Conceptualization and Measurement of Physiologic Health for Adults

Joint Disorders

Bonnie Scott, Robert H. Brook, Kathleen N. Lohr, George A. Goldberg
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Volume 10: Joint Disorders

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SANTA MONICA, CA 90406
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.


### Diseases and Conditions for Health Status and Quality of Care Measurement

<table>
<thead>
<tr>
<th>Diseases and Conditions</th>
<th>Applicable Age Group</th>
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<tr>
<td></td>
<td>0-4 Years</td>
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<td>Acne</td>
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<td>Anemia</td>
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<td>Angina pectoris and selected electrocardiographic abnormalities</td>
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<td>Asthma</td>
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<td>Cancer</td>
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<td>Chronic airway obstruction and shortness of breath</td>
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<td>Colds</td>
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<td>Congestive heart failure</td>
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<td>Convulsions</td>
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<td>Dental conditions</td>
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<td>Diabetes mellitus</td>
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<td>Eczema</td>
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<td>Enuresis (bedwetting)</td>
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<td>Growth and development disorders</td>
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<td>Hay fever</td>
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<td>Hearing disorders</td>
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<td>Hernia</td>
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<td>Hypertension</td>
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<td>Hyperthyroidism and hypothyroidism</td>
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<td>Joint disorders</td>
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<td>Lead poisoning</td>
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<td>Otitis media (middle ear infection)</td>
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<td>Stomach pain and peptic ulcer disease</td>
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<td>Urinary tract infection</td>
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<td>Varicose veins</td>
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<td>Vision disorders</td>
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SUMMARY

The Rand Health Insurance Study (HIS) will use data on the presence and adverse impact of joint disorders to study the effect of different amounts of health insurance coverage on health status and quality of health care. Joint disorders were selected for three reasons: They are quite common among adults, they have important adverse effects (pain, decreased mobility and activity), and these effects are quite responsive to medical treatment.

A variety of diseases and conditions affect the joints. The HIS has chosen to measure five of the more common chronic conditions: gout, osteoarthritis, rheumatoid arthritis, bursitis, and tendinitis.

PREVALENCE AND DISEASE IMPACT

Joint disorders are among the more common chronic conditions in the United States; they occur in 14 percent of the entire population. Prevalence increases with age, particularly after age 45. Except for gout, joint disorders are more common among women at every age. Osteoarthritis is the most common chronic joint disorder, with x-ray evidence of "moderate" or "severe" osteoarthritis in 9 percent of the adult population (NCHS, 1966a).

Joint disorders are a leading cause of disability, second only to heart conditions (NCHS, 1971). Pain is the underlying cause of the disability suffered by people with chronic joint disorders, and its effects on the quality of life experienced by patients and their families can be marked. Joint disorders account for a large proportion of both ambulatory and hospital care.

HEALTH INSURANCE STUDY METHODS

At enrollment, the HIS used two data sources to estimate the prevalence of joint disorders among its adult enrollees. The first was a Medical History Questionnaire (MHQ) that gathered information on recent symptoms of joint problems, use of medicines, and adverse effects of joint problems. The second was a medical screening examination that measured uric acid (for gout), rheumatoid factor (for rheumatoid arthritis), grip strength, walking speed, joint size, and
x-ray evidence of joint disease in the hands and wrists of symptomatic examinees. At exit from the HIS, after 3 to 5 years, both the MHQ and the screening examination will be re-administered.

A person is defined as having had a joint disorder at some time during the HIS if at least one of the following criteria is met:

1. Physician diagnosis of a joint disorder on health insurance claim forms filed during the HIS.
2. Symptoms of joint disorder reported on the MHQ:
   a. No chronic symptoms (acute joint disorder).
   b. 1 of 3 chronic symptoms (chronic-mild).
   c. 2 or 3 of 3 chronic symptoms:
      i. Rheumatoid factor negative (chronic-moderate).
      ii. Rheumatoid factor positive (rheumatoid arthritis).
3. Physician diagnosis of gout reported on the MHQ (gout).

The HIS assesses the effect of joint disorders through MHQ items dealing with the amount of pain, worry, activity restriction, and days in bed caused by joint problems and through measurement of grip strength and walking speed at the medical screening examination.

HEALTH INSURANCE STUDY ENROLLMENT RESULTS

Based on responses to the MHQ at enrollment, 25 percent of HIS adults were classified as having a joint disorder (1432 of 5713 respondents): One percent had gout, 8 percent had acute joint problems, and 16 percent had chronic nonspecific joint disorders (9 percent mild, 7 percent moderate). Less than 1 percent had rheumatoid arthritis.

Among the 1432 people with joint disorders at enrollment, 1 to 2 percent were unable to perform even the basic activities of daily living (eating, bathing, walking upstairs, etc.), and 1 to 7 percent had abnormally poor grip strength or walking speed. However, 91 percent reported some recent adverse impact from their joint problems: 89 percent reported pain, 69 percent reported worry or concern, 32 percent reported limitation of activity, and 4 percent reported being bedridden for part of the past month.

QUALITY OF CARE

Quality-of-care criteria are directed at measuring patient outcomes and process of medical care. With respect to outcomes, they specify
reduced (or not increased) adverse impact as measured in the HIS. For processes, the criteria specify appropriate tests and treatments.
ACKNOWLEDGMENTS

The authors wish to thank Joseph Lee Hollander of the Hospital of the University of Pennsylvania, Philadelphia, for a careful and constructive review of this report, particularly of the chapters dealing with clinical assessment of joint problems. We also express our appreciation to Rand colleagues Joseph P. Newhouse, Nancy Lee, Caren J. Kamberg, and Randi Rubenstein for their contributions to the work reported here. Additionally, special thanks are given to Dorothy Boyd, Barbara Eubank, and Marie Knight for their outstanding efforts in bringing several drafts of this manuscript into final form.
CONTENTS

PREFACE .......................................................... iii
SUMMARY ......................................................... ix
ACKNOWLEDGMENTS ........................................... xiii
FIGURES AND TABLES .......................................... xvii

Chapter
1. INTRODUCTION .............................................. 1

2. DEFINITION AND MEASUREMENT ISSUES ............... 2
   Definitions ................................................. 2
   Measurement of Joint Disorders ......................... 6
   Summary .................................................... 12

