Conceptualization and Measurement of Physiologic Health for Adults

Angina Pectoris

Daniel M. Berman, Robert H. Brook,
Kathleen N. Lohr, Mark Rosenthal,
George A. Goldberg, and
Kenneth H. Applegate

Rand HEALTH INSURANCE EXPERIMENT SERIES

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Volume 4: Angina Pectoris

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PREFACE

The Rand Health Insurance Study (HIS), funded by a grant from the U.S. Department of Health and Human Services, is a large-scale social experiment designed to assess how varying the patient's cost of health services affects his or her use of services, quality of care, patient satisfaction, and health status. It is also designed to study how the provision of services in either the fee-for-service system or a prepaid group practice affects those same variables.

Nearly 8000 people in 2750 families were enrolled in the experiment in six sites across the United States: Dayton, Ohio; Seattle, Washington; Fitchburg, Massachusetts; Franklin County, Massachusetts; Charleston, South Carolina; and Georgetown County, South Carolina. The sites were chosen to represent the four Census regions of the country and an urban-rural mix, and to reflect variation in the amount of stress on the ambulatory medical care system (in terms of long or short delay for new and return appointments).

Families were enrolled in the HIS for either 3 or 5 years (approximately 70 and 30 percent, respectively). Low-income families were oversampled. Eligibility for participation in the HIS was broad; ineligible persons were mainly heads of households 61 years of age and older at the time of enrollment, members of the military, people confined to various institutions, and people eligible for Medicare. When families were enrolled, they agreed to assign their own health insurance benefits (if they were previously covered) to the HIS for the duration of their enrollment. Their policies were held in escrow and returned at the end of their participation. For persons who had not been previously insured, some coverage was obtained during the HIS and made available at the end of enrollment.

The families were assigned to one of 16 different insurance plans. For this purpose, a complex, unbiased allocation model was used to ensure that the assortment of families in each plan closely resembled that in every other plan in terms of 24 different demographic and socioeconomic variables. The 16 experimental plans were as follows:

One plan in which care is free to the family (i.e., 0-percent coinsurance).

Three plans with 25-percent coinsurance (i.e., the family pays 25 percent of its medical bills).

Three plans with 50-percent coinsurance.

Three plans with 50-percent coinsurance for dental and outpatient mental health services and 25-percent coinsurance for all other services.

Three plans with 95-percent coinsurance.

One plan with 95-percent coinsurance on outpatient expenditures up to a maximum out-of-pocket expenditure of $150 per individual ($450 per family) per year and no coinsurance above that; all hospital care is free on this plan.

One plan that assigns some Seattle participants to a prepaid group practice (Group Health Cooperative of Puget Sound).

One plan (a control group) that consists of a random sample of people already enrolled in the Seattle prepaid group practice who also meet the HIS eligibility requirements.

All plans except the first one and the last three have a ceiling on annual out-of-pocket expenditures by the family amounting to 5, 10, or 15 percent of annual family income. The maximum out-of-pocket expenditure per year per family is $1000 for the 50- and 95-percent coinsurance plans and $750 for the 25-percent plans. All plans have an identical, very comprehensive benefits package that covers ambulatory and hospital care, preventive services, all dental services except orthodontia, prescription drugs, certain over-the-counter drugs, most supplies and durable medical equipment, psychiatric and psychological services, and almost all other personal medical services, including those delivered by chiropractors and Christian Science healers.

Over the life of the HIS, data are collected on demographic and socioeconomic variables, health status, use of health services, satisfaction with and attitudes toward health care, and types of providers seen. The sources of health data include baseline interviews before enrollment, self-administered (or parent-completed) Medical History Questionnaires, biweekly Health Reports, annual Health Questionnaires, medical screening examinations, and claims submitted (chiefly by providers) for reimbursement for services rendered.

Comprehensive assessment of each person's health status occurs upon enrolling in the experiment, annually during the enrollment period, and upon leaving. As noted, a major HIS objective is to assess the effects of varying the cost of health services on the health status of individuals sampled from a general population. To this end, reliable, valid, and understandable measures are being specially developed or

adapted that will detect small but meaningful changes in the health status of enrollees.

HIS enrollment began in 1974. At the time of writing this Rand report series (R-2262-HHS), the HIS is still in progress. Enrollment data from all six sites are available and reported herein, but longitudinal (experimental) data are not yet available.

The volumes that constitute Rand report R-2262-HHS, which has the series title *Conceptualization and Measurement of Physiologic Health for Adults,* cover a wide variety of diseases and organ system defects, such as eyesight and hearing problems, cardiovascular and bronchopulmonary diseases (e.g., hypertension, chronic obstructive pulmonary disease), and surgery-related conditions (e.g., hernia, varicose veins). These are used to measure physiologic health, one of four conceptually distinct dimensions of health status defined for the HIS. The other three are physical, mental, and social health.

Volume 1 of this series is an overview of the HIS design. It includes a more detailed description of insurance plans and sites; a discussion of the health model adopted for the HIS, with particular emphasis on physiologic health; and notes on the statistical methods used to estimate the prevalence and level of effect of the various diseases and conditions in the HIS sample. The other, disease-specific, volumes of R-2262-HHS detail the suitability of these conditions as health status measures for the HIS, discuss important measurement issues, describe HIS techniques for determining the prevalence and personal impact of the conditions, give HIS enrollment results, and outline the disease-specific criteria for quality-of-care analyses for the HIS. These volumes report on enrollees aged 14 years and older. A companion series on the measurement of physiologic health among children under 14 years of age will also be published.

Different conditions have been selected for use in different age groups in the HIS population (see the list at the end of the Preface). For this reason, and because a few conditions have a relatively low prevalence in the general population under age 61, some findings and conclusions reported in the R-2262-HHS series are based on comparatively small numbers. Such conclusions should be generalized with caution.

Three other dimensions of health status—physical, mental, and social health—have been defined for the HIS, as has an integrative measure—general health perceptions. These measures are described in the eight volumes of R-1987-HEW, which has the series title *Conceptualization and Measurement of Health for Adults in the Health Insurance Study* and is a companion series to R-2262-HHS.

Detailed descriptive information about the Health Insurance Study, including site and sample selection methods, can be found in *Vol. I, Model of Health and Methodology,* of the R-1987-HEW series, by

John E. Ware, Jr., Robert H. Brook, Allyson Davies-Avery, Kathleen N. Williams, Anita L. Stewart, William H. Rogers, Cathy A. Donald, and Shawn A. Johnston. A synopsis of the health measurement strategy and enrollment results for these three health dimensions from the first site (Dayton, Ohio) appears in *Volume VIII, Overview,* by Robert H. Brook, John E. Ware, Jr., Allyson Davies-Avery, Anita L. Stewart, Cathy A. Donald, William H. Rogers, Kathleen N. Williams, and Shawn A. Johnston; this is also published as a Supplement to *Medical Care,* July 1979. Other volumes give more detailed methods and enrollment results for physical health in terms of functioning (Volume II), mental health (Volume III), social health (Volume IV), and general health perceptions (Volume V). More specialized analyses are covered in Volumes VI and VII on relations among health status measures and power analysis of the measures, respectively.

Measurement of these same health status dimensions for children under age 14 enrolled in the experiment is discussed in Marvin Eisen, Cathy A. Donald, John E. Ware, Jr., and Robert H. Brook, *Conceptualization and Measurement of Health for Children in the Health Insurance Study,* R-2313-HEW, May 1980.

Another Rand report series, *Conceptualization and Measurement of Health Habits for Adults in the Health Insurance Study,* contains information on two health habits being used by the HIS as proxy measures of future health status: smoking and overweight. These habits could conceivably be influenced by personal medical care, and the evidence strongly suggests that they have a serious effect on future morbidity and premature death. The series comprises two volumes, both by Anita L. Stewart, Robert H. Brook, and Robert L. Kane: Volume I, *Smoking,* R-2374/1-HEW, June 1979, and Volume II, *Overweight,* R-2374/2-HEW, July 1980.

A number of other Rand reports and publications discuss design and measurement issues related to the experiment. Currently the most up-to-date listing of HIS publications is given by Joseph P. Newhouse and Rae W. Archibald, *Overview of Health Insurance Study Publications,* P-6221, November 1978. The experimental design for estimating the effects of financing on demand for care is described in Joseph P. Newhouse, "A Design for a Health Insurance Experiment," *Inquiry,* 11:5-27, 1974; and in Joseph P. Newhouse, *The Health Insurance Study: A Summary,* R-965-1-OEO, March 1974. The structure of the experiment is reported in Lorraine Clasquin and Marie E. Brown, *Rules of Operation for the Rand Health Insurance Study,* R-1602-HEW, May 1977. Carl Morris describes the unbiased allocation model for assigning families to insurance plans in "A Finite Selection Model for Experimental Design of the Health Insurance Study," *Journal of Econometrics,* 11:43-61, 1979. *The Health Insurance Study Screening Examination*

Procedures Manual, R-2101-HEW, September 1978, by Lisa H. Smith, George A. Goldberg, Robert H. Brook, Laura Tosi, and Rae W. Archibald, presents a detailed description of all aspects of tests and procedures carried out in the enrollment and exit screening examinations.

DISEASES AND CONDITIONS FOR HEALTH STATUS AND QUALITY OF CARE MEASUREMENT

Diseases and Conditions	Applicable Age Group		
	0-4 Years	5-13 Years	14+ Years
Acne			X
Anemia	X	X	X
Angina pectoris and selected electrocardiographic abnormalities			X
Asthma		X	
Cancer	X	X	X
Chronic airway obstruction and shortness of breath			X
Colds	X		
Congestive heart failure			X
Convulsions	X	X	
Dental conditions	X	X	X
Diabetes mellitus			X
Eczema	X	X	
Enuresis (bedwetting)		X	
Growth and development disorders	X		
Hay fever		X	X
Hearing disorders		X	X
Hemorrhoids			X
Hernia			X
Hypercholesterolemia (high cholesterol)			X
Hypertension			X
Hyperthyroidism and hypothyroidism			X
Joint disorders			X
Lead poisoning	X	X	
Otitis media (middle ear infection)	X	X	
Stomach pain and peptic ulcer disease			X
Urinary tract infection		X	X
Varicose veins			X
Vision disorders		X	X

SUMMARY

INTRODUCTION AND DEFINITION

Angina pectoris is one of several diseases that will be used by the Rand Health Insurance Study (HIS) to investigate the different levels of insurance on health status and quality of care among adults. Angina was selected as an appropriate indicator because (a) it is a common manifestation of arteriosclerotic cardiovascular disease (ASCVD), the most common cause of death in the United States; (b) it can have a substantial impact on the well-being of the afflicted individual; and (c) it is highly amenable to treatment.

ASCVD is a catch-all name for many conditions, all of which have one underlying functional abnormality: ischemia, or insufficient oxygen supply to tissues of the body. Angina is a clinical syndrome characterized by short-term episodic chest pain that is produced by an imbalance of oxygen supply and demand, resulting in deprivation of oxygen to the heart muscle. Activity and excitement usually bring on chest pain, but the pain can arise in some persons even with minimal provocation. Rest usually relieves the pain; heart medications are helpful for most patients.

PREVALENCE AND DISEASE IMPACT

Studies from the National Center for Health Statistics (NCHS) have shown that over 3 million persons in this country have definite coronary heart disease; half of them have angina without evidence of a prior heart attack. The prevalence of angina increases with age up to age 75 and then declines slightly; incidence also increases with age.

Although death from angina per se is virtually unheard of, people with angina are at substantially higher risk of dying from other forms of ASCVD, such as a myocardial infarction (heart attack) and sudden death. The deleterious effects of angina on a person's life are often severe. Apart from suffering the pain itself, persons who are afflicted with angina may restrict physical activity, often markedly; worry and anxiety about the condition and how to control it can obviously impair one's mental health.

Good medical care for angina can lessen the number of restrictions on physical activity and alleviate pain and worry. Typically, angina is first treated medically rather than surgically; the objective is to relieve

the person's episodic chest pain, increase his tolerance to exercise, and raise his productivity. In addition to reducing the level of such risk factors as hypertension and smoking, physicians use two main therapies—short- or long-acting nitrates and propranolol. Nitroglycerine, a short-acting nitrate, has short-term utility (30 minutes), which is sufficient for symptomatic relief in most cases. Propranolol, whose effect is longer, is especially useful in conjunction with nitroglycerine because it lowers the amount of nitroglycerine needed to reduce symptoms. Generally, such medical approaches are justified because of their success in reducing symptoms and improving productivity. The effect of medical therapy on mortality is unknown, although in theory it should be beneficial.

About 5 percent of patients may be unresponsive to the medical approach; when certain other conditions are met, they can be considered for coronary artery bypass surgery. Symptomatic relief from bypass surgery is usually immediate and profound; about 90 percent of all patients experience at least some improvement. The life-prolonging effect of surgery is subject to great controversy, but when other approaches have not been successful, its effect on symptoms, such as relief of pain, can justify its use.

HEALTH INSURANCE STUDY METHODS

The HIS used data from the Medical History Questionnaire (MHQ), administered at enrollment, to estimate the prevalence of angina among its adult enrollees (14 years of age and older). The MHQ contained a battery of questions on chest pain and other signs and symptoms related to angina (the so-called Rose questions) from the previously validated Rose Questionnaire (see Appendix A), which is known to be reliable for detecting angina in men 35 years of age and older. The MHQ also included additional questions on the use of medications, a physician diagnosis of angina, and levels of pain, worry, and activity restriction. The MHQ is again administered to all participants at exit from the HIS experiment.

A medical screening examination was administered to a randomly selected subsample of the enrollment population, and to all participants at exit. An at-rest electrocardiogram was given to adults meeting certain age or illness criteria. The exit examination also includes a physician examination of all persons under treatment for angina.

Health insurance claim forms are filed during the HIS. These problem-oriented forms show the reasons for visiting a physician, the physician's diagnoses, and any prescribed medicines or laboratory tests.

An individual will be considered to have angina if one of the following criteria is met:

1. A score of "present" in response to the Rose questions on either the enrollment or the exit MHQ, if the respondent is 35 years of age or older.
2. A positive response to the physician diagnosis question ("Has a doctor ever said that you had angina?") in the Chest Pain battery of the MHQ *and* a score of at least "probable" in response to the Rose questions on either the enrollment or the exit MHQ.
3. At least three insurance claim forms listing a diagnosis of angina pectoris.

The HIS assesses the impact of angina through four MHQ items dealing with the amount of pain, worry, activity restriction, and days in bed caused by the condition.

Generally, one might expect to see better technical medical care associated with more generous health insurance. Individuals with generous coverage may experience better physical and mental health than persons with less generous coverage. The former may visit physicians more frequently or in a more timely fashion following the onset of symptoms; they may receive more effective treatment by drugs; they may benefit from greater or more regular reassurance and support. However, because a person may be adversely affected simply by being told that he or she has angina, generous insurance may be associated with negative effects in the form of overdiagnosis of cardiac disease, undue worry about a non-life-threatening condition, or unwarranted restriction of daily activities.

HEALTH INSURANCE STUDY ENROLLMENT RESULTS

On the basis of responses to the Rose questions, the respondent's age, and the physician-diagnosis question on the MHQ, 70 of 5713 adult enrollees in the HIS (1.2 percent) were classified as having angina. Six of these 70 persons were positive ("present") for angina by the Rose questions and also had a physician diagnosis of angina; 8 were "probable" and had a previous physician diagnosis of angina; and the remaining 56 were positive but had no prior physician diagnosis. Fifty of the 70 individuals with angina (71 percent) were women.

A substantial amount of pain, worry, and activity restriction was reported by those who had or thought they had angina. Overall, 84

percent of the 70 people with angina reported at least one adverse effect of their condition: 83 percent reported pain; 76 percent, worry; and 46 percent, activity restrictions. Compared with those who did not have angina but believed they did, those with angina had significantly more of these ill effects.

QUALITY OF CARE

Criteria directed specifically toward angina are few. Several criteria sets, however, deal with good quality of care for patients with ASCVD. For outpatient settings, they emphasize (a) detection and control of risk factors that might otherwise bring on the disease and (b) appropriate use of drugs to alleviate symptoms. The HIS quality-of-care criteria for angina build on ideas taken from these criteria sets and take advantage of the unique kinds of information available to the HIS. The data used to assess quality are from the MHQ and screening examinations at enrollment and exit, and from the health insurance claim forms filed during the HIS. Favorable outcomes include low rates of anginal attacks, little disability from the condition, and good control of risk factors. Good processes include appropriate medications in adequate doses, pertinent diagnostic and followup tests, and advice about risk factors. They are expressed in a manner that assumes a high level of quality of care.

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Chapter 1

INTRODUCTION

Arteriosclerotic cardiovascular disease (ASCVD) is the most common cause of death in the United States, accounting for about half of all deaths in the nation annually. ASCVD is a catch-all name for many diseases, all of which have one underlying functional abnormality: ischemia, or inadequate delivery of sufficient oxygen to body tissue. It assumes several forms in the heart, including manifestations such as angina pectoris or heart attack. To deal with this range of expression of disease, treatment programs vary from modification of life-style for those without symptoms to intensive hospital-based coronary care for those who are at immediate risk of dying from a heart attack.

Angina pectoris is one of the more common manifestations of ASCVD; although not itself fatal, it is one of the more serious expressions of the disease. It is also highly amenable to treatment. For these reasons, it has been chosen for intensive investigation in the Rand Health Insurance Study (HIS).

Data on the prevalence and adverse effects of angina, and on the use of medical services for the condition, will be used to determine the effect of differing levels of insurance on health status and quality of care. In particular, the amount of pain, worry, and disability experienced by a patient with angina may vary according to the different levels of quality of care that may be provided by different levels of insurance coverage. Given the natural history of this disease, however, different levels of insurance are not expected to produce changes in the incidence or prevalence of angina pectoris within the 3 or 5 years of the HIS enrollment period.

