Special Article

Chronic Disease in a General Adult Population

Findings From the Rand Health Insurance Experiment

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Using questionnaire and physical screening examination data for a general population of 4,962 adults aged 18 to 61 years enrolled in the Rand Health Insurance Experiment, we calculated the prevalence of 13 chronic illnesses and assessed disease impact. Low-income men had a significantly higher prevalence of anemia, chronic airway disease and hearing impairment than their high-income counterparts, low-income women a higher prevalence of congestive heart failure, diabetes mellitus, hypertension, hearing impairment and vision impairment. Of our sample, 30% had one chronic condition and 16% had two or more. Several significant pairs or "clusters" of chronic illnesses were found. With few exceptions (diabetes, hypertension), the use of physician care in the previous year for a specific condition tended to be low. Disease impact (worry, activity restriction) was widespread but mild. Persons with angina, congestive heart failure, mild chronic joint disorders and peptic ulcer disease reported a greater impact than persons with other illnesses.

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Treating chronic disease presents an ever-increasing challenge to the medical community. As a consequence of progress in curing acute diseases, the emphasis in medicine has turned to long-term management of functional impairments associated with chronic conditions. We can assess the burden of chronic illness in many ways—epidemiologic, economic and psychologic. Despite extensive statistics on the incidence and prevalence of individual diseases, however,[1-13] we know little about the overall ramifications of chronic illnesses for a general population of nonelderly adults.

Chronic diseases can be defined as conditions that last more than three months; they encompass incurable diseases (such as osteoarthritis, hypertension), seasonal conditions (such as allergic rhinitis) and those that disappear and then "flare up" (peptic ulcer). They may appear singly or in combinations.[14,15] Among adults younger than 65 years, about 33% (or nearly 20 million persons) suffer from one or more chronic diseases that limit their function.[16,17] They are disproportionately poor and elderly; more than half face limitations in their major life activities (work, housework and so forth).[17-19]

The nation devotes 80% of its health resources to chronic disease.[20-26] "Indirect costs" in the form of earnings lost often exceed "direct costs" for medical treatment.[26] Persons with rheumatoid arthritis, for instance, earn 50% of the income they might otherwise have earned.[27]

Significant psychologic effects of chronic disease include concern about the disease itself, worry about not being able to carry on normal activities, anxiety about the loss of independence and loss of work and uncertainty about the cost of

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ABBREVIATIONS USED IN TEXT
CHF = congestive heart failure
COAD = chronic obstructive airway disease
HIE = [Rand] Health Insurance Experiment

treatment. For example, 63% of patients with rheumatoid arthritis in one study experienced a major change in their psychosocial status as a result of their disease.[28]

Little information in the clinical literature illuminates the chronic disease status of the general adult population. Here we combine information on the prevalence, associated effects and use of medical care for important chronic conditions or impairments in a sample of persons 18 to 61 years of age in the United States at the end of the 1970s.

Methods

The Rand Health Insurance Experiment

Data for this paper came from the Rand Health Insurance Experiment (HIE), a decade-long randomized controlled trial of the effects of alternative methods of financing health care services.[29,30] The HIE enrolled 7,706 persons in 2,756 families who participated from November 1974 to January 1982. They came from six sites—Dayton, Ohio; Seattle, Washington; Fitchburg/Leominster, Massachusetts; Franklin County, Massachusetts; Charleston, South Carolina, and Georgetown County, South Carolina—that represented urban and rural locations in the four US census regions. Excluded from the experiment were persons eligible for Medicare because of age or disabilities, persons eligible for care in the military medical system, persons indefinitely institutionalized (such as in prison) and families whose incomes exceeded $57,000 (the upper 3% of the income distribution in mid-1984 dollars). Except for these intentional differences, families were representative of the general population of the area where they resided.

We report on the experience with chronic disease of 4,962 adults (aged 18 to 61 years) up to the time they began their participation in the experiment.

Definitions of Health

Building on the World Health Organization definition of health,[31] we developed a broad set of health status measures covering several distinct categories[32]: general health (physical, mental and social health and general health perceptions), health habits and physiologic health (presence and impact of various chronic diseases). The physiologic dimension comprised 18 chronic or quasi-chronic "tracer" conditions that met several criteria[33-48]:*

- They are common.
- They can be defined concretely in terms with which most physicians would be comfortable.
- They can be measured easily and accurately with the tools available to the HIE.
- They can cause substantial discomfort, disability, morbidity or premature death.
- They are disorders for which appropriate medical care offers considerable symptom relief and control of physiologic status, if not outright cure.

