resident 131 becomes 231, then 331.

Training Programs

1. If each trainee within a residency program maintains his or her own manual E-Book, he/she will have immediate access to descriptive information on his/her own practice experience. By computation of frequencies of diagnoses and of total contact with specific disorders, he/she may be better able to evaluate his/her clinical exposure.

2. In the same manner, faculty audit of trainees' charts will be simplified. At any time, spot checks may be made on trainees' charts with certain diagnoses as tracers.

3. The diagnostic index-E-Book gives insight into each trainee's experience with acute vs chronic problems. If an appropriate mix of the two is not evidenced, patient load may be shifted or otherwise normalized.

4. As a guide to curriculum development, the E-Book serves a particularly significant purpose.[9] Total practice content may be described both in terms of diagnostic frequency and diagnostic workload. Those areas where further training is warranted may be established. Examples of the use of aggregate E-Book data to determine the content of family medicine are given in Tables 3, 4 and 5. Table 3 gives the rank order of the thirty most frequent problem episodes for a 12-month period in the Rochester Family Medicine Training Program. In this table each disease or problem episode is counted only once, despite the number of return visits during which that problem was considered. It is apparent that there are certain differences between rank frequencies of episodes and problem contacts or workload (Table 4). Problem contact refers to a patient/professional transaction in regard to one problem (newly diagnosed or return check of prior diagnosis). There may be several problem contacts during each encounter. It is of interest to note that neither diabetes nor asthma appear within the thirty most frequent episodes but rank 11th and 14th respectively in frequency of problem contacts. Although the average number of contacts per episode of illness is 1.55, some conditions necessitate more frequent return evaluation as shown in Table 5. These data may be further analyzed against the background of the practice age-sex distribution (Table 6).

Table 3. Rank Order of Episodes
January 1, 1976 - December 31, 1976

Rank	ICHPPC No.	Diagnostic Title	Female	Male	All
1.	y00-	Medical exam, no disease detected	1,750	1,349	3,099
2.	y02-	Prophylactic immunization	1,144	999	2,143
3.	460-	Acute upper respiratory tract infection	1,109	782	1,891
4.	3810	Acute otitis media	281	312	593
5.	7855	Abdominal pain	330	145	475
6.	889-	Laceration, open wound	152	208	360
7.	401-	Hypertension uncomplicated	204	116	320
8.	277-	Obesity	213	91	304
9.	7289	Low back pain without radiating symptoms	184	106	290
10.	507-	Hayfever	162	118	280
11.	466-	Bronchitis and bronchiolitis acute	151	124	275
12.	595-	Cystitis and urinary infection NOS	227	45	272
13.	y41-	Oral contraceptives	248	-	248
14.	6221	Vaginitis NOS	238	-	238
15.	y61-	Prenatal care	229	-	229
16.	3000	Anxiety neuroses	167	58	225
17.	y60-	Diagnosing pregnancy	214	-	214
18.	791-	Headache	144	66	210
19.	3004	Depressive neurosis	159	49	208
20.	3811	Chronic and serous otitis media	110	93	203
21.	680-	Boil and cellulitis	123	79	202
22.	y71-	Advice and health instruction	115	78	193
23.	7873	Pain in joint	118	68	186
24.	929-	Bruise, contusion	94	88	182
25.	691-	Eczema and allergic dermatitis	109	67	176
26.	7820	Chest pain	82	90	172
27.	034-	Strep throat, scarlet fever, erysipelas	98	73	171
28.	787-	Pain in limb	106	63	169
29.	470-	Influenza	110	57	167
30.	7882	Rash and other nonspecific skin eruptions	96	62	158
		Total			13,853
Total episodes (all problems)					24,381
Midyear visiting patient population					9,540
(Patient visited at least once in a two-year period)					

Table 4. Rank Order of Problem Contacts (Workload)
January 1, 1976 - December 31, 1976