The remainder of this volume presents the HIS definition of angina pectoris and reviews important measurement issues. It discusses the suitability of angina pectoris as a health status measure in terms of prevalence, associated morbidity and mortality, and response to medical care. It also presents HIS enrollment results from all six sites. Finally, it outlines the HIS quality-of-care criteria that relate to angina pectoris. A separate appendix on electrocardiographic findings is included. Readers are referred to the Preface and to Volume 1 of this series for more information regarding the overall strategy used in the HIS to assess changes in health status and quality of care as a function of level of insurance.

Chapter 2

DEFINITION AND MEASUREMENT ISSUES

Angina pectoris is a clinical syndrome generally characterized by episodic chest pain that usually lasts less than 10 minutes.[1] The pain itself can be quite severe, and persons with the syndrome can have major functional impairments. It is produced by an imbalance of oxygen supply and demand, resulting in deprivation of oxygen to the heart muscle.

Angina can be the only clinical manifestation of coronary artery disease; it can follow a myocardial infarction (MI, or heart attack); and it can be a predictive symptom of an impending MI. Angina can also manifest itself when a patient attempts to resume normal levels of activity following an infarction. Activity and excitement that require additional oxygen usually bring on the chest pain or discomfort of angina, although some persons experience these symptoms with only minimal exercise or provocation. Rest usually relieves the pain, and many persons respond well to a variety of heart medications.

In conditions often referred to as "atypical" or "variant" angina, the angina system complex can be present when there is no other evidence of coronary artery disease. The anginal-type pain may occur even when the person has not undergone any exertion, may persist for more than 10 minutes, and may last even after the use of drugs traditionally taken to combat angina. "Unstable" angina is yet another version of the condition, loosely characterized as a complex of symptoms of increasing severity or frequency (or both).[2]

---

[1]Angina pectoris was the name originally given in the early 1900s to a fatal disease characterized by occlusion of the coronary arteries. By 1930, the term was reserved for the syndrome of chest pain as it is now understood, and other terms such as arteriosclerotic heart disease or ischemic heart disease became the terms of choice for the lethal forms of the disease. See Stallones (1980) for an intriguing account of the history of these conditions.

[2]For descriptions or discussions of these conditions, see Eliot and Bratt, 1969; Kemp et al., 1967, 1973; Waxler et al., 1971; Bemiller et al., 1973; Herman et al., 1973; DeMaria et al., 1980; Borer, 1980; Segal et al., 1980.

DIAGNOSIS

Angina pectoris is diagnosed on the basis of the characteristics of chest pain reported by medical history. The electrocardiogram (ECG) can sometimes provide compatible evidence if it shows a pattern of ischemia while the patient is at rest, undergoing a stress test, or experiencing pain. The angiogram (an x-ray of those blood vessels serving the heart that are filled with a contrast medium as part of the procedure) can give information on the presence or absence of coronary-artery spasm and occlusion.

A medical history can be elicited by a physician or interviewer using standardized questions; alternatively, a patient can complete a self-administered form. The Rose Questionnaire (Rose, 1965) is a standardized instrument that has been widely used to identify persons with angina pectoris. It can be interviewer- or self-administered.

Responses to items on this questionnaire can be used to classify people as being "angina-negative" or "angina-positive." Because the Rand Study uses a modified form of the Rose Questionnaire (see Chapter 4), it is discussed in detail below. The questions and scoring algorithms are given in Appendix A.

A second approach used to identify people with angina is to perform a stress electrocardiogram (an ECG done while the individual is exercising) on people reporting chest pain in any form, to see whether ECG changes characteristic of ischemia develop. To do this, a physician must monitor every exercise test to observe the person, evaluate the stress ECG, and decide whether the testing should continue (Lesch et al., 1977). The angiogram is an even more complex diagnostic procedure. It is not at all suitable for screening a general population, and in fact would not be undertaken even in patients complaining of chest pain without a good deal of evidence substantiating its use. These two means of identifying individuals with angina—namely, a stress ECG or an angiogram—were considered inappropriate for the HIS because of the costs and risks involved (see, for example, Smith et al., 1978), and will not be discussed further in this volume.

A third measurement tool, the standard at-rest ECG, is neither as accurate nor as sensitive as the stress ECG in detecting whether a person's chest pain is likely to be from arteriosclerotic cardiovascular disease (ASCVD), because at-rest ECGs are normal in approximately 50 percent of people with typical angina and demonstrable coronary arteriosclerosis (Lesch et al., 1977). Hence, the standard ECG is not diagnostic of angina per se, although it has been used to validate findings from the Rose Questionnaire, as discussed below. Analyses on ECG findings are performed on HIS enrollees, and this topic is taken up in Chapters 4 and 5 and Appendix B.

A fourth approach to identifying people who have angina is to determine whether a doctor has stated on an insurance claim form that an individual has been so diagnosed. This point is discussed in Chapter 4 as it relates to the HIS.

RELIABILITY AND VALIDITY

Several studies have established the value of the Rose Questionnaire (or slight modifications of it) as a means of identifying persons with angina pectoris (Rose, 1962, 1965, 1968, 1971; Zeiner-Henriksen, 1972; Rhoads et al., 1975), Information has been collected on how well the questionnnaire compares with a physician diagnosis of angina or a resting ECG diagnosis of ischemia, how well it does with repeated administrations, how good a prognostic tool it is, and how it performs as a self-administered instrument compared with the original interviewer-administered one.

Results from the Rose Questionnaire correlate highly with physician diagnoses of angina. In one study (Rose, 1962), three cardiologists examined 57 working men who had previously reported some kind of chest pain. For 43 of them (75 percent), the three physicians agreed as to the presence or absence of angina. Of the 31 (55 percent of the total) who were labeled by at least one physician as having angina, 17 were so diagnosed by all three physicians; all three agreed that no angina was present in 26. The Rose Questionnaire was then given to each of the 57 men. The prevalence of angina according to the questionnaire was 35 percent; the average prevalence according to the physicians' diagnoses was 42 percent. Questionnaire results agreed with all 26 unanimous angina-negative diagnoses by the physicians and with 14 of the 17 unanimous angina-positive diagnoses.

In another study (Rose, 1965), ECG changes compatible with ischemia presumably caused by ASCVD occurred four times more frequently (13 percent versus 3 percent) in the ECGs of 72 angina-positive subjects than in those of 1776 angina-negative subjects (as classified by the Rose Questionnaire). Changes compatible with at least suspected ischemia were found in an additional 22 percent of angina-positive patients, compared with 11 percent of angina-negatives.[3]

One might expect that an individual identified by the Rose Ques-

[3]No comparisons could be found in the literature between diagnoses based on results of the Rose Questionnaire and physician diagnoses based on medical history and exercise (stress) ECGs. In a personal communication, Dr. Rose reported that his group had not used the exercise ECG in population studies, so no comparisons of their results with those obtained from physicians using information from exercise ECGs could be made.

tionnaire as having angina would continue over time to be so identified by the questionnaire, especially because angina is considered a chronic disease. To test this hypothesis, 1136 men aged 35 to 59 years were assessed in 1961 by the standard Rose Questionnaire and reassessed by it in 1962, 1964, and 1965 (Rose, 1968). At the initial (1961) screening, 43 men (3.8 percent) were classified as angina-positive. In each subsequent year, about 40 percent of these individuals were again positive. The percent positive (of the total population) in each year was 3.8 in 1961, 2.5 in 1962, 2.9 in 1964, and 3.6 in 1965.

Of the 818 men who remained in the study group through 1965, 77 were classified as angina-positive at least once (53 one time only, 12 on two occasions, 7 on three occasions, and 5 all four times). Of the 12 individuals classified as positive three or four times, 11 (92 percent) had positive ECG findings of ischemia; of the 65 classified as positive one or two times, 22 (34 percent) had positive ECG findings. Of the persons classified "never positive," 19 percent had positive ECGs.

From these findings, Rose drew two conclusions. First, point prevalence[4] may grossly underestimate the total burden of the disease; i.e., of all men judged angina-positive at some time during the followup period, only a small number were likely to be positive at any particular instant. Second, repeated examinations were valuable in that they permitted semiquantitative grading of subjects based on the number of times that each was classified as positive.

One measure of the usefulness of the questionnaire is the degree to which responses can be used to predict the occurrence of disabling or even fatal effects of the disease. This might be termed its "prognostic ability." Rose (1965) assessed this point (measured by subsequent death from myocardial infarction or "other" causes) by following the same 1136 men initially screened in 1961 (Table 1). At that time, 44 of 1136 had given positive responses to the questionnaire, and 200 had ECG evidence of ischemia. During 2.5 years of followup, 19 of the total sample were either admitted to the hospital with a diagnosis of coronary thrombosis or myocardial infarction or had died from those conditions.

The prognostic sensitivity of the questionnaire appeared to be about half that of an abnormal ECG (7 and 13 patients identified, or 37 and 68 percent, respectively, of the 19 patients with subsequent infarction). Conversely, the specificity was better for the questionnaire than for the ECG: 0.97 (1080 of 1117 patients with no infarction) versus

[4]Point prevalence is the frequency of a disease at a designated point in time, and is the most common way to express what prevails at that particular time. It is distinguished from both incidence (the number of new cases of a disease over some period of time) and period prevalence (the sum of incidence and point prevalence) (see MacMahon and Pugh, 1970). In this report, the term prevalence will always refer to point prevalence.

Table 1

NUMBER OF PERSONS WITH AND WITHOUT MYOCARDIAL INFARCTION, BY ANGINA AND ISCHEMIA STATUS

Angina and Ischemia Status	Clinical Status After Two and a Half Years Followup			
	Myocardial Infarction	No Infarction	Total	Incidence of Infarction
Angina Status by Rose Questionnaire[a]				
Angina-positive	7	37	44	15.9
Angina-negative	12	1080	1092	1.1
Total	19	1117	1136	1.7
Ischemia Status by ECG Findings[b]				
Abnormal (ischemia)	13	187	200	6.5
Normal (no ischemia)	6	930	936	0.6
Total	19	1117	1136	1.7

SOURCE: Rose, 1965.

[a]Relative risk: (7/44)/(12/1092) = 14.5.

[b]Relative risk: (13/200)/(6/936) = 10.1.

0.83 (930 of the 1117 patients), respectively. In addition, the relative risk of a person subsequently having a myocardial infarction was higher if the diagnosis of angina was made by the questionnaire (relative risk of 14.5) than if the diagnosis of ischemia was made on the basis of changes in the ECG (relative risk of 10.1). In summary, the questionnaire was less sensitive but more specific than the ECG and seemed to identify those at higher risk for having subsequent morbid events.[5]

To evaluate the questionnaire as a self-administered instrument, Rose et al. (1977) randomly divided 1936 men into interviewer- and

[5]In this discussion, sensitivity refers to the ability of the instrument to identify correctly persons who subsequently suffered an MI, and specificity refers to its ability to pinpoint correctly those persons who did not. Relative risk is a ratio measure of how much more probable it is that one group rather than another will develop a disease or condition. Groups are typically defined by the presence or absence of some characteristic or by the degree to which some characteristic is present. In this case, comparison groups were defined by positive scores on the Rose Questionnaire and by abnormal ECG findings. The outcome measure of interest in this example is the incidence of MI; the ratio of the incidence rates for the two groups is the relative risk. For instance, from the data in Table 1, the relative risk for the questionnaire group is 14.5, or 7 persons with heart attacks out of 44 persons positive for angina (an incidence of 15.9 per 100 persons) divided by 12 persons with heart attacks out of 1092 persons not positive for angina (an incidence of 1.1 per 100 persons). This indicates that the group identified as angina-positive by the questionnaire was 14.5 times more likely than the angina-negative group to suffer a heart attack.

self-administered groups (Table 2). (This study is especially relevant because the HIS uses the self-administered format.) Over twice as many angina-positive people were identified in the self-administered group as in the interviewer-administered group (8 and 3 percent, respectively). Among those who were angina-positive, however, the proportion who had abnormal ECGs was the same (18 percent) for both groups (5 of 28 persons and 14 of 76 persons). Self-administration increased the measured prevalence of angina. The same study evaluated how well the self-administered questionnaire predicted subsequent mortality from myocardial infarction and from all other causes combined; it was a better predictor of subsequent mortality than the interviewer-administered format.

Table 2

NUMBER OF PERSONS WITH ABNORMAL OR NORMAL ECG, BY ANGINA STATUS ON INTERVIEWER- AND SELF-ADMINISTERED ROSE QUESTIONNAIRE

Angina Status According to Rose Questionnaire	Interviewer-Administered Questionnaire			Self-Administered Questionnaire		
	Abnormal ECG	Normal ECG	Total	Abnormal ECG	Normal ECG	Total
Positive	5	23	28	14	62	76
Negative	64	846	910	67	855	922
Total	69	869	938	81	917	998

SOURCE: Rose et al., 1977.

The questionnaire, whether interviewer- or self-administered, is as good a predictor of mortality as an abnormal ECG. In a long-term followup of 18,246 men, those who were positive on either the questionnnaire or the ECG, but not on both, showed about the same risk of death from coronary heart disease within 5 years (Table 3). Respondents who were positive on *both* the questionnaire and the ECG, however, had a threefold higher risk of death within the same 5-year period than persons positive on only one of the measures and a sixteenfold higher risk than persons who were negative on both.

In summary, the self-administered Rose Questionnaire has been

shown to be a valuable tool in identifying people with angina pectoris. Its reliability compares favorably with physicians' diagnoses, and it satisfactorily identifies persons at higher risk of dying from coronary heart disease. Its main limitation is that, to date, it has been validated only in middle-aged male populations. No information is available to determine its validity in women of any age or in young men (in particular, men under 35 years of age).

Table 3

NUMBER AND PERCENTAGE OF PERSONS DYING WITHIN 5 YEARS OF BEING ASSESSED EITHER FOR ANGINA BY QUESTIONNAIRE OR FOR ISCHEMIA BY ELECTROCARDIOGRAM

Angina and Ischemia Status	Number at Risk	Number Dying	Percent Dying
Rose Questionnaire only (angina-positive)	732	33	4.5
ECG only (ischemia)	999	56	5.6
Questionnaire and ECG (angina and ischemia)	147	24	16.3
Negative on both	16,368	161	1.0
Total	18,246	274	1.5

SOURCE: Rose et al., 1977.

NOTE: The percentage of persons dying of those classified as positive on the questionnaire is (33 + 24)/(732 + 147) = 6.5 percent; analogously, the percentage dying of all of those classified as positive on the ECG is 7.0.

Chapter 3

JUSTIFICATION FOR SELECTING ANGINA PECTORIS FOR HEALTH INSURANCE STUDY ANALYSES

PREVALENCE AND INCIDENCE

The HIS selected angina for intensive study partly because the disease is fairly common. Based on nationally representative data, the National Center for Health Statistics (NCHS) estimated that approximately 3.1 million people had definite coronary heart disease in 1960-62; of these, one-half had angina pectoris without evidence of a previous myocardial infarction (NCHS, 1965).[1]

NCHS had classified angina as either "definite" or "suspected." Taking both categories together, NCHS estimated the prevalence of angina among adults 25 to 79 years of age to be 4 per 100 persons (see Table 4). Rates were higher for men than for women only in the middle age ranges (35 to 64 years); they were about the same for persons 25 to 34 and 65 to 74, and much higher for elderly women than for elderly men.

The age- and sex-specific rates of the disease varied according to the classification. With a few exceptions, the "suspected" rate was higher than the "definite rate." The prevalence of angina increased until about age 75 for both men and women, and declined slightly thereafter.[2]

NCHS has not reported incidence rates of angina alone. Data from the Framingham study of two decades ago suggested that the annual incidence of coronary heart disease (CHD, of which angina is a large fraction) was about 1.5 per 100 middle-aged men. A recent study in Ireland (Greig et al., 1980) reported a fairly similar incidence rate of CHD (1.7 percent) in men aged 45 to 54. Angina comprised just under half of the cases, for an annual incidence rate of about 0.8 per 100 men of that age group. The incidence of angina has also been reported to

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[1]In materials related to "emerging technologies" that might be candidates for technology assessment, the National Center for Health Care Technology (NCHCT) said in 1980 that about 4 million persons in the country have coronary heart disease and that 2 million of the 4 million suffer from angina. (See Attachment No. 3 of the NCHCT Director's "1980 Emerging Technology List," October 14, 1980.)

[2]A decline in prevalence after age 75 does not imply that any individual "recovers" from the condition. Persons with coronary heart disease, as evidenced by angina, are less likely to live beyond age 75 than are persons not so afflicted. Lower prevalence among the aged is thus an artifact of the natural history of the condition.

Table 4

Prevalence Rate of Definite or Suspected Angina (Excluding Myocardial Infarction) Per 100 Persons, by Age and Sex: United States 1960-62

Age (years)	Men			Women			Both Sexes		
	Definite[a]	Suspected	Total	Definite	Suspected	Total	Definite	Suspected	Total
25-34	0.1	--	0.1	--	0.2	0.2	0.1	0.1	0.2
35-44	--	1.3	1.3	0.1	0.5	0.6	0.1	0.9	1.0
45-54	1.4	3.4	4.8	1.3	2.5	3.8	1.3	3.0	4.3
55-64	5.0	4.4	9.4	2.7	4.8	7.5	3.8	4.6	8.4
65-74	5.3	5.3	10.6	4.5	6.0	10.5	4.9	5.7	10.6
>74	2.8	3.8	6.6	4.5	7.5	12.0	3.6	5.7	9.3
25-79	1.8	2.5	4.3	1.4	2.4	3.8	1.6	2.4	4.0

SOURCE: NCHS, 1965 (Table 4).