Data Collection

During HIE enrollment, all adults completed a lengthy self-administered medical history questionnaire. The questionnaire contained more than 25 disease-specific batteries; each was introduced by a "skip" question (or set of questions) related to any physician diagnosis in the past or to the past or current presence of significant symptoms related to that illness. Persons who said they did not have a diagnosis or symptom of a particular disease skipped on to the next diagnosis-specific battery. Those who answered the skip question positively were instructed to complete the battery. The remainder of each battery asked about additional symptoms, recency of physician visits for the problem, prescription of and use of medications or other therapies for the condition, self-care practices and adverse effects such as worry or activity restriction that the person attributed to this particular illness (see Table 1).

A randomly selected 60% sample of all adults also took a multiphasic screening examination at which we obtained numerous physiologic measures (see Table 1). Many standard tests were done, such as common blood tests; others provided data specific to our needs, such as those related to arthritis. We asked questions regarding present health or recent drug use so we could properly interpret laboratory test results and avoid contraindicated examinations, such as chest x-ray films for pregnant women. No "hands-on" examination by a physician was done, neither was an invasive or potentially embarrassing procedure carried out.

For several conditions, we used more than one source of information to classify HIE participants. For instance, we determined which persons believed they had diabetes mellitus from responses to the physician-diagnosis question; we further classified them as having diabetes or not based on the use of insulin or oral hypoglycemic pills or serum glucose results. This multiplicity of data enabled us to estimate more accurately disease prevalence and to assess the degree to which people who had a condition were aware of and acknowledged that they had it.

Field experience in the first HIE site (Dayton) led us to revise the diagnosis-specific batteries, sometimes substantially. Thus, some results exclude Dayton. Some information is also reported by income status at enrollment (that is, upper and lower third of the family income distribution).

Reliability and Validity

Extensive analyses confirmed the reliability of our disease-specific measures. For all objective tests, test-retest (split-sample) reliabilities were high. Our disease prevalence rates approximated what might be expected in a general adult population, based on comparisons with data generated by the National Center for Health Statistics and specialized prevalence studies.[33-48] Slightly understating disease prevalence is possible, however, because we adopted conservative disease definitions acceptable to experts in the relevant medical specialities and because permanently disabled persons eligible for Medicare (less than 1% of the sample) and the aged were ineligible to participate in the study. We know, however, of no systematic bias in prevalence estimates owing to refusal of

*Apart from the authors of this article, the following persons were coauthors of one or more of the disease-specific monographs cited: Kenneth Applegate; Sjoerd Beck, MD; Daniel Berman, JD; Betsy Foxman, PhD; Marc Rosenthal; Randi Rubenstein; Bonnie Scott, MD, and John Zielske, MD.

persons to participate in the HIE; those who accepted and who refused the initial offer to join the study appear not to differ in any material way.[49]

Controlling for Age and Sex

Because chronic disease is more prevalent among older people and women, we should adjust for age and sex when

TABLE 1.—*Sample Questionnaire Items, Screening Examination Tests and Disease Definitions*