3. JUSTIFICATION FOR SELECTING JOINT
   DISORDERS FOR HEALTH INSURANCE STUDY
   ANALYSES ................................................ 14
   Prevalence of Joint Disorders ......................... 14
   Morbidity and Mortality ................................ 17
   Use of Medical Care ..................................... 19
   Effects of Medical Care .................................. 20

4. HEALTH INSURANCE STUDY METHODS ................. 23
   Prevalence of Joint Disorders ......................... 23
   Criteria for Classification .............................. 27
   Disease Impact ............................................ 31

5. HEALTH INSURANCE STUDY ENROLLMENT
   RESULTS .................................................... 34
   All Joint Disorders ....................................... 35
   Gout .......................................................... 39
   Nonspecific Acute Joint Disorders .................... 44
   Nonspecific Chronic Joint Disorders ................. 45
   Rheumatoid Arthritis .................................... 47
   Disease Impact ............................................. 50
   Validity of the Medical History Questionnaire .... 59
   Reliability of the Screening Examination Measures ... 61
   Prevalence of Joint Disorders According to the HIS
   Insurance Plans .......................................... 62
Potential Effects of Health Insurance on Joint Disorders .................................................. 64

6. QUALITY-OF-CARE CRITERIA FOR JOINT DISORDERS ........................................ 66

Appendix
A. JOINT PROBLEMS BATTERY FROM THE MEDICAL HISTORY QUESTIONNAIRE ................. 67
B. PHYSICIAN EVALUATION QUESTIONNAIRE .................................................. 74
C. DISTRIBUTION OF RESPONSES TO DISEASE IMPACT QUESTIONS .......................... 78
D. QUALITY-OF-CARE CRITERIA FOR JOINT DISORDERS ...................................... 80

REFERENCES .............................................................................................................. 85
FIGURES

1. Definition of Joint Disorders Based on Responses to MHQ Questions About Joint Symptoms and a Screening Test for Rheumatoid Factor ........................................... 29
2. Numbers of Persons with Joint Disorders Based on Responses to MHQ Questions About Joint Symptoms and a Screening Test for Rheumatoid Factor ...................... 37

TABLES

1. Diagnostic Criteria for Rheumatoid Arthritis ........ 4
2. Estimated Percentages of U.S. Population 25 to 74 Years of Age with Selected Joint Symptoms, by Age .......... 16
3. Definition of Joint Disorders Based on Diagnoses Listed on Insurance Claims ......................................................... 28
4. Distribution of Responses to Questions on the MHQ About Symptoms of Joint Disorders ........................................... 36
5. Prevalence of All Joint Disorders According to Findings from the MHQ ................................................................. 38
6. Prevalence Rates of All Joint Disorders Combined, per 100 Persons, by Age and Sex ........................................ 38
7. Distribution of Responses to Questions on the MHQ About the Medical Diagnosis and Treatment of Joint Disorders 40
8. Mean Uric Acid Levels, by Age and Sex .................. 42
9. Number and Percentage of Persons Who Had Hand/Wrist X-rays Taken at the Screening Examination, by Joint Disorder ................................................................. 42
10. Interpretation of Hand/Wrist X-rays Taken at the Screening Examination, by Joint Disorder ......................... 43
11. Pattern of Joint Symptoms Reported by Persons with Chronic Joint Disorders, by Severity of Disorder ...... 46
12. Results of the Rheumatoid Factor Test at the Screening Examination, by Joint Disorder ........................................ 49
13. Distribution of Responses to Questions on the MHQ About the Effects of Joint Disorders on the Activities of Daily Living .......................................................... 52
14. Number and Percentage of Persons Reporting Mobility Limitations, by Joint Disorder and Area of Limitation ........... 53
15. Results of Two Tests of Joint Function at the Screening Examination, by Joint Disorder ........................................ 54
16. Mean Sizes of Finger Joints Measured at the Screening Examination, by Joint Disorder and Sex .................................. 55
17. Distribution of Responses to Questions on the MHQ About the Impact of Joint Disorders ........................................... 57
18. Percentage of HIS Enrollees Reporting Pain, Worry, Activity Restriction, and Days in Bed Because of Joint Disorders, by Joint Disorder .................................................... 58
19. Median Categories of Pain, Worry, Activity Restriction, and Days in Bed, by Joint Disorder ........................................ 59
20. Prevalence of Joint Disorders, by HIS Experimental Insurance Plan ........................................................................... 63
C.1. Distribution of Responses to Questions on the MHQ About Pain and Worry, by Joint Disorder ........................................... 78
C.2. Distribution of Responses to Questions on the MHQ About Activity Restriction and Days in Bed, by Joint Disorder 79
Chapter 1

INTRODUCTION

Joint disorders are common, they are painful, and they are a leading cause of disability in the United States. Their effects on health, however, can often be influenced by medical care. The Rand Health Insurance Study (HIS) is interested in joint disorders as an indicator of the health status and the quality of medical care among groups of people who have different levels of health insurance. The Study uses data on the prevalence and adverse consequences of joint disorders, and on the use of medical services for them, to investigate the effect of health insurance on health.

This volume discusses definitional, diagnostic, and measurement issues regarding joint disease (Chapter 2). Chapter 3 defines various joint disorders and describes in detail why they were selected as an indicator of health status and quality of care, with reference to their prevalence, morbidity and mortality, and responsiveness to medical care. The HIS methods for measuring the presence and adverse consequences of joint disorders—as an indicator of health status—are described in Chapter 4. Chapter 5 presents results from enrollment at all six HIS study sites (Dayton, Ohio; Seattle, Washington; Fitchburg and Franklin County, Massachusetts; Charleston and Georgetown County, South Carolina). Chapter 6 discusses the criteria used by the HIS to evaluate the quality of medical care rendered to people with joint disorders.

Readers are referred to the first volume of this series for information about the overall design of the HIS and the plan of analysis to study the impact of health insurance coverage on health status and the quality of health care for certain specific diseases and conditions such as joint disorders.
Chapter 2
DEFINITION AND MEASUREMENT
ISSUES

A variety of diseases and conditions affects the joints of the human body. They range from injuries to infections to cancer. Arthritis is a general term for inflammation of the joints (pain, swelling, redness, and warmth). Rheumatism is a general term for aches and pains, not necessarily in joints. The Health Insurance Study (HIS) has limited its consideration to five particular joint disorders that are both frequent and chronic: gout, rheumatoid arthritis, bursitis, tenosynovitis (tendinitis), and osteoarthritis. These disorders affect joints by causing inflammation, stiffness, and limited motion. They often wax and wane in a chronic, episodic pattern of periods of severe pain alternating with periods of relatively little pain.