[a]Distinction between definite and suspected angina pectoris made by the examining physician.

increase with age. Hartunian et al. (1980) provided national data for 1975 from which an estimate of 0.1 percent for persons of all ages can be calculated as the annual incidence of uncomplicated angina (i.e., angina occurring for the first time without myocardial infarction, coronary insufficiency, or coronary death). The average age at incidence was 63 years (61 for men, 65 for women), and women represented slightly more than half of the estimated new cases for that year. Thus, although at ages below, say, 40 years the occurrence of new cases of angina may be relatively minor, at ages above, say, 45 years, it may be above 1 in 100. These figures underscore that angina is a significantly widespread illness.

As of two decades ago, angina was considered more common in men than women in all age groups. More recent work, however, indicates that the overall incidence may not be much higher in men than women. Kannel and Feinleib (1972) reported that the rates for men and women were apparently comparable for uncomplicated angina. Indirect evidence that angina may strike equally at men and women comes from data marshalled by Stallones (1980). He claimed that when ischemic heart disease is mostly nonfatal (i.e., related more to chronic angina than to acute myocardial infarction), no predominance among men is evident. He also found that chronic ischemic heart disease has not declined in the United States since the mid-1960s, whereas acute myocardial infarction, which does seem to be strongly associated with males, has fallen rather markedly. These phenomena are consistent with an argument that, at present, the incidence of angina may not differ appreciably between men and women in this country. Moreover, Hartunian et al. (1980) suggested that women have at least the same, if not more, new cases of angina as men, and Kemp and associates (1967, 1973) presented evidence suggesting that the prevalence of angina with no demonstrable coronary arteriosclerosis by arteriography was twice as high for women as for men. Finally, DeMaria et al. (1980) noted that "atypical angina" (i.e., angina associated with normal coronary arteries) is believed either to occur more frequently in women or to be equally prevalent among men and women.

In the nearly 20 years since that NCHS report, clinicians have increasingly recognized and discussed a disease entity involving anginal-like chest pain but no arteriographic evidence of coronary artery abnormality. This "anginal syndrome" (or "variant" or "atypical" angina) can overlap disease categories such as "unstable angina," (progressive angina of increasing frequency or increasing severity, or both). The literature is only now beginning to provide definitive descriptions of these various types of angina or their relation to classical angina, where the latter is understood to be nonlethal and to encompass pain of 10-minute duration or less. (See Chapter 2 for selected cita-

tions.) Furthermore, no reliable estimates of the prevalence of atypical angina in a general (national) population are available.

For all of these reasons, finding valid and reliable figures for the current prevalence or incidence of angina nationally is difficult. Nevertheless, ischemic heart disease, taken broadly, remains a widely prevalent problem; as one of its prime manifestations, angina similarly can be regarded, epidemiologically, as a serious health problem.

MORTALITY AND MORBIDITY

Virtually no mortality is ascribed to angina per se. Even patients with unstable angina (which, as noted above, involves progressive angina toward classic myocardial infarction) may have, on average, a mortality during hospitalization of only 4 to 6 percent (Segal et al., 1980). Nonetheless, individuals suffering from any type of angina have a higher risk of dying from myocardial infarction or sudden death syndrome. This is especially true of those afflicted with unstable angina, which can become an acute emergency (Segal et al., 1980; Neill et al., 1980; Borer, 1980).

Angina can severely limit the level of physical activity that an individual can undertake. This, in turn, can reduce productivity on the job and at home. It can also markedly influence a person's mental well-being.

Classically, angina arises with physical or emotional stress, but it can appear during rest or sleep. It can develop suddenly while one is walking up a slight grade, on exposure to cold, or after a meal. Other activities that can bring on attacks are bathing, dressing, and coitus (Segal et al., 1977). Emotional changes equivalent (in cardiac strain and demand for oxygen) to mild or moderate exercise may also bring on the anginal pain.

The amount of effort or emotion needed to provoke an attack varies considerably from person to person. In the stable patient, the level of stress needed to activate angina does not vary much from episode to episode, but in those suffering from unstable angina it may be quite unpredictable. Knowledge that one is susceptible to anginal attacks can cause anxiety or worry about having an attack; this, in turn, can produce an attack. DeMaria and his colleagues speculated that many cases of atypical angina may arise from psychosomatic disturbances. Moreover, attempts to protect oneself against an attack may prompt a patient to avoid emotional stimulation by severe denial or repression or by withdrawal and isolation (Backus and Dudley, 1974).

Few hard data are available on the economic costs of angina. Plain-

ly, it can seriously affect the earning power of persons who are gainfully employed by forcing them into premature retirement. As discussed in the following section, treatment for angina can include a variety of medications and reasonably regular physician followups. Hartunian et al. (1980) estimated, for example, that in 1975, the total direct costs (for treatment and administrative measures) associated with the incidence of uncomplicated angina were $384 million; another $7 million in indirect costs (foregone earnings) were also estimated for that year. Thus, the total costs associated with angina were estimated to be $391 million, which can be compared, for example, with $13.3 billion for all coronary heart disease other than angina, $6.5 billion for stroke, and $14.4 billion for motor vehicle fatalities. The losses from angina, although substantial, are lower than those from the other diseases because the remainder are much more likely to be associated with death rather than disability.

A growing body of literature (see Neill et al., 1980; Borer, 1980; Antman et al., 1980; DeMaria et al., 1980; Segal et al., 1980) implicates spasms of the coronary artery (which may occur without any exertion or emotional stress) as the precipitating events in some anginal attacks. These spasms occur more or less spontaneously near the sites of serious atherosclerotic blockages or narrowings (plaques) of the coronary arteries. They have the effect of instantaneously lowering the supply of oxygen to the heart (in contrast to other presumed causes of angina that involve a sudden increase in demand for oxygen by the heart). The presence of such a plaque, even if small, may promote blood clotting, and the clot itself may produce a sudden myocardial infarction. Thus, clinical evidence supports the thesis that angina is a complex problem, in which various kinds and types of medical care may be appropriate and are often necessary. It further argues that angina has many serious ramifications for both disability and premature death.

EFFECTS OF MEDICAL CARE

Medical care may reduce physical limitations, pain, and worry arising from angina; the likelihood of death may also be somewhat lessened. Apart from dietary cautions and advice about not smoking, physicians usually treat angina first with medications, not surgery. The ultimate objectives are to relieve the patient's episodic chest pain, to increase his tolerance to exercise, and to make him more productive. Fewer than 5 percent of patients with angina are usually refractory to this type of medical management. For those who are not likely to

respond successfully to medical regimens alone, surgical or other experimental therapies are possible.

Drugs

In the past, the therapy generally chosen for angina has been nitroglycerine. Discovered by Murrell in 1879 (Murrell, 1879), this treatment has short-term utility (30 minutes), but it is usually long enough for the effective relief of symptoms. (An exception may be in atypical anginal syndrome.) Nitroglycerine dilates and relaxes blood vessels. It reduces cardiac energy needs through vascular dilation and subsequent reductions in intracardiac pressure and blood pressure. Nitroglycerine acts primarily on large vessels, including the large coronary arteries on the heart surface, but it can also improve regional blood flow to ischemic areas by dilating atherosclerotic coronary arteries and coronary collateral vessels (Abrams, 1980). In addition to its use to relieve the symptoms of an angina attack, nitroglycerine can be taken before activities that stress the heart are begun. By so doing, the individual is often able to extend the time during which comparatively strenuous activities are performed or to function at a higher level, because the drug has helped to prevent oxygen deprivation in the heart muscle (Goodman and Gilman, 1965). Long-acting nitrates—both pastes applied to the skin, and pills taken orally—work by the same mechanism and can be effective for a longer time (Reichek, 1976; Abrams, 1978).

With the introduction of propranolol in 1965, a second effective class of medications for patients with angina became available (Keelan, 1965; Segal et al., 1980; Zito et al., 1980). Propranolol (a beta-adrenergic blocking agent) is particularly useful when combined with nitroglycerine, because the amount of nitroglycerine required to relieve symptoms is reduced. Various reports have shown that 77 to 100 percent of people with angina respond favorably to propranolol (in the sense of having less chest pain at a given level of work by the heart) (Dunkman et al., 1974).

Some experimental drugs that promote coronary vasodilation have also been shown to be quite effective in this condition. In particular, nifedipine has been observed to be useful in exertional angina (Lynch et al., 1980), in coronary artery spasm (Antman et al., 1980), and in some cases of unstable angina (Segal et al., 1980). Some observers claim a positive synergetic effect of nifedipine combined with propranolol, in terms of producing notable "subjective and objective improvement with good tolerance" (Lynch et al., 1980), but case reports of heart failure in persons given the combination suggest that such an approach should be used with caution (Anastassiades, 1980).

As might be expected from the discussion about different types of angina, a medical regimen can include more than drugs. Much has been made of associations between the problems of angina and, for instance, smoking and high serum cholesterol (see, for example, Stallones, 1980; Fox et al., 1980).[3] (The possible association between high serum levels of triglycerides and coronary heart disease is much less well accepted. See, for example, Hulley et al., 1980.) Thus, one might expect advice and counseling about not smoking and changing dietary intake of fat, fiber, and cholesterol (Lewis, 1980) to be part of a well-rounded medical approach to patients with angina. To the degree that stress is a precursor of coronary heart disease, efforts to help patients cope with stressful life events extrinsic to their coronary problems would also be indicated.[4] Thus, some remedies for angina are related to life-style and hence essentially patient-mediated, such as not smoking or following a recommended diet.

The effect on mortality of comprehensive medical therapy (compared with no therapy) is unknown. Except for randomized clinical trials of various drugs related to coronary heart disease (see, for example, references cited in Coronary Drug Project, 1980; Lynch et al., 1980), which include the use of placebos, medical care is never knowingly withheld from people with angina. Medical therapy theoretically reduces the incidence of sudden death and myocardial infarction by improving conditions of oxygen imbalance in the heart, but people treated for angina may take more risks because they feel better, thereby producing more episodes of oxygen imbalance. At any rate, medical therapy for people with angina is justified by its marked ability to control symptoms and increase productivity.

Surgery

When disabling pain cannot be controlled by a comprehensive medical regimen, or when the patient's desired exercise level cannot be achieved because of the onset of pain, and when a suitable coronary arterial bed and left ventricular function are present (as established by coronary arteriography), the patient can be considered for coronary artery bypass surgery (now often called coronary artery bypass graft, or CABG). Results in terms of symptomatic relief are usually excellent, according to studies from the mid-1970s (Alderman et al., 1973; Dunkman et al., 1974). When patients undergoing the procedure were evalu-

[3]Volume 11 of this series treats the subject of hypercholesterolemia and its relationship to various serious illnesses.

[4]See Haney (1980) for a lucid assessment of the literature on the links between life events and coronary heart disease.

ated up to 60 months postoperatively, 50 to 82 percent (on average, 70 percent) were completely relieved of chest pain. Moderate relief of pain occurred in an additional 9 to 39 percent (on average, about 20 percent), although 6 to 20 percent (on average, 10 percent) showed no improvement or were worse. Overall, approximately 90 percent of those surviving the operation experienced some relief of symptoms. Segal et al. (1980) noted that many studies of unstable angina found that persons surviving surgery had many fewer symptoms than persons treated medically.

Patients (particularly those under age 40) with severe left main coronary artery disease or its equivalent are especially likely candidates for coronary artery bypass graft. (The definition of severe—high-grade—obstruction varies from expert to expert but is often taken to be greater than 50-percent obstruction.) Such patients are at high risk for sudden death; for many of them, physicians would recommend CABG as initial therapy, especially if obstruction is greater than 70 percent (Takaro et al., 1976; Aronow, 1979). For persons with 90-percent or greater obstruction of that artery or the left anterior descending artery, surgery as soon as possible is recommended by some experts (Segal et al., 1980).

There is no evidence that CABG prolongs life in the majority of people with angina who undergo this type of surgery (see, for example, Segal et al., 1980). In two random assignment studies (which minimized possible selection bias), no difference in survival after 3 years of followup was demonstrated between patients who received comprehensive medical therapy and those who underwent surgery (Murphy et al., 1977; Kloster et al., 1979). One important subgroup (persons with chronic stable angina and left main artery disease), however, enjoys significantly greater longevity following surgical rather than medical treatment (Takaro et al., 1976; Aronow, 1979).

Because of the ambiguities surrounding the benefits, risks, and costs of CABG, it is one of about 17 candidates for assessment within the guidelines for technology assessment of the National Center for Health Care Technology. It was also a topic of "consensus development" by the National Institutes of Health in 1980. Thus, the advantages of, or indications for, such surgery, as compared with medical therapy (alone or first), are yet to be fully explicated.[5]

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[5]The same is true of an "emerging" technology known as Percutaneous Transluminal Coronary Angioplasty (PTCA), which is a nonsurgical technique for dilating narrowed coronary arteries with a balloon catheter. It is considered an experimental or investigational procedure for use in those few patients with fairly recent but medically intractable disease of a single coronary blood vessel. PTCA was only introduced in 1977 in the United States, in a few highly specialized centers. Thus, it was not available at the time persons were enrolled into the HIS, and is probably unlikely to be observed in any HIS enrollees before the Study ends.

In summary, the remedies available for treating patients with angina are quite varied. They can be medical, surgical, or both; they can involve both patient- and physician-mediated activities. Finally, they can vary greatly in cost, risk, and potential benefit. Thus, data on the use of services for angina can provide much information about the effects of insurance level on quality of care and health status in the HIS.

Chapter 4

HEALTH INSURANCE STUDY METHODS

PREVALENCE OF ANGINA

Medical History Questionnaire

As discussed in Chapter 2, a diagnosis of angina pectoris can be established on the basis of appropriate responses to the Rose Questionnaire. This was the main technique used in the Health Insurance Study (HIS) to identify people with angina pectoris. The HIS questions relating to angina were basically the same as those in the Rose Questionnaire (with slight modifications in response patterns), and are henceforth referred to as the Rose questions. (The original Rose Questionnaire and scoring algorithms are presented in Appendix A.) Together with additional questions relating to (a) physician diagnosis of angina, (b) use of medical care and medications, and (c) pain, worry, and disability because of chest pain or angina, they made up the HIS Chest Pain battery.

In Dayton, the entire Chest Pain battery appeared in Form A of the HIS Medical History Questionniare (MHQ); in all other HIS sites, it appeared in Form B of the MHQ. All enrollees 14 years of age or older were given the relevant MHQ form upon enrollment in the Study (about 3 weeks prior to the medical screening examination), either in their homes or at the screening examination site. The battery appears in Form B of the exit MHQ, which is administered to all adult enrollees at the end of the enrollment period in the HIS. Both versions of the enrollment battery are reproduced in Appendix C.

The differences in the two versions were generally minor. The modifications in the Dayton battery were intended to obtain more detailed information on the use of relevant medications and on the timing of medical care for the condition, or they were intended to improve response choices according to results from fielding the questionnaire in Dayton.

The Rose questions (and indeed the entire battery) were introduced differently in Dayton than in the other sites. In Dayton, one major "skip" question was used: "Have you had pain, discomfort, heaviness or pressure in your chest in the past 12 months?" Persons who responded

"no" immediately "skipped out" to the next disease-specific battery. Two skip questions were used in all other sites; one referred only to pain, and the other to discomfort, heaviness, or pressure. Persons who responded "no" to the pain item had an opportunity to answer the discomfort item; persons who responded "no" to both skipped out to the next battery. Selected items within the battery were also preceded by a similar skip question, so that persons to whom the item might not apply were not required to respond. Answers to such items from persons who should not have responded were excluded from analyses reported in Chapter 5.

Combinations of responses to Rose questions can lead to different classifications as to the likely presence or absence of angina, and some combinations can be quite complex. A score indicating that angina was present (hereafter "angina-present") in response to the Rose questions on the MHQ was defined by the same criteria used for the original Rose Questionnaire (see Appendix A). In particular, HIS enrollees with angina of Grades 1 and 2 by the Rose scoring algorithm were considered angina-present; a separate category of "angina-probable" (which represents minor departures from the Rose scoring algorithm) was also defined. These categories and the HIS scoring rules are discussed in more detail in Chapter 5.

Medical Screening Examination

A randomly selected subset of the HIS sample received a medical screening examination upon enrollment in the Study.[1] This examination included a single at-rest electrocardiogram (ECG) for men 30 years of age and older, women 35 years and older, and any younger person with high blood pressure by history or physical examination or who had a history of hypercholesterolemia, heart failure, shortness of breath, or chest pain. Results from this enrollment ECG were used to validate the Rose questions on the Chest Pain battery and to indicate the presence of arteriosclerotic cardiovascular disease.

Appendix B describes the methods used by the HIS to identify enrollees with selected at-rest ECG abnormalities, regardless of the enrollees' angina status. The selected manifestations (including intraventricular conduction abnormalities, ST-segment and T-wave changes, ventricular hypertrophy, and dysrhythmias) are associated with increased likelihood of cardiovascular events or death. Because at least some of them may be preventable or modifiable by medical inter-

[1]This random sample of participants will be used to study the effect of the screening examination on health status and use of medical services.

vention, they also serve as measures of health status in the HIS. The rationale for their selection is discussed in more detail in Appendix B.

All participants receive a screening examination upon exit from the HIS. Those meeting the criteria specified above are given an at-rest ECG. Actual procedures at both enrollment and exit examinations are detailed in Smith et al. (1978).