Chronic Condition	*Sample Questionnaire Item*	*Screening Examination Measure*	*Definition of Disease at Enrollment**
Anemia	In the past 12 mo, has a doctor prescribed any of these treatments for your anemia: special diet, iron pills or shots, vitamin pills or shots or blood transfusions?	Hemoglobin, hematocrit, erythrocyte count and other hematologic measures	Hemoglobin (grams/dl): <13.0, men 18 yr and older <11.5, women 18 yr and older <10.0, pregnant women
Angina pectoris	Have you had any discomfort, heaviness or pressure in your chest during the past 12 mo?	None	Angina probably present or present with mild or moderate impairment according to responses to series of questions about pain in specific locations in chest with or without exertion and use of nitroglycerin
Chronic obstructive airway disease, chronic bronchitis (CB) and chronic obstructive pulmonary disease (COPD)	During the past 3 mo, how much has your chronic bronchitis or emphysema worried or concerned you?	Pulmonary function tests: Forced vital capacity (FVC) Forced expiratory volume in 1 s (FEV_1)	CB: phlegm on most days for at least 3 mo of year, or MD diagnosis and use of breathing exercises or postural drainage COPD: FEV_1<75% of predicted, FEV_1/FVC ratio< 80%, *and* has CB; FEV_1<75% of predicted, FEV_1/FVC ratio<80%, no CB, no CHF, dyspnea, history of smoking
Congestive heart failure (CHF)	Do you currently take diuretic pills for your condition?	Chest x-ray film	Combinations of responses to questions about use of heart medications, dypsnea at night, MD diagnosis, ankle edema, use of diuretics and dyspnea with little or no exertion
Diabetes mellitus	In the past 30 d, how many days did you actually check your urine at least once?	Postload blood glucose level	Taking insulin or oral antidiabetic agents; 2-h postload glucose>200 mg/dl; 2-h postload glucose level 160 to 199 mg/dl and MD diagnosis
Hay fever (current)	In the past 12 mo, did you get any shots to help prevent hay fever or other plant allergies?	None	Combinations of responses about past history, current symptoms and use of injections or medications
Hearing loss	Can you usually hear and understand what a person says, without seeing his face and without a hearing aid, if he whispers to you from across a quiet room?	Pure-tone audiometry	Average hearing threshold level without a hearing aid of 26 db or more
Hypercholesterolemia	When was the last time you saw a doctor about your high cholesterol?	Serum cholesterol level	Cholesterol level >300 mg/dl; taking anticholesterol drugs; cholesterol level 260 to 299 mg/dl *and* MD diagnosis or on diet
Hypertension	Has a doctor said that you had high blood pressure?	Blood pressure (BP)	BP <140/90 mmHg and taking BP drugs; BP 140/90 to 159/95 mmHg with or without medicines and MD diagnosis; BP >160/95 mmHg with or without medicines
Joint disorders (arthritis, gout)	How much of the time has the trouble with your joints or muscles kept you from doing the kinds of things other people your age do?	Grip strength, walking speed, joint size of fingers, serum rheumatoid factor, uric acid level	Pain, aching, swelling, stiffness in joints for as long as a month, or when touched, or upon getting out of bed and lasting 15 min or more; MD diagnosis of gout; positive rheumatoid factor test
Thyroid disease	Has a doctor ever said you had goiter or thyroid trouble?	Thyroid function tests: serum T_4 level, T_3 uptake, free T_4 index	Hypothyroid: Taking thyroid drugs; abnormally low free T_4 index Hyperthyroid: Taking thyroid drugs, abnormally high free T_4 index (and not pregnant or taking contraceptives); abnormally high serum T_4 level
Ulcer disease (active peptic ulcer disease)	In the past 3 mo, have you been troubled by episodes or attacks of stomach pain or stomachache (other than that caused by overeating)?	None	Previous MD diagnosis *and* taking antacids daily or recent and frequent episodes of stomach pain relieved by milk, occurring>1/2 h after eating or occurring at night
Functional far vision impairment	During the past 3 mo, how much of the time have eyesight problems kept you from doing the kinds of things other people your age do?	Visual acuity: without correction; with correction if available; pinhole acuity	Vision in one or both eyes, with correction if available, is worse than 20/20

MD = physician, mmHg = millimeters of mercury, T_3 = triiodothyronine, T_4 = thyroxine

*For more details on each condition, see references 33 to 48.

testing whether diseases are related to income or to each other. In this paper, we have used regression for adjustment. To investigate the effects of income on disease and the effects of having one disease on the probability of having another, we used logistic regression models with "dummy" variables for six sex-age subgroups (men and women; 18 to 34 years, 35 to 49 years, 50 to 61 years). For example, we used a logistic regression model to estimate the association between having congestive heart failure (in this case, the "dependent variable") and having chronic obstructive airway disease (the "explanatory variable"). The coefficient on income or on the explanatory disease is the measure of association, and the χ^2 statistic derived from the change in the likelihood ratio with that variable omitted is the measure of statistical significance; values of P less than .05 are taken as significant. Because the regression coefficient for disease A in predicting disease B is identical to the coefficient for disease B in predicting disease A, each pair of diseases was analyzed only once.[50]

Results

Sample

Of the 4,962 persons 18 to 61 years of age, just over half were women; more than a third had less than $10,660 and another third had more than $15,950 in family income adjusted for site and family size (mid-1984 dollars). The most common family configuration consisted of two adults 18 years or older and at least one child (47% of families); 18% of families consisted of just two adults.