DEFINITIONS

Gout and rheumatoid arthritis are fairly specific diseases, and so people with either of them can usually be distinguished from people with other kinds of joint disorders. Bursitis, tenosynovitis, and osteoarthritis are, by contrast, quite nonspecific in nature. Someone with bursitis of the shoulder may have symptoms that are very similar to those of someone with tenosynovitis or osteoarthritis of the shoulder. Nevertheless, each of these five chronic joint disorders has some particular characteristics of its own, and these are described below.

Gout

Gout is a chronic disease that affects the joints by forming irritating deposits of urate crystals in and about the joints. Urate is a substance that is normally present in the blood in a dissolved form (uric acid) at a level of 3 to 8 mg/dl.¹ In people who have gout, the level of dissolved urate in the blood is usually higher than normal ("hyperuricemia"). In

¹Mg/dl or milligrams per deciliter is a widely used equivalent of milligrams per 100 milliliters or milligrams percent.
most cases, this is thought to arise from some inherited metabolic abnormality that allows urate to accumulate in the blood. (Not all people with hyperuricemia also have deposits of urate crystals in their joints. Only those who do are said to have gout.)

People afflicted by gout have occasional episodes of sudden, severe inflammation of their joints, often of only one joint in the leg or foot. With repeated attacks, the inflammation may eventually destroy parts of the affected joints. Gout is therefore defined as episodic attacks of joint inflammation in combination with urate crystals in the affected joint. The diagnosis can be confirmed if urate crystals are found either in the affected joint or in nodular deposits under the skin. Chronic gout may result from long-term accumulation of urate in joints, in nodular deposits under the skin, and in kidneys.

**Rheumatoid Arthritis**

Rheumatoid arthritis (arthr = joint, itis = inflammation) is a specific chronic disease that produces inflammation of the joints in ways that are still not completely understood. Rheumatoid arthritis somehow affects the innermost lining of the joint, the synovium. The synovium is a thin film of tissue that covers all the components of the joint to form a closed sack of the joint. The synovial sack is filled with a small amount of synovial fluid (a clear thick fluid that looks like egg white). Rheumatoid arthritis begins with an inflammation of the synovium, producing painful, swollen, tender, warm joints. The synovial fluid increases in amount, producing stiffness and more swelling. The disease progresses with a variable pattern in different individuals. At its extreme, the inflamed synovium can gradually erode through the structures of a joint to produce a partial dislocation, and other parts of the body may become affected by a generalized inflammatory process. The exact cause of rheumatoid arthritis and its variable expression remains unknown.

In an attempt to define rheumatoid arthritis more consistently, the American Rheumatism Association (ARA) has developed a set of criteria by which it can be diagnosed (Ropes et al., 1958). Each criterion, by itself, is not specific for rheumatoid arthritis and may occur in other diseases as well. When several of the criteria are found in combination in the same person, however, the likelihood that the person has rheumatoid arthritis and not some other disease is increased. The 11 ARA criteria are listed in Table 1.

The ARA further defines rheumatoid arthritis as "classical," "definite," "probable," or "possible," depending on the number of criteria found in a person. For example, a person with "classical" rheumatoid
Table 1

**Diagnostic Criteria for Rheumatoid Arthritis**

<table>
<thead>
<tr>
<th>Criterion No.</th>
<th>Clinical Symptom or Sign</th>
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<tbody>
<tr>
<td>1.</td>
<td>Joint stiffness in the morning, persisting more than 1 hour</td>
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<tr>
<td>2.</td>
<td>Pain on motion and/or tenderness in at least one joint</td>
</tr>
<tr>
<td>3.</td>
<td>Swelling of soft tissues of at least one joint, persisting 6 weeks</td>
</tr>
<tr>
<td>4.</td>
<td>Swelling of at least one other joint within 3 months</td>
</tr>
<tr>
<td>5.</td>
<td>Swelling of the same joint on both sides of the body</td>
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<tr>
<td>6.</td>
<td>Nodular growths under the skin over bony prominences</td>
</tr>
<tr>
<td>7.</td>
<td>X-ray changes typical of rheumatoid arthritis</td>
</tr>
<tr>
<td>8.</td>
<td>Positive blood test for rheumatoid factor</td>
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<tr>
<td>9.</td>
<td>Poor mucin precipitate from synovial fluid</td>
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<tr>
<td>10.</td>
<td>Characteristic microscopic picture of the synovium</td>
</tr>
<tr>
<td>11.</td>
<td>Characteristic microscopic picture of rheumatoid nodules</td>
</tr>
</tbody>
</table>

Source: Ropes et al., 1958.

Rheumatoid arthritis has at least 7 of the 11 criteria. Criteria Nos. 1 through 5, if present, must have been continuous for at least 6 weeks, and Criteria Nos. 2 through 6 must be observed by a physician to be counted as present. "Definite" rheumatoid arthritis requires 5 or 6 of the 11 criteria; "probable" rheumatoid arthritis, 3 or 4. "Possible" rheumatoid arthritis requires only 2 criteria from among Criteria Nos. 1, 2, 3, and 6, with only number 6 requiring observation by a physician, and the required duration of symptoms is shortened to 3 weeks.

**Bursitis**

Bursitis is a joint disorder that affects the joints indirectly by inflaming the bursae near them. Bursae are small, closed sacks that normally contain a very small amount of fluid. They are located at sites of friction between skin, muscles, tendons, and bones. The muscles, tendons, and bones must move smoothly over each other for the joint itself to move smoothly; the bursae, being smoothly gliding pockets of slippery fluid, help to make the movement smooth and frictionless. Repeated, excessive friction, as in a baseball pitcher's shoulder, can produce irritation and inflammation (-itis) of a bursa: bursitis. The inflammation causes increased fluid to accumulate inside the bursa, producing swelling and pain.

Because most bursae are near joints, the symptoms of pain and
swelling are often experienced as being inside the joints. The shoulder is the joint most often affected, but bursitis can become a chronic problem in almost any area of active movement. It is usually defined as inflammation of bursae in an area of active movement or friction, usually near joints.