The exit screening examination also includes a physician interview of participants who were considered to be under active treatment for angina, as judged by claim forms data. By history and, where helpful, physical examination, the physician determines whether the condition is in fact present and whether current therapy and management are adequate. To standardize the physician's evaluation, he is trained in the use of two HIS forms by a physician member of the Rand staff. The first form is used for recording history and physical examination findings; the second elicits the examining physician's evaluation and interpretations through specific questions and established response categories. In addition, the physician dictates a detailed account of his history and physical findings, so that the reliability and validity of his judgments can be assessed independently by other physicians.

Because the probability is very slight that a person will have an attack of angina while being examined by a physician, and because physical examination findings are neither specific for angina nor very useful in diagnosing it, they are not used routinely in the HIS to establish the diagnosis. ECG abnormalities from an exercise stress test could not be used in the HIS for diagnosing persons with chest pain suggestive of angina because standard medical practice requires that a licensed physician be present when such a test is being performed (in view of its potential dangers). Physicians were not needed to monitor any other test performed during the HIS screening examination; hence, the costs of providing physicians for monitoring only ECG stress tests would have been prohibitive. Such tests were therefore considered impractical for HIS screening purposes.

Insurance Claim Forms

A third source of information by which the prevalence of angina can be estimated is the HIS insurance claim forms. These are submitted by the enrollee's physician and include places for as many as four diagnoses. Thus, independent of responses to the MHQ, a person can be identified as having angina if that diagnosis is recorded on claim forms filed during the Study.

Criteria for Classification

The HIS considers an individual to have angina if any one of the following criteria is met:

1. For any respondent 35 years of age and older, a score indicating angina-present in response to the Rose questions, from either the enrollment or the exit MHQ.
2. For enrollees of any age, a positive response to the physician-diagnosis question ("Has a doctor ever said that you had angina?") in the Chest Pain battery *and* a score indicating at least probable angina in response to the Rose questions, from either the enrollment or the exit MHQ.
3. For enrollees of any age, at least three insurance claim forms listing a diagnosis of angina pectoris.

DISEASE IMPACT

For enrollees with angina, the HIS strategy to detect different levels of health produced by different levels of insurance is based primarily on answers to MHQ questions about the pain, worry or concern, and disability that angina causes—i.e., the Study will investigate changes in various impacts of the disease on people's lives short of life-threatening events such as heart attack. The principal hypothesis is that more generous health insurance will produce better access to medical care and also medical care of higher quality (both technical quality and art of care) than would be available to persons with less generous insurance. This, in turn, should result in less pain, worry, or activity restriction for persons in the former category. One might also expect that individuals with better insurance would receive advice and encouragement about certain preventive measures, such as stopping smoking and following dietary habits that minimize cholesterol intake. Finally, proper selection of medications (appropriate drugs and dosages) would also be expected for persons with better insurance.

More generous insurance may have a variety of negative outcomes, however. It may, for instance, produce more physician visits for nonspecific chest pain. If these symptoms were labeled (erroneously) as heart disease, then the patient might experience a good deal of unwarranted worry and might unnecessarily restrict his or her daily activities; both such problems clearly reflect lower health status. Persons with generous insurance may also be prescribed a variety of drugs that he or she really does not need; if these medications have some probabili-

ty of adverse side effects, then the patient may suffer some unfortunate and unnecessary sequelae to the drug therapy.

To determine what adverse effects angina has on persons who have been classified as having the disease, four questions in the Chest Pain battery were asked of all who gave a positive response to the initial questions about chest pain, discomfort, heaviness, or pressure. These disease impact items centered on pain, worry, activity restrictions, and days spent in bed that the person attributed to angina. Responses to the pain, worry, and activity restriction questions could range from "none" to "a great deal" (or equivalent wording, depending on the item). The question on days in bed required only that the respondent write either zero or the specific number of days in bed attributed to the problem. In addition, a composite item called "any impact" was constructed; an individual was assigned a positive score for "any impact" if he or she gave a response other than "none" to at least one angina-related disease impact question.

These impact questions are part of a standard set that appears repeatedly in the MHQ in association with various diseases and conditions. They were not specifically constructed to measure the symptoms or adverse consequences of angina (or any other particular condition), but to facilitate comparisons of similar kinds of impact among several diseases and problems.

To compare disease impact for persons in several categories of angina, we calculated the percentages of responses at each level, from "none" to "a great deal" or of specific numbers of days in bed. Disease impact was assessed for persons who truly did have angina (according to criteria based on combinations of answers to the Rose questions and the physician-diagnosis question) and for persons who did not have angina according to the HIS criteria but who claimed to have relevant symptoms and thus completed the battery and the disease impact questions. In addition, persons who denied such symptoms and did not complete the battery were arbitrarily assigned scores equal to no impact ("none"), on the grounds that they would (if asked) logically not report any impact from the condition.

One other method of investigating disease impact is used for persons who are under active treatment for angina. This measure assesses the ability of the physician to select appropriate therapy—defined in terms of little or no expected improvement in the person's condition if therapy were changed, and little or no reduction in side effects if current medications were changed but the same therapeutic effect were achieved. It is based on information collected during the standard physician interview of persons with angina at the exit screening examination.

Chapter 5

HEALTH INSURANCE STUDY ENROLLMENT RESULTS

The Study enrolled a total of 5835 adults (14 years and older) in six sites. Just over 50 percent were women, and about 15 percent were nonwhite. The mean number of years of schooling completed by those 18 and older was 12, and the average family income (in 1973-74 dollars) was about $13,000. The experimental population was entirely under age 62 at enrollment so that no individual would reach age 65 during the course of the experiment.[1] (The Preface and Volume 1 contain additional information about the HIS sample and enrolled population.)

Of the 5835 adults enrolled, 5713 (98 percent) received and completed the form of the Medical History Questionnaire (MHQ) that contained the Chest Pain battery. They include adults enrolled in any of the experimental HIS plans, in the Dayton control group, and in a "pre-enrollment group" in South Carolina. The medical screening examination was administered to 3321 individuals at the six sites. Those who received the examination represented a random subsample of about 60 percent of the entire sample.[2]

PREVALENCE OF ANGINA ACCORDING TO THE MEDICAL HISTORY QUESTIONNAIRE

As noted above, 5713 enrollees had an opportunity to enter the Chest Pain battery, 1178 in Dayton and 4535 in the non-Dayton sites. The Rose questions were the opening questions of the Chest Pain battery. The distribution of responses to the initial ("skip") questions are given in Table 5. In Dayton, 204 of 1178 respondents (17 percent) reported pain, discomfort, heaviness, or pressure in their chests in the past year, and thus went on to complete the battery; in the other sites, 551 of 4535 enrollees (12 percent) reported chest pain; of those who did not report chest pain, 166 (4 percent of the original 4535) claimed to have experienced discomfort, heaviness, or pressure in their chests.

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[1]The control population included two individuals over age 61.

[2]Of the 5713 people who completed the relevant MHQ form, 3320 were screened. In addition, one Charleston enrollee who failed to complete Form B (which in Charleston contained the Chest Pain battery) was also screened.

Table 5

DISTRIBUTION OF RESPONSES TO QUESTIONS ABOUT ANGINA FROM THE MHQ: ROSE QUESTIONS

Question[a]	Response	Number	Percent[b]
†*Have you had pain, discomfort, heaviness or pressure in your chest in the past 12 months?*	Yes	204	17
	No	974	83
		1178	100
**Have you had chest pain in the past 12 months?*	Yes	551	12
	No	3969	88
	Missing	15	(c)
		4535	100
**Have you had any discomfort, heaviness or pressure in your chest during the past 12 months?*[d]	Yes	166	4
	No	3802	95
	Missing	16	(c)
		3984	99

[a]The question marked with a dagger (†) appeared only in the Dayton battery; questions marked with an asterisk (*) appeared only in the non-Dayton battery.

[b]Percentages may not sum to 100 because of rounding.

[c]Less than 0.5 percent.

[d]The 551 people who answered "yes" to the previous question on chest pain were instructed to skip this question.

Thus, 921 of 5713 respondents in all six sites (16 percent) indicated at least one possible symptom of angina and went on to complete the Rose questions and the remaining Chest Pain questions.

The diagnosis of angina pectoris and the ultimate identification of the population of interest were based on responses to the MHQ Rose questions in Tables 5 through 7. One of four possible angina scores was assigned to each of the 5713 MHQ respondents: (1) angina not present, (2) angina probably present, (3) angina present with mild impairment, and (4) angina present with moderate impairment. The Rose questions and the algorithms used to derive these scores are given in Tables 8 and 9. A score of 3 or 4 corresponds to Rose's grades 1 or 2, respectively (see Appendix A) and was assigned only to persons aged 35 or older; these individuals constitute the "angina-present" category. As previously indicated, the Rose Questionnaire has not been validated for persons

Table 6

Distribution of Responses to Questions About Angina from the MHQ: Rose Questions Supplemented by HIS Questions

Question[a]	Response	Number	Percent[b]
**How often do you get this feeling in your chest?*[c]	Almost every day	41	6
	A few times a week	92	13
	About once a week	41	6
	A few times a month	175	24
	About once a month	86	12
	Less than once a month	265	37
	Missing	17	2
		717	100
Do you get this feeling in your chest when you walk uphill or hurry?	Yes	289	31
	Do not walk uphill or hurry[d]	13	1
	No	602	65
	Missing	17	2
		921	99
Do you get this feeling in your chest when you walk at an ordinary pace on level ground?	Yes	81	27
	Do not walk on level[d]	3	1
	No	216	72
	Missing	2	1
		302	101
What do you usually do when you get this feeling in your chest while walking?	Stop for a while	106	35
	Slow down	168	56
	Continue at same pace	26	9
	Missing	2	1
		302	101
If you stand still, what happens to this feeling in your chest?	Goes away in less than 10 minutes	173	57
	Goes away in 10-30 minutes	54	18
	Lasts over 30 minutes	18	6
	Don't know[d]	11	4
	Don't stand still	44	15
	Missing	2	1
		302	101
When you get this feeling in your chest while walking, do you usually place a Nitroglycerine, Cardilate, or Isordil pill under your tongue?[c]	Yes, and pain gone in 10 minutes	11	4
	Yes, and some relief in 10 minutes	5	2
	Yes, but no relief in 10 minutes	4	1
	No, do not place pill under tongue	280	93
	Missing	2	1
		302	101
**When you get this feeling in your chest while walking, do you usually take a Sorbitrate pill (or similar pill) that you chew?*[c]	Yes, and pain gone in 10 minutes	2	1
	Yes, and some relief in 10 minutes	1	(e)
	Yes, but no relief in 10 minutes	2	1
	No, do not chew any pill	210	98
	Missing	1	(e)
		216	100

[a] Questions marked with an asterisk (*) appeared only in the non-Dayton battery.

[b] Percentages may not sum to 100 because of rounding.

[c] Added to the original Rose Questionnaire by the HIS.

[d] Response category in the Dayton battery only.

[e] Less than 0.5 percent.

Table 7

DISTRIBUTION OF RESPONSES TO QUESTIONS ABOUT ANGINA FROM THE MHQ: ROSE QUESTIONS ON LOCATION OF PAIN

Question[a]	Response	Number	Percent[b]
†*Where do you get this pain? Upper or middle chest?*	Yes	93	46
	No	103	50
	Missing	8	4
		204	100
Lower chest?	Yes	104	51
	No	92	45
	Missing	8	4
		204	100
Left chest?	Yes	87	43
	No	105	51
	Missing	12	6
		204	100
Left arm?	Yes	36	18
	No	155	76
	Missing	13	6
		204	100
Somewhere else?	Yes	40	20
	No	152	75
	Missing	12	6
		204	101
Where do you usually get this pain?	Left side of chest	201	28
	Right side of chest	39	5
	Middle of chest	392	55
	Neck	10	1
	Left arm	10	1
	Right arm	2	(c)
	Missing	63	9
		717	99

[a]The question marked with a dagger (†) appeared only in the Dayton battery; the question marked with an asterisk (*) appeared only in the non-Dayton battery.

[b]Percentages may not sum to 100 because of rounding.

[c]Less than 0.5 percent.

Table 8

ROSE QUESTIONS USED TO CLASSIFY PERSONS ACCORDING TO ANGINA STATUS

Question No.	Question and Site[a]
I.	a. Have you had pain, discomfort, heaviness or pressure in your chest in the past 12 months? (Dayton only)
	b. Have you had chest pain in the past 12 months? (Non-Dayton only)
	c. Have you had any discomfort, heaviness or pressure in your chest in the past 12 months? (Non-Dayton only)
II.	Do you get this feeling in your chest when you walk uphill or hurry?
III.	Do you get this feeling in your chest when you walk at an ordinary pace on level ground?
IV.	What do you usually do when you get this feeling in your chest while walking?
V.	If you stand still, what happens to this feeling in your chest?
VI.	a. When you get this feeling in your chest while walking, do you usually place a Nitroglycerine, Cardilate, or Isordil pill under your tongue?
	b. When you get this feeling in your chest while walking, do you usually take a Sorbitrate pill (or similar pill) that you chew? (Non-Dayton only)
VII.	Where do you usually get this pain? a. Upper or middle chest? b. Lower chest? c. Left chest? d. Left arm?

[a]If the site is not specified, the question was asked in all sites.

Table 9

HIS Algorithms for Combining Responses to the Rose Questions Used To Classify Persons According to Angina Status

Score — Angina Classification and Algorithm

1. *Angina Not Present*
   Any of:
   (a) "No" to Ia[a] or to Ib and Ic.
   (b) "No" to II.
   (c) "Do not do" to II *and* "No" or "Do not do" to III.
   (d) "Continue at same pace" to IV.
   (e) Any answer other than "Less than 10 minutes" to V; any answer other than "Pain gone within 10 minutes" to both VIa and VIb; *and* an answer other than "Middle chest" to VII (non-Dayton), or "No" to VIIa and to VIIb, and to either VIIc or VIId (Dayton).

2. *Angina Probably Present*
   "Yes" to Ia, Ib, or Ic; "Yes" or "Do not do" to II; "Yes" to III; "Stop" or "Slow down" to IV; *and* any of:
   (a) Any answer other than "Less than 10 minutes" to V; *and* "Pain gone within 10 minutes" to VIa or VIb.
   (b) Any answer other than "Less than 10 minutes" to V; *and* "Middle chest" to VII (non-Dayton) or "Yes" to VIIa or to VIIb, or to both VIIc and VIId (Dayton).
   (c) "Less than 10 minutes" to V; *and* an answer other than "Middle chest" to VII (non-Dayton), or "No" to VIIa and to VIIb, and to either VIIc or VIId (Dayton).

3. *Angina Present with Mild Impairment*
   "Yes" to Ia, Ib, or Ic; "Yes" to II; "No" to III; "Stop" or "Slow down" to IV; "Less than 10 minutes" to V; *and* "Middle chest" to VII (non-Dayton), or "Yes" to VIIa, or to VIIb, or to both VIIc and VIId (Dayton).

4. *Angina Present with Moderate Impairment*
   "Yes" to Ia, Ib, or Ic; "Yes" or "Do not do" to II; "Yes" to III; "Stop" or "Slow down" to IV; "Less than 10 minutes" to V; *and* "Middle chest" to VII (non-Dayton), or "Yes" to VIIa, or to VIIb, or to both VIIc and VIId (Dayton).

[a]Questions in Table 8.

under age 35; anyone in that age group who was originally scored as 3 or 4 was rescored as 2 (probably present).[3]

The MHQ Chest Pain battery also contained several items about physician care and use of drugs typically associated with angina (see Tables 10 and 11). Following some empirical studies described in greater detail below, we used one particular item—whether a doctor had ever made a diagnosis of angina (Table 10)—in conjunction with responses to the Rose questions to arrive at an additional classification category. Specifically, persons of any age who reported a physician diagnosis of angina and who were scored (or rescored) as 2 were eventually included in the angina-present category.

Table 12 shows the total number and percentage distribution of persons in each of the four angina status categories, before any rescoring of individuals was done to account for responses to the physician-diagnosis question or age. It also shows the number of respondents in each category who gave a positive or negative answer to that physician-diagnosis question. (Recall that, as shown in Table 10, 31 individuals claimed that a doctor had diagnosed angina at some time in the past.)

A total of 111 enrollees (2 percent of the entire population) was initially classified as having angina with mild or moderate impairment (84 and 27 individuals, respectively, with a score of 3 or 4). This figure of 111 probably overestimates the number of persons with angina, because 33 women and 6 men with a score of 3 and 9 women and 1 man with a score of 4 were under 35 years of age. Because of the very low prevalence of angina in this age group, we conjectured that most if not all of these 49 persons probably did not have angina. We will examine data from claim forms submitted for payment for medical services delivered during the HIS to clarify what conditions they in fact had.

Eliminating these 49 individuals from the initial enrollment prevalence estimate yields a provisional estimate of 1.1 percent (62 of 5713 persons). Empirical analyses (see "Disease Impact," below) suggested that persons who had reported a physician diagnosis of angina and had a score of at least 2 (probably present) on the Rose questions should also be considered as belonging to the angina-present group. Thirty-one persons in the HIS sample (0.5 percent of the 5713 MHQ respondents) had responded positively to the physician-diagnosis question (see Table 10 or Table 12). Of the 31, 27 were 35 years of age or older. Of the 4 persons under age 35 who reported having a physician diagnosis of

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[3]The Rose Questionnaire has been validated only for men 35 years and older. The HIS has decided, somewhat arbitrarily, to use scores of 3 or 4 as sufficient evidence of angina in women 35 and older as well. As documented in Chapter 3, women of that age do suffer from coronary heart disease (including angina pectoris), perhaps to the same degree as men for some types of angina. Individuals under age 35 are not often afflicted with this disease, so responses to the Rose questions in this age group will not be considered sufficient evidence of angina.

