Clinical records on computer for ambulatory patients

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Computer systems now are available not only to record patient information but to use that data to help the physician care for patients. Besides maintaining records in a readable form, the computer can provide valuable summaries and access to data from a remote site, increase efficiency of paperwork through avoiding re-entry procedures, and remind the physician to perform preventive, diagnosis-related, and treatment-related procedures. Costs and problems associated with the use of such systems are not unreasonable when compared to the benefits.

The computer has become an important instrument for physicians for a variety of purposes. This paper explores the most valuable features of computerized records, and some potential problems and costs. Several software programs are described briefly.

See December DO for articles on computers in medicine.

Features

Although the ability to read clinical record data is an important feature of computerization, maintainance of information in a usable fashion, avoidance of re-entry of data, and use of data to generate reminders all may be more valuable functions of the electronic record system.

A quick glance at a problem or medication list or, perhaps, a graph of vital signs and critical laboratory data can be extremely useful in emergency situations or at any time to review a patient's history. Unfortunately, these lists often are not kept, not current, or not readily available. The most likely reason is that it is time consuming to rewrite and keep current data that has already been recorded in progress notes. Even if all of these lists and graphs are maintained properly, they often are not available when they are needed (such as in the emergency room or when the patient telephones the physician at home).

A computerized record system can sort data entered in a progress note automatically, can maintain up-to-date problem and medication lists, and even can graph numerical data. It can make these data available with reasonable security to remote sites such as the emergency room or the physician's home. Finally, such data can be used for cross-population searches for research or medication recall purposes.

Using data more than once is the key to making a clinical computer system cost effective. This feature requires integration with business systems to be most effective. The diagnosis, for example, may be written in the progress notes, on the patient's billing form, on insurance forms, and, perhaps, in correspondence to a consultant or referring physician. Demographic data are used for business and medical purposes. Also, prescriptions must be recorded on the chart and then rewritten for the pharmacist, who must rewrite the information for the patient. A computer system can, with a few key strokes, help the physician to find the right name, dose, and quantity of the medication, record it, check for interactions, print a prescription (or send it electronically to the pharmacy of the patient's choice), and print instructions for the patient.

Probably the greatest potential for improving quality of care comes from the computer's ability to remind. It has been shown in a study[1] on airline pilots that reliance on memory in critical situations is a vital error. An electronic record system can remind us to perform preventive medicine procedures (for example, mammography annually for women past age 50), diagnosis-related procedures (for example, electrocardiography annually for patients with a history of myocardial infarction), and treatment-related procedures (for example, potassium determinations quarterly for a patient taking a thiazide drug). Potential drug interactions can be identified automatically on entry of a new medication. McDonald and associates[2,3] have shown that these actions are taken twice as often when a reminder is provided than when it is not.

Potential problems and costs

Common concerns in using the computer for memory jogging are that the recommendations will become out of date or that a particular physician will not agree with them. Medi-Span drug and drug interactions data sets are one example of how to keep data current. These sets, which are used by several systems for prescription writing and interaction checks, are updated quarterly at a reasonable cost. Most systems that provide reminders make them either user-defined or user-modifiable. Any system that appears to recommend patient care likely will come under FDA scrutiny in the near future as a "medical device."[4]

Entering and accessing data efficiently and unobstrusively also are significant aspects of computer use. McDonald[5] notes that "most of the labor problems and costs of establishing a medical record system are on the input side," but that much data potentially can be captured from other sources. Further, there is some concern about the intrusion of the computer into the physician-patient relationship.[6] To utilize such functions as printing prescriptions and patient information, the physician or nurse must enter some current clinical data, including new medications and diagnoses, while the patient is present. For access to historic data, a paper summary must be printed for each encounter or a computer terminal must be present wherever the physician or nurse sees the patient. Therefore, patients will need to be acclimated to computers in this setting as well.