Prevalence

Prevalence of individual chronic diseases. Hypertension, chronic obstructive airway disease (COAD), chronic mild joint disorders, anemia (among women), hay fever and far vision impairment were the most common chronic conditions in this adult population (Table 2). We observed significantly more joint disorders, anemia, congestive heart failure (CHF), thyroid disease (all $P < .001$) and angina ($P < .01$) among women than men and more COAD and hypertension (both $P < .001$) among men than women. All conditions except anemia and hay fever among women showed the expected positive association with age.

We were particularly interested in learning whether the prevalence of these chronic conditions differed by income group (low versus high income). Because income is confounded with age and sex, we tested whether income was significant in predicting the presence of each disease or impairment in regressions that controlled for age and sex. Across both sexes and all ages, low income was significantly related to the presence of COAD ($P < .05$), anemia and joint disorders (both $P < .01$), CHF, hearing impairment and functional far vision impairment (all $P < .001$). Income had no detectable relationship to the other illnesses studied. All the conditions significantly related to income were more likely to appear among the poor than the well-off.

To focus on the older age group, we show in Table 3 the rates by sex and income for persons aged 45 to 61 years. Except for hypercholesterolemia among men, again any conditions significantly related to income occurred more among the poor.

Severity of chronic conditions. Illness severity among persons whom we classified as having a disorder was generally mild for all conditions assessed by an objective physiologic measure. For example, among persons with hypertension (defined here as those with a measured diastolic blood pressure of greater than 90 mm of mercury), the mean diastolic blood pressure was 97.3 mm of mercury and the mean systolic blood pressure 171.2 mm of mercury. Among persons classified according to physiologic evidence, the level of severity was also mild for diabetes mellitus (mean glucose level, 247.8 mg per dl), anemia among women (mean hemoglobin level, 10.8 mg per dl) and hypercholesterolemia (mean serum cholesterol level, 290.1 mg per dl).

Prevalence of 'chronic illness.' The burden of chronic disease is not limited to the presence of a single condition in any given person. To determine how widespread "multiple" chronic disorders might be, we calculated the percentages in our adult sample with none, one and two or more major chronic conditions. We restricted these analyses to ten condi-

TABLE 2.—*Prevalence Rates Per 100 Men and Women of Selected Chronic Conditions by Sex and Age*

Chronic Condition or Impairment	Men			Women		
	Age Group, Yr			Age Group, Yr		
	Total 18 to 61	18 to 44	45 to 61	Total 18 to 61	18 to 44	45 to 61
Anemia	3.0	2.5	4.4	11.4	11.8	10.4
Angina	0.9	0.3	2.8	1.8	0.7	5.1
COAD*	13.5	12.6	17.0	8.4	8.0	9.5
Congestive heart failure	1.7	0.8	5.0	3.5	2.4	6.8
Diabetes	2.2	1.6	4.1	3.0	1.6	7.1
Hay fever	14.9	16.2	10.5	16.9	17.5	15.2
Hearing impairment	3.6	1.7	10.2	3.5	1.6	9.0
Hypercholesterolemia	5.2	3.7	10.5	4.6	1.6	13.2
Hypertension	16.2	11.1	33.4	11.1	4.3	31.4
Joint disorder	14.7	11.7	24.5	21.3	15.1	39.4
Thyroid disease	0.9	0.6	2.0	3.2	2.1	6.6
Ulcer disease	3.8	3.4	5.1	3.8	3.2	5.7
Vision impairment	16.4	12.9	27.9	22.1	17.2	36.9

COAD = chronic obstructive airway disease

*Persons 18 and 19 years of age are not included.

tions, excluding hay fever and vision and hearing impairments, to persons 20 years and older who received the enrollment screening examination and to those with valid data on all ten illnesses. (We adopted this age restriction because we considered the interpretation of spirometry results to be problematic for persons aged 14 to 19 years.) Overall, about 30% of persons 20 to 61 years of age had one chronic illness and an additional 16% had two or more (Table 4). Almost two fifths of the women aged 45 and older had two or more such problems.

Are there clusters of illness, or do illnesses occur independently? Some demographic groups, such as older women, are more likely to have certain of these illnesses, but even allowing for age and sex, certain illnesses may occur together more frequently than would be predicted by chance alone. In fact, the data in Table 4 show somewhat more clustering within the age-sex groups than expected ($P = .04$ based on a summed χ^2 test against the four Poisson distributions).