**Tenosynovitis**

Tenosynovitis (teno = tendon; synov = egg white; itis = inflammation), sometimes called tendinitis, is an inflammation of the tendon structure. Tendons are extensions of muscles; they attach muscles to bones. Many tendons are surrounded by sheaths that contain synovial fluid. The synovial fluid helps the tendons to slide freely over bones and other tendons. Like bursae, tendons and their sheaths can become inflamed after excessive activity: tenosynovitis. Because tendons, like bursae, are near joints, the pain and swelling of tenosynovitis usually feels like pain inside the joint. Shoulders, elbows, wrists, fingers, and ankles are the joints most often affected, and repeated episodes of tenosynovitis can result in chronic pain and stiffness. Tenosynovitis is usually defined as inflammation in the area of a tendon and its sheath.

**Osteoarthritis**

Osteoarthritis (osteo = bony; arthr = joint; itis = inflammation) is sometimes referred to as degenerative joint disease but is called osteoarthritis in the United States. This disease usually produces pain and swelling without obvious inflammation. It affects weight-bearing joints, particularly the hips, knees, and feet, as well as those that get a great deal of use, such as the joints in the hands. Osteoarthritis is by far the most common of the chronic joint disorders. It is found more often in older people and is believed to be an exaggeration of the normal aging process of the body.

In osteoarthritis, gradual changes occur in the joint structures, consisting primarily of degeneration of the cartilage of the joint and irregular growth of bone around the joint. Cartilage is the smooth, firm, rubbery material that covers the ends of the bones inside a joint and acts as a cushion between bones, preventing direct bone-on-bone contact during movement of a joint. The cartilage itself has no sensation of pain, but the bone surfaces are very sensitive. With age, or as a result of injury to a joint, the cartilage degenerates. It roughens, frays, and cracks. The bones adapt to the gradual degeneration of the
cartilage by growing outward in an irregular way as the cartilage thins. The new outgrowths may form jagged "spurs" on the bone. Pieces of cartilage and bone may break off and float loose inside the joint ("joint mice"). These pieces can produce grating or even locking of the joint as it is moved.

Osteoarthritis can flare up, with inflammation occurring in addition to the usual pain and stiffness of simple degeneration. Changes in the x-ray appearance of the joint can sometimes help to confirm the diagnosis: bony spurs appear on the margins of the joint, the joint space appears narrower as the cartilage becomes thinner, and the underlying bone appears irregularly hardened. Thus, this joint disorder is usually defined as a combination of pain, stiffness, jerky motion, and irregularly enlarged bones in the joints of an older person.

MEASUREMENT OF JOINT DISORDERS

The characteristics of joint disorders are usually measured by interview, physical examination, x-ray examination, and by certain laboratory tests. These measures are used to determine the presence or absence of the disease, as well as its severity and impact on function.

Interview and Questionnaire

Interviews or questionnaires can be used to gather information about the symptoms of joint disorders, such as pain, swelling, and stiffness. Some symptoms are common to all joint disorders, but certain patterns of symptoms are more characteristic of one joint disorder than of another. For example, sudden severe pain and swelling in a toe joint that lasts for a few days is more characteristic of gout than of other joint disorders.

Joint swelling is a symptom that can occur in all joint disorders, but it is found very often in rheumatoid arthritis and osteoarthritis. It is included in 3 of the 11 ARA criteria for rheumatoid arthritis (see Table 1), and Burch and O'Brien (1965) found it to be the most valuable of those criteria for the purpose of screening for rheumatoid arthritis. They studied the relative value of the ARA criteria for use in screening a general population for the presence of rheumatoid arthritis, using Blumberg's method (Blumberg, 1957) for calculating the "relative health value" of screening tests. They used only the first 8 of the 11 ARA criteria; the remaining 3 criteria would have required cutting into the skin or the joint. When they applied the first 8 criteria to a population of 1049 Blackfeet Indians aged 30 and over, they
found 45 people with at least 3 of the 8 criteria present, for a prevalence of probable, definite, or classical rheumatoid arthritis of 4.3 percent. To determine which of the criteria were most consistently "correct," they then scored each criterion by awarding it one point for each person whom the criterion labeled correctly as being among the 45 or the remaining 1004, for a maximum score of 1049 for each criterion. Swelling of two joints was the most consistently correct criterion (correct in 989 out of 1049 cases), followed, in decreasing order, by symmetrical joint swelling (987), nodules (957), swelling of one joint (947), x-ray changes (933), rheumatoid factor (909), morning stiffness lasting longer than 10 minutes (869), and pain (639).

Joint stiffness in the morning is another symptom that is common to both osteoarthritis and rheumatoid arthritis. The stiffness of osteoarthritis, however, typically decreases with movement, i.e., "limbers up." The stiffness of rheumatoid arthritis lasts longer and is not quickly relieved by activity. In a study of 491 persons with rheumatoid arthritis, 76 percent reported having joint stiffness in the morning that lasted for at least 25 minutes, and 69 percent said it lasted longer than an hour (Cooperating Clinics, 1965).

Interviews or questionnaires can be used to gather information about joint function as well as joint symptoms. Questions usually ask about the activities required for daily living: "Can you walk up a flight of stairs?" "Can you dress yourself?" At least 12 scales of physical or joint function are currently in use (Lee et al., 1973). All are indicators of the relative functional level among groups of patients or in the same patient over a period of time, as well as good measures of absolute functional ability for the specific activities asked about. Two simple scales of functional assessment have been evaluated for reliability and validity (Lee et al., 1973; Convery et al., 1977). The scores from the scales are reproducible and correlate significantly with the results from physical tests of functional ability and with physicians' assessment of function.

**Physical Examinations**

In addition to interviews or questionnaires about joint symptoms, a physical examination of joints yields information about joint tenderness (pain upon movement or touch), swelling, redness, warmth, excess fluid, and range of motion. Such examinations can be time-consuming when used to screen a large population, and in addition, there is a lack of reliability among examiners (Eberl et al., 1976).
To improve the reliability of assessments of the presence and severity of joint disorders, many researchers have substituted simple, standardized physical measurements for actual physical examination. Examples of such measurements include grip strength, walking speed, and joint size. The absolute values of these measurements have limited meaning, however. They are more meaningful as relative values with which to compare serial measurements over time in the same person and average measurements between groups of people.

Grip strength measurements are widely accepted as a measure of muscle and joint function in the arms and hands. They reflect the ability to perform common activities such as lifting, writing, opening doors, and holding onto a stair railing. Measurement of grip strength with springs is too crude to pick up minor changes. The apparatus most often used is a rolled blood pressure cuff inflated to a pressure of 20 mm on the attached mercury manometer. The person being measured is instructed to squeeze the cuff as hard as possible, and the best of three tries, or their average, is recorded for each hand.