Table 10

DISTRIBUTION OF RESPONSES TO QUESTIONS ABOUT ANGINA FROM THE MHQ: PHYSICIAN CARE

Question[a]	Response	Number	Percent[b]
Has a doctor ever said that you have angina?	Yes	31	3
	No	850	92
	Don't know	20	2
	Missing	20	2
		921	99
Has a doctor ever said that you had a heart attack?	Yes	35	4
	No	864	94
	Missing	22	2
		921	100
†*Are you currently under a doctor's care or supervision for this chest pain?*	Yes	41	20
	No	161	79
	Missing	2	1
		204	100
**When was the last time you saw a doctor for this chest pain?*	Within past 3 months	97	14
	3-6 months ago	57	8
	7-12 months ago	78	11
	More than 1 year ago	259	36
	Have not seen a doctor[c]	180	25
	Missing	46	6
		717	100

[a]The question marked with a dagger (†) appeared only in the Dayton battery; the question marked with an asterisk (*) appeared only in the non-Dayton battery.

[b]Percentages may not sum to 100 because of rounding.

[c]This response category appeared only in South Carolina enrollment MHQ.

angina, one had a score of 2. Six of the 27 over age 35 were already classified as angina-present. Seven of the remaining 21 over age 32 had a score of 2. In sum, then, 8 persons (see Table 12) had a physician diagnosis of angina and a Rose score of 2; 7 were older than 35, and 1 was younger. When they were added to the 62 persons who were already considered definitely positive for angina, the prevalence of angina among enrollees aged 14 and older is estimated to be 1.2 percent (70 of 5713 persons). This is the final estimate of enrollment prevalence according to MHQ data for all adult enrollees.

Age- and sex-specific prevalence rates for angina in the HIS enrollment sample are given in Table 13 for only persons aged 35 to 64 years. U.S. rates of "definite" and "total" angina, derived from the 1960-1962

Table 11

Distribution of Responses to Questions About Angina from the MHQ: Use of Medications

Question[a]	Response	Number	Percent
During the past 12 months, did you ever place a Nitroglycerine, Cardilate, or Isordil pill under your tongue for your chest pain?	Yes, and it helped	27	3
	Yes, but it did not help	5	1
	No, put no pill under tongue	870	94
	Missing	19	2
		921	100
* *During the past 12 months, did you ever take a Sorbitrate pill (or a similar pill) that you chew for your chest pain?*	Yes, and it helped	9	1
	Yes, but it did not help	1	(b)
	No, chewed no pill	686	96
	Missing	21	3
		717	100

[a]The question marked with an asterisk (*) appeared only in the non-Dayton battery.

[b]Less than 0.5 percent.

Table 12

Number of MHQ Respondents, Classified by Angina Status and Physician Diagnosis

Score	Angina Status[a]	Physician Diagnosis of Angina		Total	
		Yes	No	Number	Percent[b]
1.	Not present	17	5467[c]	5484	96.0
2.	Probably present	8	110	118	2.1
3.	Present, mild impairment	3	81	84	1.5
4.	Present, moderate impairment	3	24	27	0.5
Total		31	5682	5713	100.1

[a]See Tables 8 and 9 for scoring.

[b]Percentages do not sum to 100 because of rounding.

[c]Includes persons with missing responses.

Table 13

PREVALENCE RATE OF ANGINA PER 100 PERSONS, BY AGE AND SEX: UNITED STATES 1960-62 AND HIS ENROLLMENT 1974-77

Age Group (years)	U.S. Rate[a]		HIS Rate[b]	
	Definite	Total	Rate	Cases per Sample
Men				
35-44	--	1.3	1.1	5/473
45-54	1.4	4.8	2.7	9/339
55-64	5.0	9.4	3.2	6/190
35-64	1.8	4.7	--	--
Crude rate[c]	--	--	2.0	20/1002
Adjusted rate[c]	--	--	2.3	--
Women				
35-44	0.1	0.6	2.8	14/501
45-54	1.3	3.8	4.9	22/447
55-64	2.7	7.5	5.5	13/235
35-64	1.2	3.5	--	--
Crude rate	--	--	4.1	49/1183
Adjusted rate	--	--	4.6	--
Both Sexes				
35-44	0.1	1.0	2.0	19/974
45-55	1.3	4.3	3.9	31/786
55-64	3.8	8.4	4.5	19/425
35-64	1.5	4.1	--	--
Crude rate	--	--	3.2	69/2185
Adjusted rate	--	--	3.6	--

[a] See NCHS (1965, Table 4) for definitions of definite and total (definite plus suspected) angina.

[b] Based on 62 individuals 35 years or older on the Rose questions and a score of 3 or 4 plus 7 individuals of that age with scores of 2 and a physician diagnosis of angina.

[c] The crude HIS rate is simply the number of cases divided by the number of persons in the sample. The adjusted rate is the prevalence rate adjusted for age and sex by using the indirect method (see text). The HIS adjusted rates are only for comparison with the U.S. prevalence rates, and do *not* represent the actual observed prevalence in the HIS population.

Health Examination Survey (NCHS, 1965), are also shown. Both data sets show higher prevalence with higher age, although this effect is stronger in the NCHS data. The HIS rates were age- and sex-adjusted (using the indirect method)[4] to provide a more accurate comparison with the NCHS data. For men, both the crude and adjusted rates fell between the definite and total U.S. rates; the HIS rate for men 55 to 64, however, was lower than the U.S. definite rate. The crude and adjusted rates for all HIS women were higher than the U.S. rates, as was true for the rates for women 35 to 44 and 45 to 54. Only the rate for women 55 to 64 fell between the definite and total U.S. rate. These figures had the net effect of producing a higher prevalence rate for women than men among the HIS enrollees, as contrasted with a higher rate among men than women in the U.S. data.

Some of these differences in prevalence could be explained by the different methods used for identifying cases. Specifically, in the NCHS survey, physicians made a direct diagnosis of angina and thus could label a case as either definite or suspected. In the HIS, respondents self-reported information (including prior physician diagnosis), which was used to classify them with respect to angina. As discussed earlier, the self-administered form of the Rose Questionnaire, as used in the HIS, has been shown to classify a higher proportion of respondents as angina-present than the interviewer-administered Rose Questionnaire. If the interviewer-administered Rose Questionnaire is similar to a physician's interview, at least for women, then the generally higher prevalence of angina among the HIS women compared with the NCHS sample would not be wholly unexpected.

Prevalence rates in the HIS do not rise as sharply with age as in the NCHS data. One explanation for this arises from the way in which the HIS selected its sample; the HIS excluded from its sample all individuals who retired early with a disability and were eligible for Medicare benefits. Because some of these people may have angina, this exclusion may bias downward the HIS prevalence rate for the 55-to-64 group. Furthermore, the HIS experimental population was truncated at age 61; thus, that age cohort was composed of individuals aged 61 or younger. This further reduces the expected angina prevalence in that group, as angina rates even within this age group clearly increase with age.

The prevalence of angina by sex differs between the U.S. sample

[4]The indirect method adjustment begins with a calculation of the overall prevalence that could be expected if the reported U.S. rates in each age/sex group were applied to the HIS population. The indirect adjusted rate for the HIS is then computed as the overall rate for the standard (U.S.) population adjusted by the ratio of the crude prevalence rate observed for the HIS to the expected HIS prevalence rate. See Fleiss (1973) for a description of this method, which is the most commonly used technique for such adjustment.

and the HIS sample. One explanation may be the different time periods of the two studies. The NCHS survey was completed between 1960 and 1962, whereas the HIS questionnaires were completed between 1974 and 1977. During the intervening decade, incidence and prevalence rates of uncomplicated angina among women rose so that they are now similar to rates for men. As noted in Chapter 3, moreover, rates of variants to classical angina may be even higher for women than for men.

Another possible explanation for this difference by sex is that the HIS questionnaires may have identified a population of women suffering from "atypical angina"—i.e., the syndrome of typical angina symptoms in the absence of evidence of coronary artery disease. As discussed in Chapter 3, no reliable estimates of the prevalence of this condition in a general (national) population are available, but at least among individuals who have been so diagnosed, the prevalence of this condition appears to be generally twice as high in women as in men. The HIS prevalence rates, therefore, are not inconsistent with parts of the recent literature on the prevalence of coronary artery disease, and we judge them to be reasonably in line with rates that would be expected for the mid-1970s.

USE OF MEDICAL CARE AND MEDICATIONS FOR ANGINA

Persons Claiming Chest Pain

MHQ questions on consultations with physicians about chest pain differed between the Dayton and non-Dayton sites (see Table 10). If "currently" under the care of a physician is taken to mean a physician visit within the preceding 3 months, then 138 individuals in all sites (15 percent of the 921 claiming chest pain or discomfort) were under a doctor's supervision. Of the 717 non-Dayton respondents, over 60 percent had not, in effect, had any care at all (or not for more than a year) for their chest pain even though they claimed to have had chest pain symptoms within the year.

Just under 4 percent of the respondents completing the Chest Pain battery had used nitroglycerine or other (under-the-tongue) nitrates during the previous year; the drugs did help relieve the symptoms in the overwhelming number of cases (see Table 11). Only about 1 percent of the respondents (non-Dayton sites only) had used a chewable nitrate, and again the pills were helpful in the majority of cases. Given the

known efficacy of nitroglycerine for at least classical angina, this level of use of those remedies appears low.

Persons Scored Angina-Present

We also examined MHQ data on use of medical care by the 70 HIS enrollees who were judged to have angina primarily on the basis of their responses to the Rose questions and by the 49 enrollees who were scored angina-present on the Rose questions but were not so labeled by the HIS because they were less than 35 years old. (The data were taken from MHQ questions given in Tables 10 and 11, above.)[5]

Of the 70 angina-present enrollees, 24 were in the Dayton sample. In Dayton, the enrollees were asked if they were currently under a physician's care for their chest pain; 11 of the 24 (46 percent) replied affirmatively. In the other sites, the enrollees were asked when they had last consulted a physician about their chest pain; 17 of 46 (37 percent) had done so in the past 6 months; 21 (46 percent) had gone to a doctor within the past year. Of the above 28 individuals who were currently under a physician's care or who had been to a doctor within the past 6 months, 12 (43 percent) had been diagnosed as having angina; only 2 (5 percent) of the 42 persons who had not gone to a doctor recently had been so diagnosed.

Among the 14 individuals having angina according to the Rose questions and a physician diagnosis, 10 (71 percent) had been prescribed medication (nitroglycerine, sorbitrate, or similar drugs) for their symptoms. Of the 56 persons having angina but no physician diagnosis, only 5 (9 percent) claimed that they were being medicated for the condition.

Of the 49 persons under age 35 who were angina-positive according to the Rose questions, only 4 (8 percent) had consulted a doctor for their chest pain within the past 6 months. None had been diagnosed by a physician as having angina, and none were given any medications for the illness. However, of the 24 persons in this group who received an ECG at the HIS screening examination, 3 (13 percent) exhibited changes indicative of ischemia. With the limited information reported at enrollment, we cannot now identify the conditions causing these angina-like symptoms in a group composed almost entirely of young women. It appears, however, that despite their reported symptoms, they did not seek care nearly to the same degree as did those persons who were classified as definitely having angina.

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[5]Women predominated in both groups, being just over 70 percent of the 35-and-older sample with angina and just over 85 percent of the 35-and-younger sample with only questionable disease.

DISEASE IMPACT

As described in Chapter 4, four MHQ questions (on pain, worry or concern, limiting usual activities, and spending days in bed) were included in the Chest Pain battery to measure the type and degree of adverse consequences that angina inflicts on people's lives. The distribution of responses to these four items is given in Table 14. Of those

Table 14

DISTRIBUTION OF RESPONSES TO QUESTIONS ABOUT ANGINA FROM THE MHQ: DISEASE IMPACT

Question	Response[a]	Number	Percent[b]
During the past 3 months, how much pain has your chest pain or heart trouble caused you?	A great deal of pain	34	4
	Some pain	110	12
	A little pain	521	57
	No pain at all	237	26
	Missing	19	2
		921	101
During the past 3 months, how much has your chest pain or heart trouble worried or concerned you?	A great deal	57	6
	Somewhat	104	11
	A little	442	48
	Not at all	298	32
	Missing	20	2
		921	99
During the past 3 months, how much of the time has your chest pain or heart trouble kept you from doing the kinds of things other people your age do?	All of the time	13	1
	Most of the time	19	2
	Some of the time	61	7
	A little of the time	119	13
	None of the time	690	75
	Missing	19	2
		921	100
During the past 30 days, how many days has your chest pain or heart trouble kept you in bed all day or most of the day?	0	870	94
	1	4	(c)
	2	4	(c)
	3	3	(c)
	5-9	6	1
	10-14	4	(c)
	15-19	4	(c)
	20+	4	(c)
	Missing	22	2
		921	97

[a] See Appendix C for the different responses in the two MHQ versions.

[b] Percentages may not sum to 100 because of rounding.

[c] Less than 0.5 percent.

responding, about three-quarters of them acknowledged experiencing pain; two-thirds, worry; one-quarter, activity restrictions; and less than one-tenth, days in bed.

In addition to these four items, a summary measure, "any impact," was constructed. An enrollee was given a positive score for "any impact" if he or she reported the presence of any angina-related pain, worry, activity restrictions, or days in bed. Altogether, of the 921 MHQ respondents who claimed to have had chest pain or discomfort, 735 (80 percent) reported one or more of these effects of chest pain and thus were positive for any impact.

Shown in Fig. 1 are the percentages of persons who reported "none" to "a lot" of pain, worry, activity restrictions, days in bed, or any impact for the 70 enrollees classified by HIS criteria as having angina. Among this group with a fairly definite diagnosis, pain and worry about angina were more prevalent than were activity restrictions or days in bed. Eighty-three percent reported at least a little pain; 76 percent, worry or concern; 46 percent, activity restrictions; and 10 percent, days in bed; 84 percent of the respondents were scored positive for any impact.

The percentages of enrollees reporting each impact are shown in Tables 15 and 16 according to angina status. We considered the following six groups (identified by row numbers on these tables and Table 17): (1) 6 individuals with angina plus a physician diagnosis; (2) 56 persons with angina but no physician diagnosis; (3) 8 individuals with probable angina plus a physician diagnosis; (4) a total of 70 people with angina (the sum of the first three groups, and the same as those shown in Fig. 1); (5) 851 persons who did not have angina according to HIS criteria but who nevertheless completed the Chest Pain battery and thus answered the disease impact questions; and (6) 5643 persons without angina who completed the MHQ, including the 851 individuals in group (5). For this analysis, scores equal to no impact were assigned to each person who completed the MHQ but did not enter the Chest Pain battery (4792 of the 5643 individuals in group (6), as explained earlier).

The median level of impact for each impact category is given in Table 17 according to angina status. These medians refer to enrollees who gave a response other than "none" to the particular question under consideration. Thus, Tables 15 and 16 report the prevalence of ill effects of angina among the various groups of respondents, and Table 17 gives some indication as to the strength of those consequences.[6]

Angina clearly produced a considerable amount of disease impact, as seen in the data presented in Tables 15 through 17. Individuals with angina exhibit more ill effects than those without (see, for instance, row

[6]Readers are referred to Appendix D, Table D.1, for the full frequency distribution of the data summarized in Tables 15 through 17.

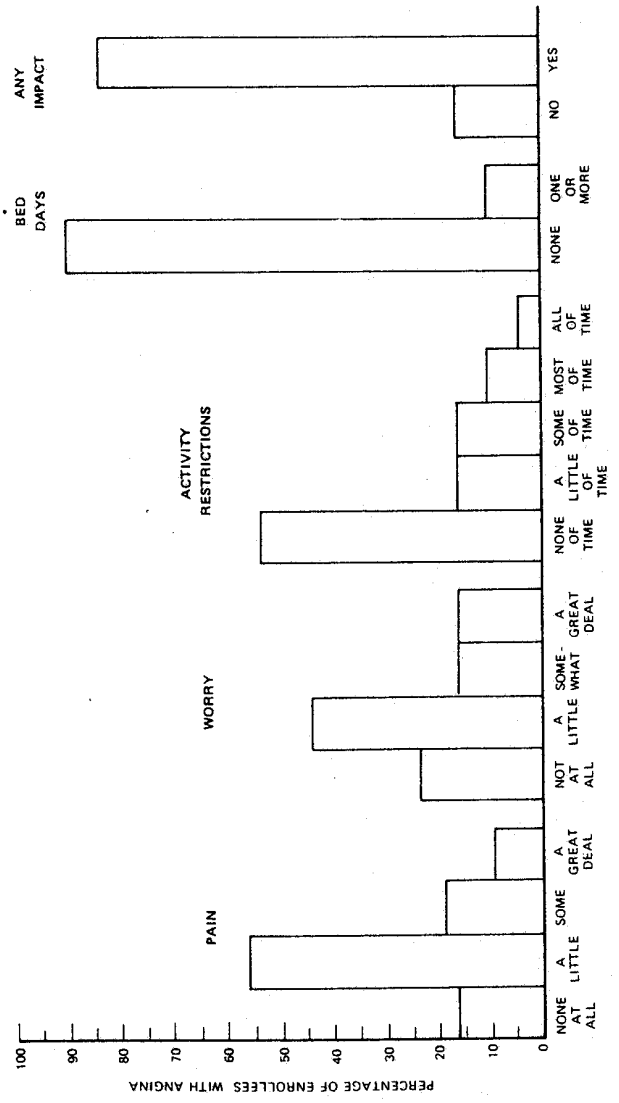


Fig. 1—Percentage distribution of disease impact among enrollees with angina

Table 15

Percentage of Enrollees Reporting Pain and Worry, by Angina Status

Angina Status[a]	Number of Enrollees	Percent Reporting Pain	Percent Reporting Worry
1. Present by Rose questions; physician diagnosis	6	83	83
2. Present by Rose questions; no physician diagnosis	56	80	71
3. Probable by Rose questions; physician diagnosis	8	100	100
4. *Total with angina*	*70*	*83*	*76*
5. Angina not present, but answered impact questions	851	71	65
6. *Total without angina*	*5643*	*11*	*10*

[a]The distribution of responses to the disease impact question is given in Appendix D.