Table 5 shows which of the chronic diseases were significantly correlated (in pairs) after controlling for age and sex. The measure of association shown in the lower triangle of the table is the level of significance of the coefficient of the "explanatory variable" disease (such as COAD) in a logistic regression predicting the probability of occurrence of a "dependent variable" disease (such as CHF). Congestive heart failure is significantly associated with eight of the nine remaining chronic diseases; by contrast, anemia and thyroid disease are each associated with only two other conditions. One cluster consists of angina, CHF, COAD, joint disorders and ulcer disease; another cluster comprises CHF, high blood pressure, hypercholesterolemia, diabetes and possibly thyroid disorders.

What are the chances that an individual patient might have the second problem in one of these illness pairs if he or she already has the first? The chance of having an illness is usefully expressed in terms of the "odds," $P:(1-P)$, where P is

TABLE 3.—*Prevalence Rates of Chronic Conditions Per 100 Persons 45 to 61 Years by Sex and Income Tertile*

Chronic Condition or Impairment	Men		Women	
	Low Income	High Income	Low Income	High Income
Anemia	13*	2	14	11
Angina	5	2	6	5
COAD	29*	12	11	9
Congestive heart failure	6	3	10*	5
Diabetes	4	4	12*	4
Hay fever	9	10	14	14
Hearing impairment	18*	7	13*	6
Hypercholesterolemia	2	13†	14	10
Hypertension	37	31	38*	27
Joint disorders	22	25	42	37
Thyroid disease	2	2	6	6
Ulcer disease	4	4	5	5
Vision impairment	26	25	44*	28

COAD = chronic obstructive airway disease

*Significantly different from high income at $P < .05$.
†Significantly different from low income at $P < .05$.

TABLE 4.—*Men and Women With One, Two or More Selected Chronic Conditions by Age**

Count of Chronic Conditions†	Men		Women		Total
	20 to 44 Yr	45 to 61 Yr	20 to 44 Yr	45 to 61 Yr	
Sample, number	892	277	1,039	369	2,577
1 chronic condition, percent	27.8	36.8	28.2	32.8	29.6
2 or more conditions, percent	10.5	25.6	11.0	38.2	16.3

*Table includes only those enrollees who underwent the enrollment multiphasic screening examination, completed the medical history questionnaire and had valid data on all ten illnesses.
†Anemia, angina, chronic obstructive airway disease, congestive heart failure, diabetes mellitus, hypertension, hypercholesterolemia, joint disorders, peptic ulcer disease, thyroid disease.

TABLE 5.—*Associations Among Pairs of Chronic Conditions After Controlling for Age and Sex*†*

Chronic Conditions	Chronic Conditions									
	Anemia	Angina	COAD	CHF	Diabetes Mellitus	Hypercholesterolemia	Hypertension	Joint Disorders	Thyroid Disease	Ulcer Disease
Anemia	...	2.4		2.4						
Angina	‡	...	4.9	12.0				3.9		2.9
COAD		‡	...	5.1				2.4		2.6
Congestive heart failure (CHF)	§	‡	‡	...		4.0	2.8	3.6	2.8	3.6
Diabetes mellitus					...	2.6	2.3		3.8	
Hypercholesterolemia				‡	‡	...	2.5			
Hypertension				‡	‡	‡	...			
Joint disorders		‡	‡	‡				...		3.7
Thyroid disease				‡	‡				...	
Ulcer disease		§	§	‡				‡		...

COAD = chronic obstructive airway disease

*Each number represents the increased odds of one disease being present when a second disease is present, versus when the second disease is absent, based on a logistic regression that predicts the probability of occurrence of one disease in the presence of another after controlling for age and sex.
†Blank spaces mean that there was no significant association between the two conditions.
‡The association is significant at $P < .001$.
§The association is significant at $P < .05$.

the probability of having the illness (as reflected in population prevalence rates). For instance, if the prevalence of a disorder such as angina is 2%, the odds a given patient will have it are 1:49 (.02/1 − .02 = .02/.98 = 1:49). Conversely, the probability corresponding to odds of x:y is given by $P = x/(x + y)$, so odds of 1:49 have a probability of 1/(49 + 1), or 1/50.

Building on the properties of odds and odds ratios, we show in the upper triangle of Table 5 (for the most highly related pairs) how much more likely people with a certain disease are to have another disease, controlling for age and sex. The values are the *change* in the odds of one disease being present when a second disease is present versus when the second disease is absent. From these numbers, we can estimate the probability that a person with one disorder will have a related condition by multiplying the odds of having only one of the diseases by the value shown in the table.