Normal grip strength for men is at least 200 mm Hg, and for women, at least 150 mm Hg (Bowers et al., 1975). People learn to grip better, so this test may improve over time without corresponding improvement in the joint disorder. Also, grip strength varies with the time of day, improving during the late afternoon and evening, so measures intended for comparison should be done at around the same time of day (Lee et al., 1974). Changes in grip strength of as little as 10 mm Hg are detectable (Cooperating Clinics, 1965), but reproducibility is such that changes of more than 20 mm Hg are needed before they can be considered clinically significant (Lee et al., 1974).

Walking speed is a measure of joint function in the hips, knees, and feet. It is usually recorded as the time taken to walk 50 feet, using canes or other devices as needed, but with no human assistance. A person without impairment should be able to walk 50 feet in less than 12 seconds (Bowers et al., 1975). As with grip strength, motivation and learning can greatly affect the outcome of this measure.

Joint size is a physical measurement that does not involve motivation. Joint size increases with swelling or bony overgrowth. The circumference of a joint can be quickly and easily measured with a tape measure, jeweler’s sizing rings, or a device called an arthrocircameter. The latter device has been shown to produce results comparable to those obtained with jeweler’s rings. Boardman and Hart (1967) found a correlation coefficient of 0.95 among 100 joint-size measurements in which both devices were used. The size of joints in people with rheumatoid arthritis would be expected to decrease after a course of therapy intended to reduce inflammatory swelling. However, in one study the effects of anti-inflammatory drug therapy on finger joint size in
rheumatoid arthritis patients was so slight that in some cases it was exceeded by observer variation (Boardman and Hart, 1967).

Joint size among people with osteoarthritis appears to be more directly related to the progress of the disease. Using jeweler's rings to measure joint size, Acheson et al. (1972) found that joints showing osteoarthritis by x-ray were significantly larger than healthy joints, even controlling for other factors affecting joint size, such as obesity. Furthermore, joint size increased as the severity level of the disease increased (measured by x-ray).

Other Physiologic Measures

In addition to the questionnaire and physical measures already discussed, x-rays and laboratory measures are sometimes useful for determining the presence or absence of certain joint disorders. X-rays show changes in bones and joints that are affected by rheumatoid arthritis and osteoarthritis. X-ray changes are rarely found in bursitis or tenosynovitis unless there are calcium deposits within the bursae or along tendons (Rodnan, 1973). Watt and Middlemiss (1975) reviewed the literature on the x-ray features of gout and studied the x-rays of 64 patients who were hospitalized for gout, but were unable to find any x-ray features specific for gout. Any radiologic changes that do occur in gout usually take years to develop (Rodnan, 1973).

X-rays are helpful in confirming the diagnosis of rheumatoid arthritis, but their interpretation can vary a great deal (Kellgren and Bier, 1956; Bland et al., 1969). To reduce interobserver variability, Kellgren and Lawrence (1957) developed a reference set of x-rays of bones and joints known to be affected by rheumatoid arthritis. Their standards have become widely used for comparison in interpreting x-rays for the presence of rheumatoid arthritis. The x-ray changes that occur in rheumatoid arthritis are fairly specific for the disease, and they are among the 11 ARA criteria for diagnosing rheumatoid arthritis.

X-rays can also be used to determine the presence or absence of osteoarthritis, and agreement between observers about the interpretation of the x-ray changes that occur in osteoarthritis is very good. The 1960-1962 Health Examination Survey of the National Center for Health Statistics (NCHS, 1966a) used x-rays of the hands and feet as the only basis for estimating the prevalence of osteoarthritis in the United States; a five-point severity scale (from no disease to severe osteoarthritis) was used to interpret the x-rays. Three specialists in arthritic disease independently rated 6413 sets of radiologic films; the level of agreement among them on the grades of osteoarthritis was generally quite high. For the 6413 sets of x-rays, for instance, the
coefficient of correlation between pairs of interpreters was 0.75 or higher. They agreed significantly more often on the hand x-rays than on the x-rays of the feet. Wright and Acheson (1970) also found good interobserver agreement in their survey of a general population for osteoarthritis in New Haven, Connecticut. Three interpreters independently graded at least 431 x-rays of the hands and wrists on a five-point scale. All three assigned the same grade to 68 percent of the x-rays, and 86 percent of the x-rays were assigned gradings within one point of each other.

Although x-rays are very reliable for determining the presence or absence of osteoarthritis, they often show signs of osteoarthritis long before any joint symptoms appear. Therefore, x-rays may be measuring the prevalence of the aging process in bones and joints rather than a true joint disorder. The NCHS found "minimal" evidence for osteoarthritis among 14 percent of all adults between the ages of 18 and 44. For "moderate" or "severe" x-ray changes, the prevalence in the same group was less than 1 percent (NCHS, 1966a). After examining 478 people from a random sample in Pittsburgh, Cobb et al. (1957) estimated that only about 30 percent of people with osteoarthritis evident on x-rays complain of pain in the affected joints. Similarly, Acheson et al. (1972) found that more than 50 percent of the people with at least minimal x-ray evidence of osteoarthritis reported no pain, stiffness, or swelling of their joints.

Laboratory tests for joint disorders are few and disappointingly nonspecific. Of course, the most specific laboratory test for the diagnosis of gout is the demonstration of the typical needle-shaped, negatively birefringent crystals of urate in the fluid obtained from gouty joints (McCarty, 1979). To screen a general population for gout, however, the level of urate in the blood can be measured. As noted earlier, though, many people with high levels of urate (hyperuricemia) do not have gout. Besides being relatively nonspecific for gout, urate-level measurement can be confounded by other substances. Many common substances can spuriously raise the urate level (i.e., produce a measured level higher than it actually is)—caffeine and ascorbic acid (Vitamin C) among them. More importantly, many medications, especially diuretics and low doses of aspirin, raise the true level of urate in the blood.