The cost of a basic computer system will be $20,000 to $100,000, and additional personnel time probably will be required. However, Lloyd[7] demonstrated that in the first year of use in his office, computerization using Duchess software generated more income than outgo and also resulted in fewer patient visits. The increased income was produced by performing recommended tests and preventive measures that had been overlooked previously. Also, computer-generated postcard reminders for flu shots can increase compliance to near 90% (communication, S.C. Lloyd, September 1986) from what it is commonly 20%.[8] This mechanism can produce significant income. The potential savings in time by avoiding re-entry of data has been discussed previously.

Improved quality of care should decrease costs for patients by preventing serious illness and the attendant high cost of hospitalization and long-term care. The systems themselves are likely to become more affordable as hardware costs continue to drop, methods of data entry improve, and new technology creates greater efficiency. For example, optical storage devices (laser discs) make storage of large volumes of data more affordable. Insurance companies and the government also are showing signs of interest in supporting such systems. One example is *LifeCard*, which is owned by Blue Cross and Blue Shield of Maryland.

TABLE 1. SOURCES FOR SOFTWARE PROGRAMS.

The Consultant Series
Medical Software Consortium
PO Box 76069
St. Peters, MO 63376
(314) 928-7373

Duchess Corporation
900 Elmwood
Columbia, SC 29201
(803) 779-0557

LifeCard International, Inc.
(Subsidiary of Blue Cross and Blue Shield of Maryland)
Nottingham Centre
502 Washington Ave
Suite 300
Towson, MD 21204
(301) 494-4800

Medi-Span
5980 W 71st St
PO Box 68875
Indianapolis, IN 46268-0875
(800) 428-4495

Practice Partner
Physician Micro Systems, Inc.
2033 Sixth Ave
Suite 707
Seattle, WA 98121
(206) 441-8490

Smart Chart
Ash Medical Systems, Inc.
2701 B Kent Ave
West Lafayette, IN 47906
(317) 463-940

The Medical Record (TMR)
Database, Inc
PO Box 3054
Durham, NC 27705-1054
(919) 493-6969

The Regenstrief Institute for Health Care
1001 W Tenth St
Indianapolis, IN 46202
(317) 630-7400

Available software systems

Of the dozen of computerized record systems available, some are simply modified word processors with few features other than recording of data. Several business systems have begun offering add-on record components. Some of the most sophisticated systems have been developed at universities, these

For patients with elevated cholesterol

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Superior lipids performance in hypertensive patients with elevated cholesterol[1,2]*

HYTRIN® (terazosin HCl)

1 mg, 2 mg, 5 mg, 10 mg TABLETS

ONCE-A-DAY ONE PRICE†

The first once-a-day alpha, blocker

■ *During controlled clinical studies, patients receiving HYTRIN had a small but significant decrease (−3%) compared to placebo in total cholesterol and LDL + VLDL cholesterol fraction.*[1,2]

■ *Although HDL fraction showed a slight increase from baseline and triglycerides decreased, neither change was significant compared to placebo.*[1,2]

	Alpha, blockers (HYTRIN)[2,3]	*ACE inhibitors*[4,5]	*Calcium antagonists*[4,5]	*Diuretics*[3]	*Beta blockers*[3]
Total cholesterol	↓	↔	↔	↑	↔
LDL + VLDL cholesterol	↓	↔	↔	↑	↔ ↑
HDL cholesterol	↔ ↑	↔	↔	↔ ↓	↓
Triglycerides	↔ ↓	↔	↔	↑	↑

*HYTRIN is not indicated for the treatment of hyperlipidemia.

†*Average wholesale price.*

HYTRIN®

(terazosin hydrochloride tablets)

Brief Summary

CLINICAL PHARMACOLOGY: Pharmacodynamics: Clinical studies of terazosin used in once-a-day (majority) and b.i.d regimens with total doses usually in the range of 5-20mg/day, in patients with mild or moderate hypertension. Because terazosin, like all alpha antagonists, can cause large falls in blood pressure after the first dose or first few doses, the initial dose was 1mg in virtually all studies, with subsequent titration to a specified fixed dose or titration to a specified blood pressure end point.