For example, if the prevalence of CHF in those without angina is 4%, the corresponding odds are .04/.96 = 1:24 in this group. The odds are 12 times as great, or 12:24, that a similar person with angina will have CHF; this translates into a probability of CHF in the presence of angina of 33% (12/[24 + 12]). Further, the prevalence of hypertension in the HIE population was roughly 12% and that of diabetes roughly 3%, giving odds of 12:88 and 3:97, respectively. If the "explanatory condition" is not too common, the prevalence of the "dependent condition" in the absence of the other condition is approximately the overall prevalence. Thus, the odds that a person with diabetes will have hypertension are 2.3*12:88 (about 24% prevalence among diabetic persons), and the odds of a person with hypertension having diabetes are 2.3*3:97 (almost 7% prevalence among hypertensive persons). For these "clusters," therefore, the risk of having one chronic disease when a certain other disease is present can be greatly increased even among a general adult population.

Awareness of and Use of Physician Care for Chronic Conditions

Undetected illness. By comparing screening test results with questionnaire information, we could estimate the degree to which people were aware of a particular problem or impairment that we eventually classified them as having. More detailed analyses reflected a considerable reservoir of undetected illness at the start of the study.[33-48] For instance, about half of the persons with hypercholesterolemia and with diabetes mellitus were unaware of their condition (based on physiologic measures of elevated levels of cholesterol and serum glucose, respectively), as were more than two thirds of persons with anemia (based on abnormally low hemoglobin levels). Finally, even though blood pressure checks are perhaps the easiest (being noninvasive) and most widespread of screening tools, almost three in ten adults apparently had no knowledge of their elevated blood pressures.

Use of physician care. For persons whom we classified as having a definite condition and who themselves claimed on the questionnaire to have the illness, we calculated the percentages of those who reported receiving medical care for that condition. Percentages of people with care in the previous year or currently under physician care (mainly within the previous three months) are given in Table 6.

Two thirds or more of the people classified as having CHF, diabetes, hypercholesterolemia, hypertension and thyroid disease had seen a physician for that specific problem within the previous year. Not surprisingly, patients with those same conditions had the highest percentages for being under current care. Less than a third of the relevant patient group had sought care in the preceding year for hay fever or hearing disorders. Less than a quarter of persons with anemia or peptic ulcer disease was under current care for those disorders and only about a tenth of those with hearing impairment had seen a physician recently for that problem.

TABLE 6.—*Persons With a Specific Condition Who Reported Receiving Physician Care in the Past Year or Within the Past 3 Months*

Chronic Condition or Other Illness	Condition Known to Patient, Number	Saw Physician Within Previous Year,* Percent	Currently Under Care, Percent
Anemia	140	48	24
Angina	70	46	31
Congestive heart failure	95†	66	41†
Diabetes	39	87	56
Hay fever	664†	27	12†
Hearing impairments	25	31	16
Hypercholesterolemia	62	72	37
Hypertension	220†	79	47†
Joint disorders	707†	39	18†
Thyroid disease	57	68	42
Ulcer disease	139†	42	19†

*All entries in this column are for non-Dayton sites only.
†Specified entries in these columns are for non-Dayton sites only.

Levels of reported compliance with physician prescriptions and therapeutic advice. Compliance with physician advice about therapy or self-care activities is an important element of management. We asked our sample about medications or other kinds of curative or preventive activities that their physicians might have recommended or prescribed and about the degree to which they followed their doctors' advice. Therapies and preventive measures can also be self-initiated, so in some cases we asked about the use of certain remedies or activities with or without a physician's advice.*

Physicians evidently advised the use of medications to manage hypertension and ulcer disease quite frequently (see column 2 of Table 7). Counseling for self-care activities among patients with diabetes was also commonly provided.

Compliance, reflected by the percentage of persons who said they currently used prescribed therapies, was in general high (see column 3 of Table 7), although in some cases this conclusion is based on a small number of people. Reported levels of compliance were higher for patients with diabetes, for those who had had iron or vitamin supplements (or both) prescribed for anemia and for patients who had had medications prescribed for hay fever, hypertension and hypercholesterolemia.