Urate levels are usually measured as part of a routine, automated, chemical analysis of the blood for several other constituents. One of the more widely used automated methods for measuring urate is that of Musser and Ortigoza (1966) (an automated version of the Sobrinho and Simoes method).²

²This method takes advantage of the ability of urate to reduce sodium phosphotungstate to blue-colored sodium phosphotungstite, which is then analyzed by a spectropho-
The definition of a normal urate level is arbitrary because the range of urate levels in the general population follows a continuous distribution. The upper limit of normal urate levels is usually defined as two standard deviations above the average urate level, a threshold level that automatically labels 2.5 percent of the population as hyperuricemic. The upper limit of normal values for urate as measured by the reduction method of Musser and Ortizgoza is 7.5 mg/dl for women and 8.5 mg/dl for men. Characteristics such as age, race, and body weight can affect the normal range of urate level (Liang and Fries, 1978).

Another laboratory test used to determine the presence or absence of a joint disorder is a blood test for rheumatoid factor. Rheumatoid factor is a protein that is present in the blood of approximately 90 percent of people who have rheumatoid arthritis (Singer and Plotz, 1958). It is produced in the body apparently in response to the changes that occur in the synovial lining of the joints involved in rheumatoid arthritis (McDuffie and Bunch, 1977). It was first discovered in the 1940s, and for the past 35 years researchers have been trying to develop a blood test for rheumatoid factor that would reliably distinguish between people who have rheumatoid arthritis and those who do not.

One problem with tests for rheumatoid factor is that they are positive in many conditions other than rheumatoid arthritis, ranging from infectious diseases and recent immunizations to psychiatric disorders (Bartfeld, 1969). One of the more common factors that increase the likelihood of a positive test is simply old age. In a study of 235 healthy persons over the age of 70, approximately one-third were found to have a positive test for rheumatoid factor (Litwin and Singer, 1965). Among 6,672 people aged 18 to 79 in the general population tested by NCHS, 3.4 percent had a positive reading; among people under 45 years of age, 1 percent had a positive reading; and among those over 75, 10 percent had a positive reading (NCHS, 1966b).

Several laboratory techniques for measuring rheumatoid factor have been tried over the years. A major problem with all tests is that increasing the specificity of the test for "true" rheumatoid factor, and thus rheumatoid arthritis, decreases the sensitivity of the test to detect the factor at all (McDuffie and Bunch, 1977). The method most commonly in use today is the latex fixation or agglutination test, as standardized by Singer and Plotz (1956). This technique is positive in less than 5 percent of the general population, and still detects rheumatoid factor in over 90 percent of rheumatoid arthritis patients (Singer and Plotz, 1958).

tometer. Because hydroxyamine is used to enhance the color change that accompanies the reduction, this technique is sometimes referred to as the hydroxyamine method.
A positive test for rheumatoid factor is not specific enough to be used as the only evidence for the diagnosis of rheumatoid arthritis. It is one of the 11 ARA criteria by which the condition is diagnosed, but it qualifies only if positive by a laboratory technique whose specificity is such that no more than 5 percent of healthy people have a positive reading (as does the Singer and Plotz technique) (Rodnan, 1973). Nevertheless, the prevalence of rheumatoid arthritis in the general population is so low (about 3 percent in adults) that the predictive value of the test is only 54 percent. That is, when a person has a positive test for rheumatoid factor, the likelihood of that person's having rheumatoid arthritis, solely on the basis of the positive test, is only 54 percent. Therefore, a positive rheumatoid factor test should not be the only basis for a diagnosis of rheumatoid arthritis.

SUMMARY

A wide variety of disease processes can afflict the joints of the human body. The more frequent, chronic conditions include gout, rheumatoid arthritis, bursitis, tenosynovitis, and osteoarthritis. These problems are manifested primarily by inflammation (pain, swelling, redness, and warmth), stiffness, and limited motion. The first two are fairly specific diseases with highly characteristic patterns of symptoms and signs; the latter three are relatively nonspecific.

Numerous measures are available by which to identify and diagnose joint disorders. These include patient interview and questionnaire, which elicit information about symptoms such as pain, swelling, or stiffness and about the condition's impact on daily living. Physical examination of patients contributes information on a number of dimensions important to correct diagnosis, including joint size, joint swelling, grip strength (which is pertinent to hands and arms), and walking speed (pertinent to hips, knees, and feet). X-rays are helpful in confirming certain joint diagnoses (especially rheumatoid arthritis). Finally, certain laboratory tests (e.g., tests for measuring the level of uric acid in the blood as indicative of gout or for measur-

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The positive predictive value of a test is equal to the actual disease rate among the group with the positive test result: \( A/(A + B) \), where \( A \) is the number of people with a positive test result who actually have rheumatoid arthritis, and \( A + B \) is the number of people in the total population with a positive test result. For this condition, 50 people out of every 1000 (i.e., 5 percent) will have a positive test result (i.e., \( A + B = 50 \)), and 30 out of every 1000 will have rheumatoid arthritis. Since the test is positive among 90 percent of people with the condition, \( A \) in this example will be 27 people (90 percent of 30). The positive predictive value is, therefore, 27/50, or 54 percent.
ing the presence of rheumatoid factor in the blood as indicative of rheumatoid arthritis can contribute to the diagnostic process, but they tend to be disappointingly nonspecific. Of course, findings from careful examination of the synovial fluid may yield much more specific diagnostic information.
Chapter 3

JUSTIFICATION FOR SELECTING JOINT DISORDERS FOR HEALTH INSURANCE STUDY ANALYSES

PREVALENCE OF JOINT DISORDERS

Joint disorders are among the more common chronic conditions in the United States. Based on data from a 1976 interview survey of approximately 40,000 representative households throughout the United States, the National Center for Health Statistics (NCHS) estimated the prevalence of chronic joint disorders to be 14 percent in the total population (NCHS, 1978, Tables 13, 17, and 18). Nearly 12 percent of the population reported having nonspecific "arthritis or rheumatism"; 1.9 percent, bursitis or tenosynovitis; and 0.8 percent, gout.

The prevalence of these three chronic joint disorders taken together was found to increase dramatically with age, from 7 percent among adults 17 to 44 years of age to 32 percent among adults 45 to 64. Among all of those with joint ailments, 81 percent were over 45 years old; 35 percent were over 65. Prevalence of arthritis and bursitis was higher among women than among men, 17 percent versus 10 percent, whereas for gout, the sex difference was reversed, men being affected two to three times as often as women (NCHS, 1978, Tables 12, 17, and 18).

Osteoarthritis

The prevalence of the most common of the chronic joint disorders, osteoarthritis, is difficult to assess for at least two reasons. First, because it may be part of the process of aging, almost every adult will eventually have the condition. Second, it may be present in a mild form with only minor symptoms, and such early disease may be evident only by x-ray (Acheson et al., 1972).