Blood pressure responses were measured at the end of the dosing interval (usually 24 hrs.) and effects were shown to persist throughout the interval, with usual supine responses 5-10mmHg systolic and 3.5-8mmHg diastolic greater than placebo. The responses in the standing position tended to be somewhat larger, although this was not true in all studies. The magnitude of blood pressure responses was similar to prazosin and less than hydrochlorothiazide (in a single study). In measurements 24 hrs. after dosing, heart rate was unchanged.

Limited measurements of peak response (2-3 hrs. after dosing) during chronic terazocin administration indicate that it is more than twice the trough (24 hr.) response, suggesting some attenuation of response at 24 hrs., presumably due to a fall in blood terazosin concentrations at the end of the dose interval. This explanation is not established with certainty and is not consistent with the similarity of blood pressure response to once-a-day and b.i.d. dosing. With the absence of an observed dose-response relationship over a range of 5-20mg, i.e., if blood concentrations fall to the point of providing less than full effect at 24 hrs., a shorter dosing interval or larger dose should lead to increased response. Measure blood pressure (BP) at the end of the dose interval; if response is not satisfactory, patients may be tried on a larger dose or b.i.d. regimen. The latter should be considered if side effects, such as dizziness, palpitations, or orthostatic complaints, are seen within a few hours after dosing.

The greater BP effect associated with peak plasma concentrations (first few hours after dosing) appears somewhat more position-dependent (greater in the erect position) than the effect of terazosin at 24 hrs. In the erect position there is a 6-10 bpm increase in heart rate in the first few hours after dosing. During the first 3 hrs. after dosing 12.5% of patients had a systolic pressure fall of 30mmHg or more from supine to standing, or standing systolic pressure below 90mmHg with a fall of at least 20mmHg, compared to 4% of a placebo group.

INDICATIONS AND USAGE: Indicated for the treatment of hypertension.

CONTRAINDICATIONS: None known.

WARNINGS: Syncope and "First-dose" Effect: Terazosin, like other alpha-adrenergic blocking agents, can cause marked hypotension, especially postural hypotension, and syncope in association with the first dose or first few doses. A similar effect may occur if therapy is interrupted for more than a few doses. Syncope has been reported with other alpha-adrenergic blocking agents in association with rapid dosage increases or introduction of another antihypertensive drug. Syncope may be due to an excessive postural hypotensive effect, although occasionally the syncopal episode has been preceded by severe supraventricular tachycardia with heart rates of 120-160 bpm.

To decrease the likelihood of syncope or excessive hypotension, always initiate treatment with a 1mg dose at bedtime. The 2mg, 5mg and 10mg tablets are not indicated as initial therapy. Increase dosage slowly, and add additional antihypertensive agents with caution. Caution patients to avoid situations where injury could result if syncope occurs during initiation of therapy.

In early studies, where increasing single doses up to 7.5mg were given at 3 day intervals, tolerance to the first dose phenomenon did not necessarily develop and the "first dose" effect was observed at all doses. Syncopal episodes occurred in 3 of 14 subjects given doses of 2.5, 5, and 7.5mg, which are higher than the recommended initial dose. Severe orthostatic hypotension (BP 50/0mmHg) was seen in two others and dizziness, tachycardia, and lightheadedness occurred in most subjects. These adverse effects all occurred within 90 min. of dosing.

In multiple dose clinical trials involving nearly 2000 patients, syncope was reported in about 1% of patients, in no case severe or prolonged, and was not necessarily associated with early doses.

If syncope occurs, place patient in recumbent position and treat supportively. There is evidence that the orthostatic effect of terazosin is greater, even in chronic use, shortly after dosing.

PRECAUTIONS: *General: Orthostatic Hypotension:* While syncope is the most severe orthostatic effect of terazosin, other symptoms of lowered BP, such as dizziness, lightheadedness and palpitations, are more common, occurring in 28% of patients in clinical trials. Patients with occupations in which such events represent potential problems should be treated with particular caution.

Information for Patients: Make aware of possibility of syncopal and orthostatic symptoms, especially at initiation of therapy, and to avoid driving or hazardous tasks for 12 hrs. after the first dose, after a dosage increase, and after interruption of therapy when treatment is resumed. Caution to avoid situations where injury could result should syncope occur during initial therapy. Advise to sit or lie down when symptoms of lowered BP occur and to rise carefully from a sitting or lying position. Bothersome dizziness, lightheadedness, or palpitations should be reported to physician.