4 versus row 6). Among the categories labeled by the HIS as angina-present, those who had a previous physician diagnosis of angina (rows 1 and 3) typically reported more impact than those who did not (row 2). Altogether, from 80 to 100 percent of the persons with angina had a positive score for any impact, in contrast to the 12 percent of the persons without angina (many of whom, nonetheless, had chest pain).

These apparent differences were tested with the Wilcoxon Two-Sample test.[7] The 70 individuals with angina (row 4) had statistically significantly more pain, worry, and activity restrictions (all $p < 0.01$) than the 851 individuals who answered the disease impact questions but were not labeled as having angina according to the HIS criteria (row 5). They also reported significantly more pain, worry, activity restrictions, and overall impact (all $p < 0.01$) than the 5643 individuals without angina (row 6). The 8 individuals considered to have angina by virtue of a physician diagnosis plus a "probable" Rose score (row 3) had significantly more worry ($p < 0.05$) and activity restrictions ($p < 0.01$)

[7]This procedure compares answers to a question between two groups by ranking responses from lowest to highest among all members of the population and then summing the ranks for each group. It is equivalent to the Mann-Whitney U test (see Fleiss, 1973).

Table 16

Percentage of Enrollees Reporting Activity Restrictions, Days in Bed, and Any Impact, by Angina Status

Angina Status	Number of Enrollees	Percent Reporting Activity Restrictions	Percent Reporting Days in Bed	Percent Reporting Any Impact
1. Present by Rose questions; physician diagnosis	6	83	0	100
2. Present by Rose questions; no physician diagnosis	56	36	7	80
3. Probable by Rose questions; physician diagnosis	8	88	38	100
4. *Total with angina*	*70*	*46*	*10*	*84*
5. Angina not present, but answered impact questions	851	21	3	79
6. *Total without angina*	*5643*	*3*	(b)	*12*

[a]The distribution of responses to the disease impact questions is given in Appendix D.

[b]Less than 0.5 percent.

Table 17

MEDIAN CATEGORIES[a] OF PAIN, WORRY, ACTIVITY RESTRICTIONS, AND DAYS IN BED, BY ANGINA STATUS

Angina Status	Pain	Worry	Activity Restriction	Days in Bed
1. Present by Rose questions; physician diagnosis	Some	Some	Some	(b)
2. Present by Rose questions; no physician diagnosis	A little	A little	Some	5/10[c]
3. Probable by Rose questions; physician diagnosis	A little/some[c]	Some	Some	6
4. *Total with angina*	*A little*	*A little*	*Some*	*6*
5. Angina not present	A little	A little	A little	9

[a]Median categories among enrollees who gave a response other than "none" to the question under consideration. See Appendix D for the full frequency distribution on which these medians are based.

[b]No enrollee responded positively to this question.

[c]Dual median.

than the 56 individuals with angina attributed solely to a "present" score on the Rose questions. (Persons with a "present" score and a physician diagnosis were excluded from this latter comparison.)

Because the prevalence of angina differed by sex, the impact of the disease was also compared between the sexes: 20 men and 50 women. The adverse consequences of angina did not differ between the sexes, according to the Wilcoxon test.[8]

RELIABILITY AND VALIDITY OF HIS ANGINA MEASURES

Reliability of Screening Examination and Questionnaire Measures

Reliability refers to the ability of an instrument to produce the same results when the same object is measured. No estimates of relia-

[8]Appendix D, Table D.2, contains these data. They correspond to the data for the 70 people with angina shown in row 4 of Tables 15 and 16 or in Table D.1.

bility were made of the at-rest electrocardiographic readings provided by the board-certified cardiologist for the enrollment screening examination, but reliability will be tested for the exit screening examination tests (see Appendix B). As documented in Chapter 2, the Rose Questionnaire has been shown by others to be a reliable method for eliciting data; it will allow researchers to classify men over age 35 correctly as to the presence or absence of classical or typical angina. Thus, we carried out no tests of reliability (such as test-retest or alternate-forms studies) on the Rose questions included in the MHQ Chest Pain battery.

Validity of the Rose Questions

Validity refers to the extent to which a measure assesses what it purports to assess. In the HIS context, the question would be, How accurately do the MHQ Rose questions classify people as to the presence or absence of angina judged on the basis of some external criterion? As noted in Chapter 4, the HIS had no fully satisfactory external basis by which to judge the Rose questions, because we did not use a physician to take a medical history, conduct a physical examination, or monitor an electrocardiographic (ECG) stress test. However, as discussed in Chapter 2, some association does exist between the likely presence of angina and changes on at-rest electrocardiograms consistent with ischemia. Thus, we could explore the validity of the Rose questions at least provisionally.

To do this, we compared angina scores and ECG results for the 1291 HIS participants over age 35 who had been randomly assigned to the medical screening examination and who thus received a routine ECG. Thirty-four such participants were considered to have angina according to the Rose questions; of these, 10 persons (29 percent) had ischemic ECG changes (Table 18). Of the 1257 persons without angina, 1045 (83 percent) had no ECG changes indicating ischemia.

These results are similar to those reported in the Rose (1965) studies (also shown in Table 18), despite the fact that Rose examined only men, whereas the HIS population included women. The similarity of these results lends support to the decision to use the Rose questions as the main (but not necessarily the only) approach for labeling a person as having angina and to extend the application of the questions to women.

A question arose as to how valid the Rose questions had been in the HIS context for correctly classifying people who might have had forms of angina other than the purely classic version. The question was prompted in part by the findings reported above on disease impact, because they seemed to indicate that the 8 persons labeled as only

Table 18

DISTRIBUTION OF PERSONS WITH AND WITHOUT ANGINA ACCORDING TO ROSE QUESTIONS AND ELECTROCARDIOGRAPHIC EVIDENCE OF ISCHEMIA

Angina Status According to Rose Questions	Number in Sample	ECG Evidence of Ischemia[a]			
		Positive		Negative	
		Number	Percent	Number	Percent
HIS[b]					
Positive	34	10	29	24	71
Negative	1257	212	17	1045	83
Rose studies (1965)					
Positive	72	25	35	47	65
Negative	1776	249	14	1527	86

[a]According to the Minnesota Code of 1.1-3, or 4.1-4, or 5.1-3, or 7.1 (Blackburn et al., 1960).

[b]Based on the 1291 persons in the HIS who were 35 years of age or older and who were randomly selected to receive a screening examination.

"probable" by the Rose questions, who also claimed to have had a physician diagnosis of angina in the past, expressed a fair amount of impact from the disease (and generally more impact than did persons labeled "present" by the Rose questions who had not had such a diagnosis). Furthermore, another 17 persons had claimed a past physician diagnosis of angina and yet had been scored on the Rose question as not having angina at all.

We conducted several minianalyses of data on these 25 individuals to determine what interpretation might be given to the physician-diagnosis information. First, of these 25 people, 14 had received the screening examination and thus had ECG data available. Of these 14 people, 7 showed evidence of ischemia, including 2 who showed ECG evidence of a prior myocardial infarction. All 7 persons whose ECGs were within normal limits were judged not to have angina by the Rose questions. Thus, half of this group showed definite ECG evidence of ischemic heart disease. For the other half, the basis for the diagnosis of angina was not clarified by our ECG. However, as discussed in Chapter 2, angina is often present without abnormal findings on a resting ECG (and, indeed, can be present without any cardiographic abnormalities), so the absence of ischemic changes on an ECG does not invalidate the claim of a previous physician diagnosis of angina.

To explore further why the Rose questions had not labeled these 25 persons as "angina-present," we reviewed their response patterns on items in the Chest Pain battery. As mentioned above, 8 of the 25 scored "angina-probable" on the Rose questions, and 17 scored "not present." The single major reason that the "probable" cases did not score "present" was that the time needed for the pain to resolve after cessation of activity was greater than 10 minutes; in other words, their pain lasted too long to be considered classical angina. Three of these 8 persons had been screened; all 3 showed ECG evidence of ischemia, demonstrating a strong likelihood that they had coronary heart disease. In addition, 5 of these 8 persons reported that they had taken nitroglycerine in the previous 12 months. This finding indicated that their doctors had not only told them that they had angina but had also prescribed medication for it, evidence again of a high probability of heart disease.

All of these lines of evidence support the HIS policy of labeling a person as having angina if he or she had a prior physician diagnosis and had scored at least "probable" on the Rose questions. The other 17 people will be followed closely during the HIS; additional evidence of angina, such as the diagnosis of angina on insurance claim forms, will be needed before they are labeled as having angina. We judge, therefore, that the Rose questions are a satisfactorily valid way to classify persons who exhibit classic signs and symptoms of angina, but that additional information may be needed to make a valid judgment about persons who seem to have variant forms of angina.

PREVALENCE OF ANGINA ACCORDING TO HIS INSURANCE PLANS

The distribution of persons with angina according to the HIS experimental insurance plans is given in Table 19. The 16 plans (described in the Preface) have been aggregated into four fee-for-service plans (in all six sites), depending on level of coinsurance or maximum dollar expenditure, and into two prepaid group practice plans (Group Health Cooperative of Puget Sound, hereafter GHC, which is located only in the Seattle site). Only the persons assigned to one of these plans are included in the analyses (column 1).[9] The number and percentage

[9]Of the 5713 persons who completed the MHQ form containing the Chest Pain battery, 741 eventually were not assigned to an HIS experimental plan; they were left over from a large pool of possible HIS participants from which the unbiased assignments were made. For more information on the process of assigning families to plans, see Morris (1979).

Table 19

PREVALENCE OF ANGINA, BY HIS EXPERIMENTAL INSURANCE PLAN

HIS Experimental Insurance Plan[a]	(1) Number of Persons Classifiable	(2) Number of Persons with Angina[a]	(3) Percent with Angina
Fee-for-service			
Free care	1179	11	0.9
25- or 50-percent coinsurance	954	15	1.6
95-percent coinsurance	701	8	1.1
Individual/family deductible	822	9	1.1
Prepaid group practice[b]			
Experimental	783	6	0.8
Control	533	6	1.1
Total	4972	55	1.1

[a]For definitions, see the Preface (insurance plan) and Chapter 4 (angina status).

[b]Seattle only. For a comparison of the prepaid group practice and Seattle fee-for-service plans, see text.

with angina include only those persons with definite angina according to the criteria given in Chapter 4.

Differences in the prevalence of angina among the four types of fee-for-service plans (aggregated across sites) were not statistically significant. Thus, the prevalence of angina across plans reflects an unbiased assignment of people among these insurance plans at the time of enrollment in the HIS, before data from the MHQ or screening examination were collected. The prevalence of angina in the fee-for-service plans (taken together) in Seattle alone was 0.5 percent (4 of 867 persons); this figure was not significantly different from the rate for the *experimental* GHC plan. The control GHC plan is not strictly comparable to any other HIS plan, even in Seattle, because it comprises people who were enrolled in the prepaid group practice before the HIS began in that site. In this case, however, the difference in prevalence between the experimental and control GHC plans was also not significant.

These findings support the contention that HIS insurance plans were not biased at enrollment with respect to the presence of angina. Thus, the HIS should be able to determine whether the course of the disease—among those who definitely have angina—differs as a function of differences in the amount or type of care associated with the various levels of insurance coverage.

POTENTIAL EFFECTS OF HEALTH INSURANCE ON ANGINA

Generous health insurance that pays for all or nearly all care (i.e., the "free care" plan in the HIS) could influence the identification and treatment of persons with angina pectoris at several points. Angina symptoms are first noticed by the person, who must then decide whether to consult a physician; having generous health insurance will presumably increase the likelihood of this initial physician consultation, compared with having parsimonious insurance (the "non-free-care" plans).

The next step in the treatment process is a determination by the physician as to whether to take steps to make a definitive diagnosis of angina. This may involve the use of laboratory procedures, such as a resting or stress ECG or coronary arteriography, or of a therapeutic trial of nitroglycerin. All of these activities involve expense and time, and the decision as to which diagnostic regimens, if any, to use may be influenced by the generosity of the patient's insurance coverage.

The "angina symptom complex" can arise as a result of atherosclerotic heart disease or with no apparent cause (i.e., in the absence of demonstrable coronary artery disease, although arterial spasms may be involved). The former condition can be life-threatening (especially the "unstable angina" version), but the latter is not believed to be lethal. Thus, differentiation between the two symptom complexes is an important element of care. Having more generous health insurance, which provides a greater incentive for close followup and other procedures used to make such a differentiation, may promote these diagnostic processes.

Essentially free medical care may have its negative effects, however. As we have seen, a fairly large number of HIS enrollees claim some angina-like chest pain that has yet to be identified or diagnosed as true angina. Generous insurance may prompt such people to visit their physicians more often or undergo diagnostic procedures more extensively than is warranted. Such care-seeking may be associated with overdiagnosis of coronary artery disease, overprescription of heart medications, undue limitations of usual activities, and other unjustified sick-role behaviors (cardiac neurosis) on the part of patients. A higher rate of iatrogenic problems (arising, for instance, from overuse of invasive cardiac diagnostic procedures) may also be associated with more generous insurance. Needless worry may be prompted by overdiagnosis of the chest pain problem.

Finally, the physician's recommendation as to specific treatments for angina and the physician-plus-patient choice among alternative therapies (such as medical therapy with propranolol and nitroglycerine

versus coronary artery bypass graft (CABG) surgery) may well be influenced by the patient's health insurance. More generous insurance may result in better advice about, and support for, reducing coronary artery disease risk factors, such as controlling one's weight, stopping smoking, and maintaining healthful levels of exercise. The liberality of the health insurance could also affect followup care, such as frequency of physician visits.

Chapter 6

QUALITY-OF-CARE CRITERIA FOR ANGINA

Criteria sets specifically directed toward angina pectoris are surprisingly rare. A number of criteria exist, however, for good quality of care for patients with arteriosclerotic (ischemic) cardiovascular disease. Criteria sets developed for use in outpatient settings pay attention to detection and control of risk factors for the disease and to drugs that might have been prescribed.

Building on ideas suggested by these criteria sets, we have developed criteria specifically for the HIS quality-of-care analyses. They rely on information drawn from several sources. The problem-oriented insurance claim forms filed during the HIS provide information on physician's diagnoses, laboratory tests, procedures, and medications dispensed or prescribed. Pharmacy claim forms provide information on prescriptions filled. Data from the Medical History Questionnaire emphasize management and current functional status. Finally, information on physical findings and laboratory test results is available from the exit screening examination. The HIS does not collect data directly on laboratory test results, nor does it examine medical records.

The criteria listed in Appendix E will be used to test hypotheses regarding the relationship between insurance level on the one hand and quality of care and health status on the other. They apply only to individuals who can be classified with a high degree of confidence as having angina and are expressed in a form that assumes the level of quality of care has been high. Favorable outcomes include low rates of anginal attacks, little disability from the condition, and good control of risk factors such as smoking, weight, and hypertension. Good processes include appropriate medications in adequate doses, pertinent and timely diagnostic tests, and advice about risk factors.

Appendix A

THE ROSE QUESTIONNAIRE

LONDON SCHOOL OF HYGIENE CHEST PAIN QUESTIONNAIRE[1]

(Version for self-administration)

PART A

(a) **Have you ever had any pain or discomfort in your chest?**
1. ☐ Yes 2. ☐ No (Go to C)

(b) **Do you get this pain or discomfort when you walk uphill or hurry?**
1. ☐ Yes 2. ☐ No (Go to B)

(c) **Do you get it when you walk at an ordinary pace on the level?**
1. ☐ Yes 2. ☐ No

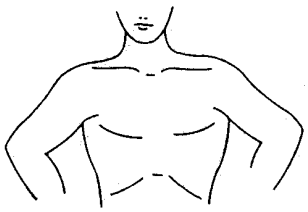
(d) **When you get any pain or discomfort in your chest what do you do?**
1. ☐ Stop
2. ☐ Slow down
3. ☐ Continue at the same pace

(e) **Does it go away when you stand still?**
1. ☐ Yes 2. ☐ No

(f) **How soon?**
1. ☐ 10 minutes or less
2. ☐ More than 10 minutes

(g) **Where do you get this pain or discomfort?**

Mark the place(s) with X on the diagram.



PART B

Have you ever had a severe pain across the front of your chest lasting for half an hour or more?
1. ☐ Yes 2. ☐ No

PART C

(a) **Do you get a pain in either leg on walking?**
1. ☐ Yes 2. ☐ No (Go to next question)

(b) **Does this pain ever begin when you are standing still or sitting?**
1. ☐ Yes 2. ☐ No

(c) **Do you get this pain in your calf (or calves)?**
1. ☐ Yes 2. ☐ No

(d) **Do you get it when you walk uphill or hurry?**
1. ☐ Yes 2. ☐ No

(e) **Do you get it when you walk at an ordinary pace on the level?**
1. ☐ Yes 2. ☐ No

(f) **Does the pain ever disappear while you are still walking?**
1. ☐ Yes 2. ☐ No

(g) **What do you do if you get it when you are walking?**
1. ☐ Stop
2. ☐ Slow down
3. ☐ Continue at same pace

(h) **What happens to it if you stand still?**
1. ☐ Usually continues more than 10 minutes
2. ☐ Usually disappears in 10 minutes or less

DEFINITIONS OF POSITIVE CLASSIFICATIONS

A. *Angina* 'Yes' to a and b, 'stop' or 'slow down' to d, 'yes' to e, '10 minutes or less' to f. Site must include *either* sternum (any level) *or* L. anterior chest and left arm. GRADE 1 = 'no' to c, GRADE 2 = 'yes' to c.