A 1961 international symposium on the epidemiology of chronic rheumatism agreed that x-ray evidence was the single most reliable criterion for the diagnosis of osteoarthritis. The NCHS Health Examination Survey of 1960-1962, therefore, estimated the prevalence of osteoarthritis in the United States based only on x-ray findings.
(NCHS, 1966a). X-ray pictures of both hands and both feet of 6672 persons from a population representative of the general adult population in the United States were examined for signs of osteoarthritis. The x-rays were graded on a five-point scale, representing: (1) no disease, (2) doubtful, (3) minimal, (4) moderate, and (5) severe. (This scale, based on the worst joint, uses the Kellgren and Lawrence (1957) method of grading severity of osteoarthritis.)

The prevalence of osteoarthritis measured in this way was 37 percent among adults 18 to 79 years of age (see NCHS, 1966a). Prevalence increased steadily with age, from 14 percent among persons 18 to 44, to 56 percent between the ages of 45 and 64, to 82 percent for persons over age 65. Of all cases, 77 percent were graded minimal; for persons under age 45, more than 96 percent of them were minimal. When these minimal cases were excluded, the prevalence of moderate or severe osteoarthritis in the adult population (aged 18 to 79) was only 9 percent.

In the first Health and Nutrition Examination Survey (HANES-I) of 1971-1975, a major component was a detailed arthritis investigation that included a physician’s examination, x-ray film of the hips and knees, and medical histories; the data from that survey refer to the civilian noninstitutionalized population aged 25 to 74. Nearly 1 percent of the population had moderate or severe osteoarthritis of the knees based on readings of x-ray films (see NCHS, 1979, Table 1): 0.5 percent of all men and 1.3 percent of all women. An additional 2.1 percent of men and 3.6 percent of women had minimal osteoarthritis of the knees. As would be expected, prevalence of this condition (taking the minimal/moderate/severe levels together) rose markedly with age, more so for women than for men. For example, 1.3 percent of the survey population aged 35 to 44 had minimal osteoarthritis of the knees, as contrasted with 2.6 percent among those 45 to 54, and 4.8 percent among those 55 to 64.

An "Arthritis History Supplement” was given to people in the HANES sample who reported either relevant joint symptoms for at least 1 month or a history of arthritis or gout. A synopsis of the findings regarding the estimated percentages of the U.S. population suffering these symptoms (on most days for at least 1 month) appears in Table 2. On the basis of self-report, over 14 percent of the adult population reported stiffness in muscles and joints upon arising from bed in the morning, over 10 percent reported significant pain in their

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1X-rays were taken of the knees for all persons in the survey; x-rays of the hips were taken of all men but only of women aged 50 to 74. Because of this emphasis on older ages, and the generally low prevalence of osteoarthritis in the hips compared with the knees, we will not comment further here on the hip x-rays.
knees, nearly 7 percent reported significant pain in their hips, and 6 percent reported swelling of joints and/or pain when the joint was touched. The rates were positively associated with age and tended to be higher for women than men, especially in the older ages.

Rheumatoid Arthritis

Worldwide, the prevalence of rheumatoid arthritis among adults is about 3 percent. Based on ARA criteria (see Table 1), reported prevalence ranges from 0.4 percent in Japan to 11 percent in Jamaica; prevalence is higher among women than men in all countries (Wood, 1970). A large survey of more than 39,000 people 7 years and older in Sweden found a prevalence of 3.1 percent, based on ARA criteria for possible, probable, definite, or classical rheumatoid arthritis (Hellgren, 1970).

The NCHS Health Examination Survey of 1960-62, also using the ARA criteria, found a prevalence of 3.2 percent of probable, definite, or classical rheumatoid arthritis among its sample of 6672 adults aged 18 to 79 throughout the United States. Of these cases, 30 percent were classified as classical or definite by the ARA criteria, and 70 percent as probable. The prevalence among women was greater than that among men at all ages, 4.6 percent for women, 1.7 percent for
men (for a ratio of 2.7 to 1). Prevalence increased with age among both sexes (NCHS, 1966b).

Gout

The prevalence of gout is difficult to assess because the episodes of joint pain are typically brief (lasting only a few days in many cases), and may not be remembered or reported. When the NCHS interviewed people in 1976 about having gout in the preceding year, 1.0 percent of adults aged 17 to 64 said they had the condition (NCHS, 1978, Table 18).

A few facts about the epidemiology of gout are generally known. Gout is uncommon before age 30, its peak incidence is in the 40s and 50s, and men are affected seven to nine times as often as women (Rodnan, 1973; McCarty, 1979). A 12-year prospective survey of 5127 people aged 30 to 59 in a Massachusetts town confirmed some of these commonly held beliefs (Hall et al., 1967). At the end of the 12-year study period, 1.5 percent of the population had had one or more attacks of gouty arthritis: 2.8 percent of men, and 0.4 percent of women. The studied population was then 42 to 71 years old. Only 36 percent of persons with a uric acid level above 8 mg/dl at any time during the study developed gout. The incidence of gout among people who previously did not have gout increased with age to about 48 years and then declined.

MORBIDITY AND MORTALITY

Joint disorders are a leading cause of disability in the United States. When the NCHS interviewed 84,000 households representative of the population throughout the United States in 1965-67, it found that 50 percent of the total population reported having one or more potentially disabling chronic conditions (NCHS, 1971). Of these, 23 percent were limited in their usual activity (e.g., work, school), and 7 percent were limited in their personal mobility (e.g., bathing, walking). "Arthritis and rheumatism" was listed as the second leading cause of limited activity (second only to heart conditions), and was the number one cause of limited personal mobility.

Data from subsequent NCHS Surveys, as in 1969-70 or in 1972, confirm the significant deleterious effects that the common joint disorders can have on people's lives (see, e.g., NCHS, 1973; 1974). Arthritis and rheumatism are consistently the first or second leading cause of activity limitation (typically second to heart conditions or impair-
ments of back or spine among all ages together and for ages 44 and younger; it is the first leading cause for persons 65 and older. Both limited mobility and limited activity increase with age, and arthritis and rheumatism become major contributors to this type of disability after age 44. Among persons with some degree of activity limitation, about one-tenth will report that arthritis and rheumatism are the main cause; among those 65 and older, about one-sixth will cite these conditions as the main cause of their limitations.