Tell patients that drowsiness or somnolence can occur, requiring caution in people who must drive or operate heavy machinery.

Laboratory Tests: Small but statistically significant decreases in hematocrit, hemoglobin, WBC, total protein and albumin were observed in clinical trials. The magnitude of decreases did not worsen with time. These findings suggest the possibility of hemodilution.

Drug Interactions: In controlled trials, terazosin was added to diuretics, and several beta-adrenergic blockers; no unexpected interactions were observed. Terazosin has also been used concomitantly without interaction in at least 50 patients on the following: 1) analgesic/anti-inflammatory (acetaminophen, aspirin, codeine, ibuprofen, indomethacin); 2) antibiotics (erythromycin, trimethoprim and sulfamethoxazole); 3) anticholinergic/sympathomimetics (phenylephrine HCl, phenylpropanolamine HCl, pseudoephedrine HCl); 4) antigout (allopurinol); 5) antihistamines (chlorpheniramine); 6) cardiovascular agents (atenolol, hydrochlorothiazide, methyclothiazide, propranolol); 7) corticosteroids; 8) gastrointestinal agents (antacids); 9) hypoglycemics; 10) sedatives and tranquilizers (diazepam).

Carcinogenesis, Mutagenesis, Impairment of Fertility: HYTRIN was devoid of mutagenic potential when evaluated *in vivo* and *in vitro*.

HYTRIN, administered in feed to rats at doses of 8, 40, and 250mg/kg/day for 2 yrs., was associated with a statistically significant increase in benign adrenal medullary tumors of male rats exposed to the 250mg/kg dose. This dose is 695 X max. recommended human dose (20mg/55kg). Female rats were unaffected. HYTRIN was not oncogenic in mice when administered in feed for 2 yrs. at a maximum tolerated dose of 32mg/kg/day.

The absence of mutagenicity in a battery of tests, of tumorigenicity of any cell type in the mouse carcinogenicity assay, of increased total tumor incidence in either species, and of proliferative adrenal lesions in female rats, suggests a male rat species-specific event. Numerous other diverse pharmaceutical and chemical compounds have been associated with these tumors in male rats without supporting evidence for carcinogenicity in man.

Effects on fertility were assessed in a standard fertility/reproductive performance study in which male and female rats were administered oral doses of 8, 30 and 120mg/kg/day. Four of 20 male rats given 30mg/kg and 5 of 19 male rats given 120mg/kg failed to sire a litter. Testicular weights and morphology were unaffected. Vaginal smears at 30 and 120mg/kg/day appeared to contain less sperm than smears from control matings and good correlation was reported between sperm count and subsequent pregnancy.

Oral use for 1 or 2 yrs. elicited a statistically significant increase in testicular atrophy in rats exposed to 40 and 250mg/kg/day, but not in rats exposed to 8mg/kg/day (> 20 X max. recommended human dose). Testicular atrophy was observed in dogs dosed with 300mg/kg/day (> 800 X max. recommended human dose) for 3 months but not after 1 yr. when dosed with 20mg/kg/day. This lesion has also been seen with Minipress®.

Pregnancy: Teratogenic effects: Pregnancy Category C. There are no adequate and well-controlled studies in pregnant women and the safety of terazosin in pregnancy has not been established. HYTRIN is not recommended during pregnancy unless potential benefit justifies potential risk to mother and fetus.

Nonteratogenic effects: In a peri- and post-natal development study in rats, significantly more pups died in the group dosed with 120mg/kg/day (> 300 X max. recommended human dose) than in the control group during the 3-week post-partum period.

Nursing Mothers: It is not known whether terazosin is excreted in breast milk; therefore, exercise caution when administering terazosin to a nursing woman.

Pediatric Use: Safety and effectiveness have not been determined.