The last column of Table 7 shows the extent of reported use of these therapies among the entire group of persons who had one of these conditions, whether or not they had been so advised. For most conditions, the percentage of people using

*We did not ask directly pertinent questions for hearing impairment or vision impairment; the therapy questions for COAD refer mainly to people with symptoms of chronic bronchitis, not emphysema or chronic obstructive pulmonary disease. Medications are omitted from the thyroid disease and diabetes groups because the use of disease-specific drugs, such as insulin for diabetes, was important in defining the presence of those diseases.

a therapy on professional advice was larger than those using it in the absence of such advice. Although this is not surprising in the case of, say, medications for an elevated cholesterol level or high blood pressure, both of which require a physician's direct action, it is perhaps surprising for conditions such as hay fever.

Summary. Medical care for patients with chronic illness can be thought of as moving from a tree trunk to a twig, where the number of persons diagnosed as having a condition is reduced as one moves to branches concerning whether they are aware of their problem and, then, whether they seek care, obtain therapy and follow such therapeutic regimens. Following persons with hypertension illustrates this concept. About 70% of our hypertensive population knew about their high blood pressure; of this "aware" group, about 80% had sought care in the prior year and almost 50% had seen a physician in the preceding three months. Moreover, of the patients who knew they had hypertension, about 80% had been advised to take medications; of them, more than 90% complied. Thus, of the original group we classified as having elevated blood pressures, about a third had had recent care for their hypertension and about half were taking prescribed medications.

Levels of Disease Impact

We wanted a wide range of "outcome" measures for longitudinal analyses in the study. Some came directly from the physiologic measure characteristic of the illness—that is, blood pressure in hypertension—but we did not have analogous physiologic measures for every condition studied. To overcome this lack, we asked several standard "disease impact" questions of all persons who had, or believed they had, these various illnesses. We then calculated the percentages of persons who reported they had been worried or concerned about their illness in the recent past or who had had to restrict daily activities at least "a little of the time" specifically because of the disorder. All persons classified as having a condition were analyzed. For respondents who were unaware of having an illness and who thus would not have been asked the disease impact questions, we imputed an answer of "none."

Nearly every one of the ten major chronic conditions occasioned a good deal of mental distress (Table 8). Problems associated with symptoms such as pain (ulcer disease, joint disorders, angina) or shortness of breath (congestive heart failure) prompted more worry and concern than did "symptomless" disorders (such as the mild anemia or hypercholesterolemia seen in our population). Worry about these illnesses was quite extensive but mild. Among persons reporting any worry or concern, the median level was only "a little" except for CHF and diabetes, for which the median level was "some" worry.

Generally, people were less likely to restrict their activi-

TABLE 7.—*Extent of Use of Medications, Therapies or Self-Care Activities Among Persons Reporting a Chronic Illness*

Condition and Therapy	1 Condition Known to Patient, Number	2 Patients Who Were Advised to Use Specific Therapy, Percent	3 Patients Who Followed Advice, Percent	4 Patients in Column 1 Who Used Specific Therapy Whether or Not Advised, Percent
Anemia	140			
Diet		6	44	6
Iron pills/shots		56	86	77
Vitamins		18	92	31
Blood transfusions		4	33	2
Congestive heart failure	95*			
Diuretics		40	79	32
Diabetes mellitus	39			
Keep feet clean		64	100	95
Cut toenails straight		62	88	77
Not walk barefoot		56	73	56
Not wear tight hose		59	91	67
Watch weight		85	79	70
Hay fever	738			
Medications		31	87	33
Hypercholesterolemia	62			
Medications		27	71	21
Diet		NA†	NA	50
Hypertension	273			
Medications		81	91	74
Use less salt		51	49‡	20
Thyroid disease	57			
Surgical procedure		18	NA	68
Irradiation		12	NA	NA
Ulcer disease	139*			
Medications		75	NA	NA

*Non-Dayton sites only.
†NA = Relevant question not asked.
‡In all, 49% reported never adding salt to food at the table; 10% reported never adding salt at the table *and* never adding or having salt added to their cooking.

ties because of these chronic conditions (see Table 8) than they were to express worry and concern. The same four diseases that ranked high for causing worry and concern also ranked high for limiting ordinary activities: CHF, chronic joint disorders, peptic ulcer disease and angina. For almost half of all the chronic disorders (CHF, angina, hypercholesterolemia, hearing loss and diabetes), the median period of activity restriction among those persons who reported any was "some of the time."

Discussion

We have reported on 13 conditions that are of major concern to those primary care physicians whose patient population consists mainly of adults. We found that in a general adult population up to late middle age, a considerable portion of its members are afflicted with one or more chronic conditions—some serious and some not so serious—that impinge negatively on their lives. For example, prevalence rates ranged from about 19% for mild joint disorders to almost 2% for angina pectoris. Strong associations with age were detected for most chronic conditions.