Rank	ICHPPC No.	Diagnostic Title	Female	Male	All
1.	y00-	Medical exam, no disease detected	2,206	1,619	3,825
2.	y02-	Prophylactic immunization	1,183	1,036	2,219
3.	460-	Acute upper respiratory tract infection	1,199	837	2,036
4.	401-	Hypertension uncomplicated	838	554	1,392
5.	y61-	Prenatal care	1,082	59	1,141
6.	507-	Hayfever	661	414	1,075
7.	3801	Acute otitis media	449	502	961
8.	277-	Obesity	541	192	733
9.	7855	Abdominal pain	474	190	664
10.	3004	Depressive neurosis	475	115	590
11.	250-	Diabetes mellitus	337	203	540
12.	889-	Laceration, open wound	223	287	510
13.	3000	Anxiety neurosis	378	119	497
14.	493-	Asthma	233	255	488
15.	7289	Low back pain without radiating symptoms	287	162	449
16.	595-	Cystitis and urinary infection NOS	375	67	442
17.	y41-	Oral contraceptives	431	-	431
18.	y60-	Diagnosing pregnancy	353	-	353
19.	466-	Bronchitis and bronchiolitis acute	204	148	352
20.	680-	Boil and cellulitis	212	119	331
21.	3811	Chronic and serous otitis media	176	149	325
22.	412-	Chronic ischemic heart disease	152	128	280
23.	6221	Vaginitis NOS	279	-	279
24.	791-	Headache	198	79	277
25.	4270	Heart failure	150	112	262
26.	691-	Eczema and allergic dermatitis	164	98	262
27.	713-	Osteoarthritis and allied conditions	206	50	256
28.	3001	Hysterical and hypochrondria neurosis	182	62	246
29.	7873	Pain in joint	147	88	235
30.	y71-	Advice and health instruction	144	84	228
		Total			21,679
Total problem contacts (all problems)					37,721
Midyear visiting patient population					9,540
(Patient visited at least once in a two-year period)					

Computer

Applications of computer E-Book information are as varied as funds, programming resources, and established needs allow. Linkage of patient, family, and provider demographics with morbidity data permits such extensive retrieval of information that all possibilities cannot be covered here. Included, instead, will be those applications which we have found to be most helpful in curriculum design, evaluation, practice management, and research. Routine reports are generally produced quarterly and yearly in our practice.

Table 5
Ratio of Problem Contacts/Episodes of Selected Problems (visits/year)

Diabetes mellitus	4.54
Hypertension uncomplicated	4.35
Asthma	3.54
Depressive neuroses	2.84
Obesity	2.41
Anxiety neuroses	2.21

Table 6
Visiting Patient Population July 1, 1976

Age	Female	Male	Total
<1	19	32	51
1- 4	338	382	720
5-14	839	928	1,767
15-24	1,276	850	2,126
25-44	1,862	1,245	3,107
45-64	691	524	1,215
>64	330	224	554
Total	5,355	4,185	9,540

The *Computer E-Book:* A simple listing by ICHPPC diagnostic code is made of all patients receiving that diagnosis. This may be produced as often as desired and may cover any specified time period for:

1. The entire practice.
2. Teams or groups of providers. Teams, in this setting, are composed of faculty, first, second and third year trainees, and nursing personnel. Groups of providers refer to all faculty, or third year residents, et seq.
3. Individual providers. By maintaining the last two digits of his/her provider code throughout the training years, an E-Book is generated to summarize all diagnostic exposure throughout training.
4. Special reports. By merging prerecorded information on patient demographics and assigned primary provider with data from individual encounters a number of other reports are generated.

A. age-sex-race-socioeconomic distribution of assigned patient population for each provider or team.

B. continuity of care assessment. Quarterly reports list the assigned patients of each provider who were seen by other than established doctor of record.

C. total workload is established by summation of problem contacts by diagnosis for each provider, team, group, or entire practice.

D. diagnostic contacts or, in some instances, diagnostic behavior of individual trainees are compared with that of peers either by individual diagnoses or by establishing frequency distribution of contacts within each of the major ICHPPC diagnostic sections. Thus, potential diagnostic problem areas are determined,[10] and appropriate corrective measures instituted.

E. Linkage of patient and family information with provider and diagnostic indexes can establish valuable managerial and curricular guides. Reports of patient population demographics and morbidity patterns for individual providers become an index for rational distribution of workload and assigned patient population.[10]

Applications of the diagnostic index as related to family constellation and socioeconomic status will be elaborated in subsequent articles in this series.

Summary

Establishment, maintenance, and applications of both the manual and computer diagnostic index have been described. Each has its advantages. Immediate, inexpensive access to diagnostic information makes the manual version desirable for solo or small group practices. In the Rochester Training Program, despite extensive use of the computer index, all trainees are required to become thoroughly familiar with the manual version so that, if desired, its use may be implemented in their future practice.

The computer index is far more versatile. The capacity for computer linkage with other parameters of patient care render this version most appropriate in large, research-oriented groups, and training or academic programs.

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