B. *Possible infarction* 'Yes' in this section.

C. *Intermittent claudication* 'Yes' to a, 'no' to b, 'yes' to c and d, 'no' to f, 'stop' or 'slow down' to g, and 'usually disappears in 10 minutes or less' to h. GRADE 1 = 'no' to e, GRADE 2 = 'yes' to e.

[1] G. Rose, P. McCartney, and D. D. Reid, "Self-administration of a Questionnaire on Chest Pain Intermittent Claudication," *British Journal of Preventive and Social Medicine* (H. Campbell, ed.), 1977, 31, p. 48. Reprinted by permission.

Appendix B

ELECTROCARDIOGRAPHIC MANIFESTATIONS OF CORONARY ARTERY DISEASE

In addition to identifying enrollees whose heart disease is manifested by symptoms of angina pectoris or congestive heart failure (see Vol. 5 of this series), the Rand Health Insurance Study (HIS) will also identify participants with selected electrocardiographic (ECG) abnormalities that portend a risk for serious, life-threatening, cardiovascular incidents and/or age-specific death rates higher than those for the general population. A number of ECG abnormalities have been associated with increased risk of cardiac morbidity and mortality, even in the absence of symptomatic heart disease or high blood pressure.

The medical care system might be able to lower the incidence of certain seriously disabling or even fatal cardiac events by altering the natural history of associated ECG abnormalities or by preventing the occurrence of such abnormalities in the first place. Such interventions include prescribing various drugs and counseling about life-style changes. Because the quantity and quality of these interventions may vary according to the generosity of a person's health insurance plan, the HIS is using the presence of selected ECG abnormalities as a measure of the effect of insurance plan on health status and quality of care.

INCIDENCE AND PREVALENCE

Higgins and Cochrane (1963), in reviewing the results of several epidemiological studies of coronary disease, found an increased risk of death from cardiovascular causes (as noted on death certificates) among men whose previous ECGs had shown any of the following: abnormal Q waves, ST depression, T-wave inversion, and T-wave flattening. An association between increased risk of cardiovascular death and abnormal Q waves was expected, because the latter often develop and persist after a myocardial infarction (heart attack). The other ECG changes, however, are considered nonspecific for heart disease (more particularly, for coronary artery disease). They are not often associated with any clinical findings of heart disease, and thus the relationship with higher risk of mortality was unexpected.

The Framingham Study, which tracked the appearance of symptomatic cardiovascular disease (including angina pectoris, myocardial infarction, coronary insufficiency, and sudden death), reached similar conclusions. For example, findings from an ECG taken at rest (such as left ventricular hypertrophy, nonspecific ST and T-wave abnormalities or intraventricular conduction defects in persons with one or more atherogenic traits) identified persons likely to have preclinical ischemic cardiomyopathy (heart muscle disease from insufficient oxygen delivery) (Kannel, 1976). Risk of cardiovascular disease in men and women aged 45 to 74, measured by age-adjusted average annual incidence of cardiovascular disease per 10,000 people, was significantly higher for people with ECG findings of left ventricular hypertrophy than for people without those specific findings; this was expected because left ventricular hypertrophy is common among hypertensive individuals and is a long-appreciated sign of increased risk of cardiovascular disease and premature mortality (Kannel et al., 1969).

The higher risk of cardiovascular disease was also seen for people with ECG findings of intraventricular conduction disturbances or nonspecific ST-segment and T-wave abnormalities. Among men, the annual incidence of cardiovascular disease was 315 per 10,000 males for those with intraventricular conduction disturbances and 192 for those without; likewise, for women, the incidence was 307 per 10,000 females for those with these disturbances and 99 for those without. For nonspecific ST and T-wave abnormalities, the respective annual incidence figures were 360 for men with these abnormalities and 185 for men without; 175 for women with abnormalities and 97 for women without.

A third study (Kitchin and Milne, 1977) confirmed the above findings, although it is less pertinent to this discussion because the population was much older than the HIS population. A survey and 5-year followup of 487 persons aged 62 to 90 was conducted. Even after age-adjustment, ischemic changes in the initial electrocardiogram (as defined by Rose and Blackburn) strongly predicted subsequent death. The ischemic heart disease death rate was four times higher, and the overall death rate 50 percent higher, if the initial ECG showed ischemic changes than if it did not. ST and T-wave abnormalities and atrial fibrillation indicated a particularly poor prognosis.

Disturbances of cardiac rhythm (arrhythmias or dysrhythmias) can also predict cardiovascular disease and death. The Tecumseh Epidemiologic Study (Chiang et al., 1969) demonstrated that, for both men and women aged 30 and older, ventricular premature systoles (beats) were positively correlated with increased prevalence of coronary heart disease and increased incidence of sudden death. This increased risk was independent of a number of known coronary risk factors—blood pressure, serum cholesterol, relative weight, glucose tolerance, and smok-

ing habits. Supraventricular premature systoles, however, were not associated with manifest heart disease or sudden death.

A survey in a random sample of 301 actively employed American men (median age 55 years) who had asymptomatic rhythm and conduction disturbances revealed that ventricular premature systoles and more complex ventricular dysrhythmias were significantly associated with the presence of coronary heart disease at the time of the examination (Hinkle et al., 1969). They were also associated with an enhanced risk of subsequent death (over a 6-year followup period) from coronary heart disease. Defects in intraventricular cardiac conduction were associated with an enhanced risk of subsequent death from coronary heart disease. Supraventricular premature systoles and even more complex supraventricular rhythms, as well as supraventricular conduction defects, however, were not associated with increased risk of premature death.

A study of 67,375 asymptomatic healthy adult men in the U.S. Air Force demonstrated that increasing age was significantly correlated with the prevalence of nonspecific T-wave changes, ventricular ectopic beats, right bundle branch block, and possible myocardial infarction. Abnormalities of simple atrial rhythm decreased significantly with age (Averill and Lamb, 1960).

HEALTH INSURANCE STUDY METHODS

Based on this literature, the HIS selected the following ECG abnormalities to study because, in all likelihood, they reflect at least some increased probability of premature death or of serious, incapacitating cardiovascular events:

1. Intraventricular conduction abnormalities (including bundle branch blocks).
2. ST-segment and T-wave changes (including nonspecific ST-segment and T-wave abnormalities).
3. Abnormality consistent with ventricular enlargement (including left ventricular hypertrophy).
4. Q-wave abnormalities consistent with myocardial infarction.
5. Atrial fibrillation.
6. Ventricular dysrhythmias (including ventricular premature systoles).
7. Artificial pacemaker rhythm.

These seven ECG abnormalities are defined according to the Minnesota code developed by Blackburn et al. (1960).

At enrollment, a randomly selected sample of all participants received a medical screening examination. At exit, all participants receive the screening examination. During both examinations, all males 30 years of age and older and all females 35 years of age and older received ECGs. These ECGs were taken at rest and consisted of a full 12 channels (see Smith et al., 1978, for details of the ECG procedures). In addition, persons 14 years of age and older who answered "yes" to any of the following questions asked at the screening examination received ECGs:

> "Have you ever taken any of these heart medicines: digitalis, digitalis leaf, digitoxin, or digoxin?"
>
> "During the past 12 months, have you ever felt short of breath or has the doctor ever told you that you had heart failure?"
>
> "Have you had pain, discomfort, heaviness, or pressure in your chest in the past 12 months, not related to an injury or a 'chest cold'?"
>
> "Has a doctor ever said you have high blood cholesterol?"
>
> "Have you ever been told by a doctor that you had high blood pressure?"
>
> "Are you now taking pills or medicine for high blood pressure?"

The exit screening examinations included an additional four questions, asked of persons 14 years of age and older; any individuals who answered "yes" to at least one question also received an ECG:

> "Do you think that you have heart disease or heart trouble?"
>
> "Have you ever had a heart attack?"
>
> "Have you ever been told that you had an irregular heartbeat?"
>
> "Have you ever had thyroid trouble or a goiter?"

Persons 14 years of age and older whose blood pressure reading during the screening examination was $\geq$ 90 mm Hg diastolic or $\geq$ 140 mm Hg systolic also received an ECG, if they had not already qualified for one according to any of the above criteria.

ECGs were interpreted by a board-certified cardiologist. The reliability of these interpretations was not measured for the ECGs done at enrollment. After the exit screening examinations are completed, however, a sample of ECGs from both the enrollment and exit examinations will be reevaluated by at least two board-certified cardiologists to assess reliability.

HEALTH INSURANCE STUDY ENROLLMENT RESULTS

Of the 1968 persons who received an ECG at the enrollment screening examination, 282 (14 percent) had one or more of the ECG abnormalities selected by the HIS for special attention, for a total of 307 abnormalities (16 percent of the 1968 ECGs) (see Table B.1). Twenty-five persons had two abnormalities each. Not all adults between the ages of 14 and 34 received an ECG (see "Methods," above), but those who did were selected on the basis of factors that could predispose them to have detectable abnormalities. Thus, the prevalence of ECG abnormalities will be overestimated in that age group and perhaps slightly overestimated for all ages together.

Table B.1

DISTRIBUTION OF ELECTROCARDIOGRAM ABNORMALITIES

Electrocardiogram Abnormality	Frequency	Percent of All ECGs (N = 1968)
Intraventricular conduction abnormalities	22	1
ST-segment and T-wave changes	228	12
Abnormality consistent with ventricular enlargement	9	(b)
Q-wave abnormalities consistent with myocardial infarction	41	2
Atrial fibrillation	1	(b)
Ventricular dysrhythmias	6	(b)
Artificial pacemaker rhythm	0	0
Total	307[a]	16

[a]The 307 abnormalities were detected in 282 persons.

[b]Less than 0.5 percent.

Almost three-quarters of the changes were nonspecific ST-segment and T-wave abnormalities. The next highest frequency was observed for changes consistent with myocardial infarction.

Table B.2 gives the number of men and women in several age groups who had ECG abnormalities. Altogether, of the 1013 men who

Table B.2

PREVALENCE OF ELECTROCARDIOGRAM ABNORMALITIES, BY AGE AND SEX

Age Group (years)	Men		Women		Both Sexes	
	Rate	Cases Per Sample	Rate	Cases Per Sample	Rate	Cases Per Sample
14-34[a]	5	22/408	7	17/260	6	39/668
35-44	7	23/308	13	39/303	10	62/611
45-54	17	31/187	30	76/250	24	107/437
55-61[b]	26	29/110	32	45/142	29	74/252
14-61[b]	10	105/1013	19	177/955	14	282/1968

[a]Only selected persons in this age group received an ECG (see text).

[b]One man included in this age group (from the Dayton control group) was older than 61.

received ECGs, 908 (90 percent) had none of the selected abnormalities, 95 (9 percent) had one, and 10 (1 percent) had two. Of the 955 women who received ECGs, 778 (81 percent) had none, 162 (17 percent) had one, and 15 (2 percent) had two. This preponderance of ECG abnormalitites among women is similar to the differences in the HIS prevalence of angina by sex (reported in Chapter 5).

The prevalence of ECG abnormalities increased with age for both men and women. This finding was expected, given the known higher prevalence of cardiovascular disease at higher ages (Lelah and Brook, 1976). Almost one-third of both men and women aged 55 to 61 had at least one of the selected abnormalities.

The presence of ECG abnormalities was compared across the HIS experimental insurance plans (Table B.3). Only the 1730 individuals who received an ECG at the screening examination *and* were assigned to one of these plans are included in this analysis. Differences in prevalence among all insurance plans, among the four fee-for-service plans, and between the Group Health Cooperative (GHC) experimental and control plans were all statistically insignificant. Similarly, the difference in prevalence between the GHC experimental plan (9 percent) and the fee-for-service plans in Seattle (26 of 258 persons, or 10 percent) was also insignificant. This supports the claim that HIS insurance plans were not biased at enrollment with respect to the presence of these selected ECG changes. Thus, the HIS should be able to determine if the course and treatment of such abnormalities differ with the various levels of insurance coverage.

Table B.3

Prevalence of Electrocardiogram Abnormalities, by HIS Experimental Insurance Plan

HIS Experimental Insurance Plan[a]	Number of Persons Classifiable[b]	Number of Persons with Abnormalities[a]	Percent with Abnormalities
Free-for-service			
Free care	472	79	17
25- or 50-percent coinsurance	351	47	13
95-percent coinsurance	257	33	13
Individual/family deductible	301	48	16
Prepaid group practice[c]			
Experimental	217	20	9
Control	132	13	10
Total	1730	240	14

[a] For definitions, see the Preface (insurance plan) and the section on "HIS Methods," above.

[b] Includes only those who received an electrocardiogram at enrollment.

[c] Seattle only.

Appendix C

CHEST PAIN BATTERY FROM THE MEDICAL HISTORY QUESTIONNAIRE

ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE[1]

CHEST PAIN, DISCOMFORT, HEAVINESS OR PRESSURE

DO NOT WRITE IN THIS SPACE

99. **HAVE YOU HAD CHEST PAIN IN THE PAST 12 MONTHS?**
(Do not include pain due to a cold or to an accident or injury.)

Yes ..... 1 —*Go to 100* 45/
No ..... 2 —*Answer 99-A*

99-A. **HAVE YOU HAD ANY DISCOMFORT, HEAVINESS OR PRESSURE IN YOUR CHEST DURING THE PAST 12 MONTHS? (Not caused by a cold or by an accident or injury.)**

Yes ..... 1 —*Answer 100* 46/
No ..... 2 —*Go to 111, page 31*

---

100. **HOW OFTEN DO YOU GET THIS FEELING IN YOUR CHEST?**
(Circle one)

Almost every day 1 47/
A few times a week 2
About once a week 3
A few times a month 4
About once a month 5
Less than once a month 6

---

101. **DO YOU GET THIS FEELING IN YOUR CHEST WHEN YOU WALK UPHILL OR HURRY?**

Yes ..... 1 —*Answer 101-A-B-C-D-E* 48/
No ..... 2 —*Go to 102, next page*

101-A. **DO YOU GET THIS FEELING IN YOUR CHEST WHEN YOU WALK AT AN ORDINARY PACE ON LEVEL GROUND?**

Yes 1 49/
No 2

[1]Used at all HIS sites except Dayton at enrollment and in all sites upon exit. Revisions incorporated in this version were based on experience with the initial Dayton battery.

101-B. WHAT DO YOU USUALLY DO WHEN YOU GET THIS FEELING IN YOUR CHEST WHILE WALKING?

(Circle one)

Stop for a while	1	50/
Slow down	2	
Continue at same pace	3	

101-C. IF YOU STAND STILL, WHAT HAPPENS TO THIS FEELING IN YOUR CHEST?

(Circle one)

It goes away in less than 10 minutes	1	51/
It goes away in 10 to 30 minutes	2	
It lasts more than 30 minutes	3	
I don't stand still	4	

101-D. WHEN YOU GET THIS FEELING IN YOUR CHEST WHILE WALKING, DO YOU USUALLY PLACE A NITROGLYCERINE (nl-tro-GLISS-er-in), CARDILATE OR ISORDIL PILL UNDER YOUR TONGUE?

(Circle one)

Yes, and pain gone within 10 minutes	1	52/
Yes, and some relief of pain within 10 minutes	2	
Yes, but no relief of pain within 10 minutes	3	
No, do not place any pill under tongue	4	

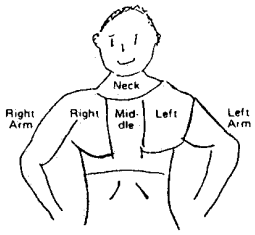
101-E. WHEN YOU GET THIS FEELING IN YOUR CHEST WHILE WALKING, DO YOU USUALLY TAKE A SORBITRATE PILL (OR A SIMILAR PILL) THAT YOU CHEW?

(Circle one)

Yes, and pain gone within 10 minutes	1	53/
Yes, and some relief of pain within 10 minutes	2	
Yes, but no relief of pain within 10 minutes	3	
No, do not chew any pill	4	

---

102. WHERE DO YOU USUALLY GET THIS PAIN?



PLEASE CIRCLE THE NUMBER THAT BEST DESCRIBES WHERE YOU USUALLY GET THIS PAIN:

(Circle one)

Left side of chest	1	54/
Right side of chest	2	
Middle of chest	3	
Neck	4	
Left arm	5	
Right arm	6	

103. WHEN WAS THE LAST TIME YOU SAW A DOCTOR FOR THIS CHEST PAIN?

(Circle one)

Within past 3 months	1	55/
3 - 6 months ago	2	
7 - 12 months ago	3	
More than 1 year ago	4	

---

104. HAS A DOCTOR EVER SAID THAT YOU HAD A HEART ATTACK?

Yes	1	56/
No	2	

---

105. HAS A DOCTOR EVER SAID THAT YOU HAVE ANGINA? (An-JI-na or AN-ji-na)

Yes	1	57/
No	2	

106-A. DURING THE PAST 12 MONTHS, DID YOU EVER PLACE A NITROGLYCERINE (ni-tro-GLISS-er-in), CARDILATE, OR ISORDIL PILL UNDER YOUR TONGUE FOR YOUR CHEST PAIN?

(Circle one)

Yes, and it helped	1	58/
Yes, but it did not help	2	
No, did not place any pill under tongue	3	

106-B. DURING THE PAST 12 MONTHS, DID YOU EVER TAKE A SORBITRATE PILL (OR A SIMILAR PILL) THAT YOU CHEW FOR YOUR CHEST PAIN?