ADVERSE REACTIONS: The prevalence of adverse reactions has been ascertained from 14 placebo-controlled studies conducted primarily in the U.S. The studies involved once-a-day administration of terazosin as monotherapy or in combination with other antihypertensive agents, at doses ranging from 1 to 40mg. All adverse events reported during these studies were recorded as adverse reactions. Adverse events where the prevalence rate in the terazosin group was at least 5%, where the prevalence rate for the terazosin group was at least 2% and was greater than the prevalence rate for the placebo group, or where the reaction is of particular interest are summarized below. Only asthenia, blurred vision, dizziness, nasal congestion, nausea, peripheral edema, palpitations and somnolence were significantly ($p < 0.05$) more common in patients receiving terazosin than in patients receiving placebo. Other events include **[%TERAZOSIN-%PLACEBO]:** asthenia (11.3%-4.3%), back pain (2.4%-1.2%), blurred vision (1.6%-0%), depression (0.3%-0.2%), dizziness (19.3%-7.5%), dyspnea (3.1%-2.4%), edema (0.9%-0.6%), headache (16.2%-15.8%), impotence (1.2%-1.4%), libido decreased (0.6%-0.2%), nasal congestion (5.9%-3.4%), nausea (4.4%-1.4%), nervousness (2.3%-1.8%), pain-extremities (3.5%-3%), palpitations (4.3%-1.2%), paresthesia (2.9%-1.4%), peripheral edema (5.5%-2.4%), postural hypotension (1.3%-0.4%), sinusitis (2.6%-1.4%), somnolence (5.4%-2.6%), tachycardia (1.9%-1.2%), weight gain (0.5%-0.2%).

Adverse reactions were usually mild or moderate in intensity but sometimes were serious enough to interrupt treatment. Adverse reactions that were most bothersome as judged by being reported as reasons for discontinuation of therapy by at least 0.5% of the terazosin group and being reported more often than in the placebo group **[%TERAZOSIN-%PLACEBO]** are: asthenia (1.6%-0%), blurred vision (0.6%-0%), dizziness (3.1%-0.4%), dyspnea (0.9%-0.6%), headache (1.3%-1%), nasal congestion (0.6%-0%), nausea (0.8%-0%), palpitations (1.4%-0.2%), paresthesia (0.8%-0.2%), peripheral edema (0.6%-0%), postural hypotension (0.5%-0%), somnolence (0.6%-0.2%), syncope (0.5%-0.2%), tachycardia (0.6%-0%).

Additional adverse reactions have been reported, but these are not distinguishable from symptoms that might have occurred in the absence of exposure to terazosin. The following additional adverse reactions were reported by at least 1% of 1987 patients who received terazosin in clinical studies or during marketing experience: abdominal pain, abnormal vision, anxiety, arrhythmia, arthralgia, arthritis, bronchitis, chest pain, cold symptoms, conjunctivitis, constipation, diarrhea, dry mouth, dyspepsia, epistaxis, facial edema, fever, flatulence, flu symptoms, gout, increased cough, insomnia, joint disorder, myalgia, neck pain, pharyngitis, pruritus, rash, rhinitis, shoulder pain, sweating, tinnitus, urinary frequency, urinary tract infection, vasodilation, vomiting.

DOSAGE AND ADMINISTRATION: Dose and dose interval (12 or 24 hrs.) should be adjusted according to BP response.

Initial Dose: 1mg at bedtime. Observe the initial dosing regimen strictly to minimize potential for severe hypotensive effects.

Subsequent Doses: Slowly increase dose to achieve desired BP response. Usual dose range is 1mg to 5mg once a day. Some patients may benefit from doses up to 20mg/day. Doses over 20mg do not appear to provide further BP effect. Doses over 40mg have not been studied. Monitor BP at the end of dosing interval to assure control is maintained. It may be helpful to measure BP 2-3 hrs. after dosing to see if maximum and minimum responses are similar, and to evaluate symptoms which can result from excessive hypotensive response. If response is substantially diminished at 24 hrs. consider an increased dose or b.i.d. regimen. **If administration is discontinued for several days or longer, reinstitute therapy using initial dosing regimen.** In clinical trials, except for the initial dose, the dose was given in the morning.