Chronic illness occurred somewhat more frequently among poorer adults after controlling for age; this was especially true of hearing and vision defects, anemia, COAD, CHF and joint disorders. We cannot tell whether low income is a cause or a result of these problems, but both explanations are plausible.

About 16% of our adult sample had two or more (of ten) chronic conditions. In addition, we found that the "relative odds" of several chronic illnesses conditional on having another were very high, even when we controlled for age and sex. Some of these associations were expected (the strong connection between CHF and angina); others, such as joint disorders and ulcer disease, may be less commonly observed in ordinary medical practice but may warrant further investigation. Undetected illness was appreciable for some of the conditions we studied.

Few, if any, published data are available on the average amount of care sought by people with the chronic conditions we studied. Thus, although the medical profession may well have "norms" or expectations about the desirable frequency of physician visits for persons with, say, elevated cholesterol levels or vision impairments, we know little about whether the average patient observes those norms. In 1975 about three quarters of the US population aged 15 to 64 years had visited a physician at least once in the preceding year.[51] By that benchmark, the rate of care-seeking in the year before the study began specifically for chronic conditions that our participants knew they had seems rather low; it was by no means excessive. Of course, our respondents could have visited a physician for other problems; whether this was so and whether the specific chronic condition might have been indirectly evaluated at such visits would not be reported in the disease-specific questionnaires.

Only for diabetes, hypertension and hypercholesterolemia did the percentage of people who saw a physician in the previous year approach the benchmark cited above. Patients with some conditions, such as chronic joint problems, angina or peptic ulcer disease, arguably ought to have at least annual follow-up; our reported rates of care-seeking for these disorders fell considerably below this standard, especially if biases related to underreporting and overreporting of medical care utilization were to be taken into account.[52] These crude "diagnosis-specific visit rates" are consistent with the view that physician care for these conditions was not being oversupplied.

The degree to which patients followed their physician's advice and counsel was high but not obviously related to the seriousness of the condition. An appreciable proportion of persons who had (and knew they had) diabetes, hypertension and hypercholesterolemia reported that they followed their physicians' recommendations, but so did those with hay fever. We did not verify the accuracy of these compliance self-reports; some respondents may well have overstated their adherence to a given medical regimen. Compliance with drug regimens for acute or chronic conditions is not easy to measure in large population surveys[53] and may well differ by the type of drug; one account puts overall drug compliance among persons with hypertension at just under 60%.[54] Nonetheless, we interpret our figures as reflecting an impressive degree of adherence to professional advice, at least about remedies or self-care activities that patients comprehend are directly related to their illnesses.

Our simple measures of the impact of specific diseases on people's lives suggest that anxiety about specific chronic illnesses is widespread but mild. Whether this implies that Americans are oversensitive about their health or that they are showing a growing sophistication about health may be largely a matter of individual interpretation. Persons with angina, CHF, joint disorders and ulcer disease tended to report more disease impact (worry and concern and activity limitations) than those with the other conditions studied.

In summary, dealing effectively with chronic disease requires a multifaceted approach. Most chronic disease in a general population is mild, but a considerable amount is undiagnosed. Efforts must be made to ensure that those who need regular care receive it, especially when the burden of chronic disease falls disproportionately on persons of low income. Finally, even mild chronic illness imparts considerable anx-

TABLE 8.—*Adults Reporting Worry and Concern or Restricted Activity, by Chronic Condition*

Chronic Condition	Persons with Condition,* Number	Reported Worry or Concern, Percent	Reported Activity Restriction, Percent
Anemia	215	22	9
Angina	70	76	46
COAD	298	50	13
Congestive heart failure	131	86	71
Diabetes mellitus	74	31	16
Hay fever	738	59	26
Hearing impairment	101	6	10
Hypercholesterolemia	148	14	7
Hypertension	384	38	12
Joint disorders	903	77	41
Thyroid disease	62	19	3
Ulcer disease	190	86	45
Vision impairment	560	47	15

COAD = chronic obstructive airway disease

*Sample includes all persons whom we eventually classified as having the disease. Those who said they did not have the condition—even though we had so classified them on the basis of other data—and who thus did not answer the question are included in the denominator and considered to have responded "no" to these questions.

iety about one's health. Effective care requires physicians to cope with this aspect of chronic disease even as they attempt to control its physiologic manifestations.

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