(Circle one)

Yes, and it helped	1	59/
Yes, but it did not help	2	
No, did not chew any pill	3	

---

107. DURING THE PAST 3 MONTHS, HOW MUCH PAIN HAS YOUR CHEST PAIN OR HEART TROUBLE CAUSED YOU?

(Circle one)

A great deal of pain	1	60/
Some pain	2	
A little pain	3	
No pain at all	4	

108. DURING THE PAST 3 MONTHS, HOW MUCH HAS YOUR CHEST PAIN OR HEART TROUBLE WORRIED OR CONCERNED YOU?

(Circle one)

A great deal	1	61/
Somewhat	2	
A little	3	
Not at all	4	

109. **DURING THE PAST 3 MONTHS, HOW MUCH OF THE TIME HAS YOUR CHEST PAIN OR HEART TROUBLE KEPT YOU FROM DOING THE KINDS OF THINGS OTHER PEOPLE YOUR AGE DO?**

(Circle one)

All of the time	1	62/
Most of the time	2	
Some of the time	3	
A little of the time	4	
None of the time	5	

110. **DURING THE PAST 30 DAYS, HOW MANY DAYS HAS YOUR CHEST PAIN OR HEART TROUBLE KEPT YOU IN BED ALL DAY OR MOST OF THE DAY? (If none, write in "0.")**

_____ days in bed last month 63-64/

ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE, DAYTON

CHEST PAIN, DISCOMFORT, HEAVINESS, OR PRESSURE

81. HAVE YOU HAD PAIN, DISCOMFORT, HEAVINESS OR PRESSURE IN YOUR CHEST IN THE PAST 12 MONTHS? 3758

NO ..... 2 —— *(GO to q. 96, page 18)*

YES ..... 1 —— *(GO to q. 82)*

82. Do you get this feeling in your chest when you walk uphill or hurry? 3759

(Circle one.)

No ..... 2 —— *(GO to q. 87, next page)*

Yes ..... 1 }

Do not walk uphill or hurry ..... 9 } *(GO to q. 83)*

83. Do you get this feeling in your chest when you walk at an ordinary pace on the level? 3760

(Circle one.)

Yes 1

No 2

Do not walk on level 9

84. What do you usually do when you get this feeling in your chest while walking? 3761

(Circle one.)

Stop 1

Slow down 2

Continue at same pace .. 3

85. If you stand still, what happens to this feeling in your chest? 3762

(Circle one.)

Goes away in less than 10 minutes 1

Goes away in 10 to 30 minutes 2

Lasts over 30 minutes 3

Don't stand still 9

Don't know 8

86. If you get this feeling in your chest while walking, do you usually place a nitroglycerine pill (small white pill) under your tongue? 3763
("Nitroglycerine" pronounced "Ny-tro-GLISS-er-in")

(Circle one.)

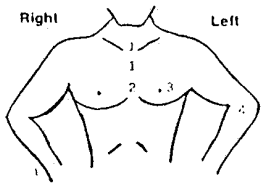
Take pill - no relief of pain in 10 minutes 1

Take pill - some relief of pain in 10 minutes 2

Take pill - relief of pain within 10 minutes 3

Do not take pill 4

87. Where do you get this pain?



(Circle one for each.)

Upper or middle chest (1 on picture)	Yes ..... 1 No 2	3764
Lower chest (2 on picture)	Yes ..... 1 No 2	3765
Left chest (3 on picture)	Yes ..... 1 No 2	3766
Left arm (4 on picture)	Yes ..... 1 No 2	3767
Somewhere else	Yes ..... 1 No 2	3768

88. Are you currently under a doctor's care or supervision for this chest pain? 3769

Yes 1
No 2

89. Has a doctor ever said you had a heart attack? 3770

Yes 1
No 2

90. Has a doctor ever said that you have angina? 3771
("Angina" pronounced "An-JI-na" or "AN-ji-na")

(Circle one.)

Yes 1
No 2
Don't know 8

91. In the last 12 months, did you take a nitroglycerine pill (small white pill) under your tongue for the chest pain? 3772
("Nitroglycerine" pronounced "Ny-tro-GLISS-er-in")

(Circle one.)

Yes, and it helped 1
Yes, but it did not help 2
No, I never took a pill under my tongue 3

92. During the past 3 months, how much pain has your chest pain or heart trouble caused you? 3773

(Circle one.)

A lot 1
Some 2
A little 3
None at all 4

93. During the past 3 months, how much has your chest pain or heart trouble worried or concerned you? 3774

(Circle one.)

A lot 1
Somewhat 2
A little 3
Not at all 4

94. During the past 3 months, how often has your chest pain or heart trouble kept you from doing the kinds of activities other people your age do? 3775

(Circle one.)

All of the time 1
Most of the time 2
Some of the time 3
A little of the time 4
None of the time 5

95. During the past 30 days, how many days has your chest pain or heart trouble kept you in bed all or most of the day? (IF NO DAYS IN BED, WRITE IN "0".) 3776

_____ Days in bed

Appendix D

DISTRIBUTION OF RESPONSES TO DISEASE IMPACT QUESTIONS

The following three tables present the number and percentages of responses to the MHQ disease impact questions in the Chest Pain battery for the same angina status categories as those used in Chapter 5 (Tables 15 through 17). Table D.1a gives the responses for the MHQ items on pain and worry, Table D.1b for the items on activity restriction and days in bed. Both tables present data on the 70 persons classified as having angina and the 5643 persons classified as not having angina. Table D.2 contains the distribution of responses categorized by sex for the 70 individuals with angina.

In all three tables, the total number of enrollees in each category is given in parentheses. The numbers given for each response may not sum to these totals, because missing responses in each category are not shown. (They amounted to less than 1 percent of all responses.) For row 6 of Tables D.1a,b, a response of "none" was imputed to all persons who were not eligible to complete the disease impact items because of negative responses to earlier items (see Chapter 4).

The entries in the "level of impact" columns are given in abbreviated form. The full wording of the questions and responses can be found in Appendix C.

Table D.1a

DISTRIBUTION OF RESPONSES TO DISEASE IMPACT QUESTIONS ON PAIN AND WORRY, BY ANGINA STATUS

Angina Status	Pain			Worry		
	Level of Impact	Number	Percent	Level of Impact	Number	Percent
1. Present by Rose questions; physician diagnosis (n = 6)	None	1	17	None	1	17
	Little	1	17	Little	1	17
	Some	4	67	Some	4	67
	Great	0	0	Great	0	0
2. Present by Rose questions; no physician diagnosis (n = 56)	None	10	18	None	15	27
	Little	34	61	Little	28	50
	Some	7	13	Some	3	5
	Great	4	7	Great	9	16
3. Probable by Rose questions; physician diagnosis (n = 8)	None	0	0	None	0	0
	Little	4	50	Little	2	25
	Some	2	25	Some	4	50
	Great	2	25	Great	2	25
4. *Total with angina (n = 70)*	None	11	16	None	16	23
	Little	39	56	Little	31	44
	Some	13	19	Some	11	16
	Great	6	9	Great	11	16
5. Angina not present, but answered impact questions (n = 851)	None	226	27	None	282	33
	Little	482	57	Little	411	48
	Some	97	11	Some	93	11
	Great	28	3	Great	46	5
6. *Total without angina (n = 5643)*	None	5018	89	None	5074	90
	Little	482	9	Little	411	7
	Some	97	2	Some	93	2
	Great	28	(a)	Great	46	1

[a]Less than 0.5 percent.

Table D.1b

Distribution of Responses to Disease Impact Questions on Activity Restrictions and Days in Bed, by Angina Status

Angina Status	Activity Restriction			Days in Bed		
	Level of Impact	Number	Percent	Number of Days	Number	Percent
1. Present by Rose questions; physician diagnosis (n = 6)	None	1	17	0	6	100
	Little	2	33			
	Some	2	33			
	Most	1	17			
	All	0	0			
2. Present by Rose questions; no physician diagnosis (n = 56)	None	35	63	0	52	93
	Little	8	14	2	1	2
	Some	6	11	5	1	2
	Most	4	7	10	1	2
	All	2	4	28	1	2
3. Probable by Rose questions; physician diagnosis (n = 8)	None	1	13	0	5	63
	Little	1	13	2	1	13
	Some	3	38	6	1	13
	Most	2	25	7	1	13
	All	1	13			
4. *Total with angina (n = 70)*	None	37	53	0	63	90
	Little	11	16	2	2	3
	Some	11	16	5	1	1
	Most	7	10	6	1	1
	All	3	4	7	1	1
				10	1	1
				28	1	1
5. Angina not present, but answered impact questions (n = 851)	None	653	77	0	807	95
	Little	108	13	1	4	(a)
	Some	50	6	2	2	(a)
	Most	12	1	3	3	(a)
	All	10	1	6	1	(a)
				9	2	(a)
				10	2	(a)
				14	1	(a)
				15	2	(a)
				18	2	(a)
				20	2	(a)
				30	1	(a)
6. *Total without angina (n = 5643)*	None	5445	96	0	5599	99
	Little	108	2	1	4	(a)
	Some	50	1	2	2	(a)
	Most	12	(a)	3	3	(a)
	All	10	(a)	6	1	(a)
				9	2	(a)
				10	2	(a)
				14	1	(a)
				15	2	(a)
				18	2	(a)
				20	2	(a)
				30	1	(a)

[a]Less than 0.5 percent.

Table D.2

Distribution of Responses to Disease Impact Questions Among Seventy Enrollees With Angina, by Sex

Sex	Pain			Worry		
	Level of Impact	Number	Percent	Level of Impact	Number	Percent
Men (n = 20)	None	4	20	None	4	20
	Little	8	40	Little	7	35
	Some	6	30	Some	4	20
	Great	2	10	Great	5	25
Women (n = 50)	None	7	14	None	12	24
	Little	31	62	Little	24	48
	Some	7	14	Some	7	14
	Great	4	8	Great	6	12
	Activity Restriction			Days in Bed		
	Level of Impact	Number	Percent	Number of Days	Number	Percent
Men (n = 20)	None	9	45	0	17	85
	Little	2	10	2	1	5
	Some	4	20	6	1	5
	Most	3	15	10	1	5
	All	2	10			
Women (n = 50)	None	28	56	0	46	92
	Little	9	18	2	1	2
	Some	7	14	5	1	2
	Most	4	8	7	1	2
	All	1	2	28	1	2

Appendix E

ANGINA PECTORIS QUALITY-OF-CARE CRITERIA

All criteria listed below, unless otherwise specified, refer only to enrollees who have angina pectoris according to the HIS definition (see Chapter 4), with the following modification: To ensure that quality-of-care criteria will be applied only to those individuals who definitely have angina, the HIS will require that if no physician diagnosis of angina is given either on claim forms or on the Medical History Questionnaire (MHQ), angina must be scored as present on the Rose questions of both the enrollment and exit MHQs before that participant is labeled as "angina-present."

Criteria that appear on several different criteria lists, because of their more general applicability, are designated as "recurrent criterion." Alternate criteria may occasionally be tested to see if the effects of insurance plan differ for slight variations in the threshold value of the criterion and are so designated below. "He" refers to both men and women.

PATIENT OUTCOMES

1. The enrollee reports having an anginal attack "about once a week" or less frequently when asked about frequency of angina pectoris on the exit MHQ. Or, alternatively, the enrollee reports having an anginal attack "a few times a week" or less frequently when asked about frequency of angina pectoris on the exit MHQ.
2. The enrollee reports "no pain at all" or "a little pain" when asked about pain caused by angina pectoris on the exit MHQ.
3. The enrollee reports "not at all" or "a little" when asked about worry and concern related to angina pectoris on the exit MHQ.
4. The enrollee reports "none of the time," "a little of the time," or "some of the time" when asked about activity restrictions caused by angina pectoris on the exit MHQ.
5. The enrollee reports "zero" days in bed attributable to angina pectoris during the past month on the exit MHQ.
6. If the enrollee was a smoker at the time of enrollment, then he has stopped smoking. [recurrent criterion]

7. If the enrollee was 20 percent or more over ideal body weight at the time of enrollment, then he has achieved a weight less than 10 percent over his ideal weight at the time of exit from the HIS. [recurrent criterion]

8. If the enrollee also has hypertension, then at exit screening (a) his systolic blood pressure is $\leq$ 140 mm Hg and his diastolic pressure is $\leq$ 90 mm Hg, or (b), alternatively, his systolic blood pressure is $\leq$ 160 mm Hg and his diastolic pressure is $\leq$ 95 mm Hg at exit screening. [recurrent criterion]

PROCESS—THERAPY

1. If the enrollee reports chest discomfort "a few times a month" or more frequently, then he has been prescribed at least one antianginal medication (beta-adrenergic blocker and/or short-acting nitrate and/or long-acting nitrate).

2. If the enrollee reports chest discomfort at least "about once a week," then he has been prescribed at least two antianginal medications (from two of the above three classes).

3. If the enrollee reports chest discomfort at least "a few times a week" and lacks contraindications to the use of a beta-adrenergic blocker such as propranolol, then the enrollee has been prescribed a beta-blocker. Contraindications to the use of a beta-blocker include asthma, use of insulin, slow heart rate (< 50 per minute), advanced heart block, cardiomegaly, or other evidence of congestive heart failure; all are based on information from claim forms or exit screening.

4. If the enrollee has been prescribed propranolol, does not have a slow heart rate (< 50 per minute) or an advanced heart block on the exit screening examination's ECG, and reports "a great deal of pain" or "some pain" on the exit MHQ, then the patient has been prescribed a minimum of 160 mg of propranolol daily.

5. If the enrollee reports using nitroglycerine at time of exit from the HIS, then he has filled a prescription for nitroglycerine within the previous year, as judged from pharmacy claim forms.

6. If the physician has prescribed a beta-adrenergic blocker, a long-acting nitrate, a digitalis preparation, or a diuretic, and the enrollee has filled the prescription at least twice, then refills have been made sufficiently often to allow continuous use of the medication, given the dosage prescribed.

7. If at least two claim forms for an enrollee contain angina pectoris as the primary diagnosis, then on at least one claim form the enrollee has written "angina," "heart attack," "heart trouble," or similar as a reason for visit.

8. If the enrollee's angina pectoris was diagnosed for the first time during the HIS, then the following should have been performed within 3 months of the appearance of the condition on a claim form:

a. electrocardiogram
b. chest x-ray
c. serum cholesterol (or multiple channel)
d. at least one return visit

(This criterion does not apply if a hospitalization occurred at the time the diagnosis was made.)

9. If the enrollee has angina pectoris on the exit MHQ and has visited a physician for "chest pain" or a similar complaint but has never been diagnosed by a physician as having angina pectoris, then investigations intended to determine the reason for the chest pain (e.g., exercise or stress test, studies of the upper gastrointestinal tract) were carried out.

10. The enrollee reports that a doctor has given advice regarding exercise.

11. If the enrollee had a cholesterol of $\geq$ 260 mg percent at the exit screening examination, then he reports that his diet is "low fat or cholesterol" on the exit MHQ.

12. If the enrollee was a smoker at the time of enrollment, then he has been told by a physician to stop smoking. [recurrent criterion]

13. If the enrollee was 20 percent or more over ideal body weight at the time of enrollment (as calculated from the enrollment MHQ), then he has been told by a physician to lose weight. [recurrent criterion]

14. If the enrollee also has hypertension, then the hypertension is under treatment. [recurrent criterion]

15. The enrollee has received annual influenza vaccinations during the HIS. [recurrent criterion]

PROCESS—PHYSICIAN USE

1. The enrollee has visited a physician for chest pain, as indicated on at least one claim form.

2. If the physician has not prescribed a beta-adrenergic blocker or a long-acting nitrate, then the enrollee will have had at least one physician visit every 6 months since the first time that the diagnosis of angina appeared on a claim form or that any antianginal medication was prescribed.

3. If the physician has prescribed a beta-adrenergic blocker or a long-acting nitrate, then the enrollee will have had at least one physi-

cian visit every 4 months since the first time that one or both of these medications was prescribed.

PROCESS—LABORATORY

1. The enrollee has had an electrocardiogram taken at least every 24 months since the diagnosis of angina pectoris was first made. [recurrent criterion]
2. The enrollee has had a chest x-ray taken at least every 24 months since the diagnosis of angina pectoris was first made. [recurrent criterion]
3. If the physician has prescribed an antihyperlipidemic agent, then serum cholesterol and triglycerides (or a lipid panel, or a multiple channel plus triglycerides) are obtained at least every 12 months. [recurrent criterion]
4. If the physician has prescribed both a diuretic and a digitalis preparation, then serum potassium level (or multiple channel or electrolyte panel) is obtained at least every 6 months. [recurrent criterion]
5. If the physician has prescribed a digitalis preparation, then a blood urea nitrogen or serum creatinine (or multiple channel) is obtained at least every 12 months. [recurrent criterion]

PHYSICIAN'S EVALUATION

The following criteria are based on the evaluation of the physician who, during the exit screening examination, examined enrollees who were under active treatment for purported angina pectoris:

1. The examinee "definitely" or "probably" has angina.
2. If treatment for the examinee's condition were changed in an effort to improve his health, the expected benefit in health that could be achieved would likely be (a) "virtually no improvement," "minimal improvement," or "minor but definite improvement" (but not "moderate improvement" or "substantial improvement"), or (b) alternatively, "virtually no improvement" or "minimal improvement" (but not "minor but definite improvement," "moderate improvement," or "substantial improvement").
3. Either no side effects are experienced from current therapy *or* only a "slight reduction" or "virtually no reduction" in side effects would be possible (with maintenance of the same therapeutic benefit from medical care) if the therapeutic regimen were changed.
4. No change in the current therapeutic regimen for the angina is suggested.

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