Use With Other Drugs: Caution should be observed when terazosin is administered concomitantly with other antihypertensive agents (e.g., calcium antagonists) to avoid the possibility of significant hypotension. When adding a diuretic or other antihypertensive agent, dosage reduction and retitration may be necessary.

Revised: Sept., 1988 **Abbott Health Care Products, Inc.** North Chicago, IL 60064 8083873

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#1004 Visit Date: 10/04/88 MS DORTHY GRANT
DOB 06/07/43 (45) F W DOCTOR NUMBER 1 FMD: DOCTOR NUMBER 1

	Problems	Onset	Id	Quan	Treatment	Strength	SIG		P	Start	#Ref
M 1	ESSENTIAL HYPERTE	401.90 02/83	1	#30	HYDROCHLOROTHIA	25 MGM	one	QD	P	09/88	x3
M 2	ANGINA	413.90 02/83									
M 3	DIABETES II	250.00 06/85									
M 4	OSTEOARTHRITIS	715.90 08/86	2	#30	FELDENE	20 MGM	one	QD		09/88	x5

New Diagnosis/Treatments

ESSENTIAL HYPERTE
CVD: Amaurosis____Focal neuro change_____TIA____Confusion___
CAD: Chest pain/Angina_____Chest tightness___Palpitations__
CHF: Edema_____Orthopnea____PND_____
CRF: Oliguria_____Nocturia_____Hematuria_____Malaise_____
PVD: Claudication___Leg pains____Cyanosis____Cold__Cramps__
BP: Lying R___/___L___/___ Sitting R___/___L___/___
BP: Stand R___/___L___/___ Pulse_____Ectopics___
Fundi:_____Lungs: rales_____ CVS: S3 S4 Murmur_____
Abdomen: Liver edge_____ Extrem: Pulses___ edema___

ANGINA
Chest Pain: Frequency Duration
Location Radiation
Palpitations Syncope Sx CHF
BP: Pulse:
CVS: PMI: Murmur: Gallop:
Extrem: Edema

DIABETES II
Hypoglycemia (weakness, tachycardia, sweats, confusion):_____
Hyperglycemia (polyuria, polyphasia, weight loss) sweet breath___
Diet_____ Vision_____ Feet_____ Infection
BP:_____ Pulse:_____ Blood sugar:_____
Fundi:_____ Feet:_____ Urine:_____

OSTEOARTHRITIS
Interval Hx_____
Acute episodes_____ Sx changes_____
Function changes_____ Compliance meds_____
General/musculoskeletal exam_____
CBC_____ SMA/CHEM-12_____
Urinalysis_____ Other_____

Fig 1. *Patient encounter form Duchess* software.

make the greatest use of computer intelligence for reminders to perform certain tests or procedures. Some systems incorporate artificial intelligence to help make decisions.

These larger systems may be too large to consider for private practice at this time but have the potential for providing the framework for smaller systems. These latter systems, particularly those from Digital Equipment Corporation, mostly are run on minicomputers. Most of the commercially available systems run on IBM AT or IBM-compatible hardware. Table 1 lists the sources for each software program discussed.

LifeCard

The *LifeCard* is a credit-card-sized, permanent personal medical record that the patient carries so that information is readily available wherever the patient may be. The system requires a reader/writer and an IBM personal computer or IBM-compatible equipment for input and output.

Consultant Series, Smart Chart

The Consultant Series and *Smart Chart* software do not at present integrate with business systems. Each has the capability of storing progress notes, maintaining problem lists, medication lists, and basic numerical data. *Smart Chart* uses a laptop computer to record all of these data on floppy disks while the physician is with the patient. Both can perform prescription writing and provide drug interaction information. Neither produces any reminders but each has some capacity for user-defined recall. *Smart Chart* costs about $1,500. *The Consult-*

MS DORTHY GRANT #1004 (10/04/88) Page: 2

SURVEILLANCE ORDERS SORTED BY DUE DATE

DUE	Exam/Test	Freq	Reason	Delete	#
*09/19/85	CBC	SEMIAN	Preventive Care		8
*09/19/85	GLUCOSE	SEMIAN	Dx: DIABETES II		19
*09/19/85	HGBA1C	SEMIAN	Dx: DIABETES II		20
*09/19/85	OCCULT BLOOD	SEMIAN	Preventive Care		5
*02/23/86	BUN	ANNUAL	Rx: FELDENE		23
*02/23/86	CHEST XRAY: PA	ANNUAL	Dx: ESSENTIAL HYP		13
*03/23/86	CREATININE	ANNUAL	Rx: FELDENE		22
*03/23/86	SED RATE (WESTE	ANNUAL	Dx: OSTEOARTHRITI		21
*03/23/86	SMA12	ANNUAL	Preventive Care		7
*03/23/86	STRESS EKG	ANNUAL	Dx: ESSENTIAL HYP		15
*03/23/87	LOV: LIMITED OV	2 YRS	Preventive Care		3
*03/22/88	ECHOCARDIOGRAM	3 YRS	Dx: ESSENTIAL HYP		18
*03/22/88	TONOMETRY	3 YRS	Preventive Care		4
*09/11/88	URINALYSIS	SEMIAN	Dx: ESSENTIAL HYP		14
03/15/89	COMPREHENSIVE E	ANNUAL	Dx: ESSENTIAL HYP		16
03/15/89	EKG	ANNUAL	Preventive Care		12
03/15/89	PAP SMEAR	ANNUAL	Preventive Care		2
02/22/90	AUDIOM	5 YRS	Preventive Care		11
03/22/90	MAMMOGRAM	5 YRS	Preventive Care		6
03/22/90	PPD SKIN TEST	5 YRS	Preventive Care		9
03/22/90	SEROLOGY	5 YRS	Preventive Care		10
03/15/91	T4	3 YRS	Dx: ESSENTIAL HYP		17
03/21/95	TETANUS TOXOID	10 YRS	Preventive Care		1

Fig 2. *Surveillance order form Duchess* software.

ant Medical Record System costs $1,995. *The Consultant* will soon have its own integrated business package (at additional cost).

Practice Partner, Duchess

The Practice Partner and *Duchess* are AT-based software systems (*Duchess* is also available for DEC hardware) that have fully integrated clinical and business functions. Both maintain demographics, problem lists, and medication lists and use these data for a variety of purposes. *Duchess* can perform prescription writing and give drug interaction information.

The Practice Partner will soon be able to do the same. The latter maintains more information, including notes as well as laboratory and other studies data, and produces flow charts. However, its reminder system essentially is limited to prevention. *Duchess*, on the other hand, concentrates on reminders based on demographics, problems, and medications. It produces a unique paper "encounter form" for each patient visit (Figs 1 and 2). This form lists problems and related treatment, suggests subjective and objective data to be addressed relative to listed problems, and reminds when preventive and other diagnosis- and treatment-related procedures should be performed. This form can be used for updating both the paper and electronic charts.

Both systems can keep information files to be printed for patients when a new drug or different problem is encountered. The cost of *The Practice Partner* software is approximately $7,000. *Duchess* is sold on a basis of percent of increased practice volume.

The Medical Record, Regenstrief Institute System

The Medical Record (TMR) (VAX Minicomputer, Digital Equipment Corporation) and the system at the Regenstrief Institute (Regenstrief medical records) are highly sophisticated systems with all of the capabilities described above. Each requires a significant investment in hardware. The Regenstrief system is not available commercially.

As with any facet of computers, changes in medical systems may occur daily. New systems and new features become available. The government or other third parties may develop a universal record system. Improvements in clarity and ease of access to data will make systems more usable. Improved integration between functions will enhance economy and greater use of reminders will improve

quality of care. Health-care providers and patients will come to accept the inclusion as opposed to intrusion of the computer.

Comments

Clinical record systems on computer are to current paper medical record systems as the present systems are to 3×5 index cards of the past. The most pressing reason for using computers for medical records is to improve quality of care. With a computer to manage data, there is greater and clearer access to information. By reusing data, and, thus, avoiding re-entry, efficiency improves. Further, efficient and clear record systems have become a necessity for medicolegal reasons. Undeniable costs and potential problems are associated with such systems, but these are not insurmountable and are outweighed by the advantages.

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