Data from the Social Security Administration on benefit payments to disabled workers further support the contention that these joint disorders contribute greatly to a compromised quality of life for substantial numbers of the population. For instance, in 1972, 10 percent of those receiving such payments had arthritis and rheumatism, compared with 19 percent with ischemic heart disease, 11 percent with mental disorders, and 10 percent with cancer (SSA, 1975).

Pain is the underlying cause of the disability suffered by people with chronic joint disorders, and its effects on the quality of life of patients with joint diseases can be marked. With the exception of gout, which produces severe pain for a few days at a time about once every 2 years (Hall et al., 1967), chronic joint disorders produce chronic pain. Rheumatoid arthritis and osteoarthritis can also produce physical disability by gradually eroding joint structures. Most people who have chronic joint disorders, however, have trouble moving their joints because it hurts to move them. That is, they are usually disabled by joint pain rather than by joint dysfunction (NCHS, 1978). Laborde and Powers (1980) speculated that the presence of chronic pain (perhaps together with decreased mobility) among arthritis patients may explain their findings that patients with arthritis viewed their present life as less satisfying than did patients with end-stage renal failure who were undergoing hemodialysis.

People with gout or rheumatoid arthritis may also have disease outside their joints. For example, the hyperuricemia associated with gout that results in the deposition of irritating urate crystals in the joints can sometimes result in deposition of urate crystals elsewhere in the body, as kidney stones for instance. The risk of these extra-joint problems in people who have hyperuricemia alone, without gout, has recently been reviewed and found to be small or unknown (Liang and Fries, 1978). However, the risk among people who already have had at least one gouty joint attack is considered to be somewhat higher. People with rheumatoid arthritis also develop nonjoint manifestations of the disease with variable frequency. Almost all rheumatoid arthritis patients have mild to moderate chronic anemia. Other problems, from chronic skin ulcers to inflammation of the heart, are rarer and
tend to occur in people who have a severe, rapidly progressive form of the disease (Rodnan, 1973).

Chronic bursitis, tenosynovitis, and osteoarthritis may sometimes require the use of a sling, cane, brace, or other aid, and may eventually result in severe disability in a few cases. Gout may produce severe or chronic disability even though its attacks are usually brief and infrequent. The average number of attacks per person was five during the 12-year Framingham Study, with one-fourth of the people having had only one attack (Hall et al., 1967). However, gout tends to become chronic if left untreated. Chronic gout causes disability by joint erosion and ulceration, and may lead to kidney infiltration even to the extent of kidney failure. Rheumatoid arthritis can also result in severe disability, such as confinement to a wheelchair or bed, even at a relatively young age. After 10 to 15 years with the disease, 30 to 50 percent of rheumatoid arthritis patients are not capable of full-time employment, and a higher percentage may have severely limited choices of occupations. After 15 to 20 years with the disease, about 10 percent will have become confined to a wheelchair or bed (Rodnan, 1973).

Mortality rates among people with rheumatoid arthritis are higher than among the general population. A study of more than 700 people with rheumatoid arthritis for a period of 10 to 12 years found an increased mortality rate of 86 percent above normal. By comparison, the same study found an 11-percent increased mortality among more than 300 people with osteoarthritis (Monson and Hall, 1976). An ongoing study in Finland is comparing the mortality among 1000 rheumatoid arthritis patients with that among 1000 persons of similar age and sex. After 5 years, 176 rheumatoid arthritis patients and 107 matched controls have died (Koota et al., 1977).

USE OF MEDICAL CARE

Another NCHS survey, conducted in 1973, collected data on office visits from a sample of 1103 physician offices (NCHS, 1975). Problems of the arms or legs were, together, the second most frequent reasons given by patients for an office visit, accounting for a total of 6.9 percent of all visits. By contrast, pregnancy accounted for 4.0 percent of visits, sore throat for 3.2 percent, and high blood pressure for 1.1 percent. When the same data were analyzed by the diagnostic category assigned by a physician to the visit, joint disorders were still among the more commonly reported principal diagnoses for an office visit. Bursitis or tenosynovitis accounted for 1 percent of all visits; osteoarthritis, 1 percent; "unspecified" arthritis, 0.6 percent; rheumatoid ar-
thritis, 0.4 percent; and gout, less than 0.3 percent; making a total of 3.3 percent of all visits that had a principal diagnosis of some kind of joint disorder. By comparison, the two highest-ranking single diagnostic categories—prenatal care and hypertension—accounted for, respectively, 3.9 and 3.5 percent of all office-based visits. Sore throat (streptococcal and pharyngitis) accounted for 2.0 percent.

The importance of arthritic and other joint problems in prompting the use of medical care was further confirmed by information from the 1977 National Ambulatory Medical Care Survey (NCHS, 1980a). Osteoarthritis, synovitis and bursitis, unspecified arthritis, and rheumatoid arthritis plus allied conditions were among the 50 most frequently rendered principal diagnoses, and collectively accounted for 18.3 million visits (3.1 percent of all office visits that year).

The major osteoarthritic and rheumatic conditions (excluding rheumatic fever and heart disease) also account for a substantial number of inpatient episodes. In 1978, for example, 549,000 persons were discharged from short-stay hospitals with those diagnoses (as the first-listed diagnoses). They accounted for about 1.5 percent of all persons discharged, which can be compared with, for instance, about 1.2 percent for acute myocardial infarction (heart attack) or 1.6 for diabetes, 3.6 percent for chronic ischemic heart disease, and 5.0 for malignant neoplasms (NCHS, 1980b). A decade earlier, the percentages of persons discharged were similar: 1.2 percent (arthritis, etc.), 1.3 percent (acute coronary occlusion), 1.4 percent (diabetes), 2.5 percent (atherosclerotic heart disease), and 3.7 percent (cancers).

In short, the arthritic conditions account for a good deal of medical care, including hospitalization. As the population ages, it is becoming or can be expected to become an even more important problem.

EFFECTS OF MEDICAL CARE

The two major beneficial effects of medical care for joint disorders are the relief of pain, which in turn increases mobility, and the prevention of deformity and further progression of the disorder. A related goal of medical care is to cure or correct an underlying etiologic condition. These effects are easier to achieve with gout, bursitis, and tenosynovitis than with osteoarthritis and rheumatoid arthritis because the latter two disorders produce more persistent pain and progression.

Treatment to relieve the pain of gout is so successful that it is often diagnostic of the disorder. The drug colchicine, given in frequent small doses, produces relief within 24 to 72 hours in almost all cases,
but occasionally has some serious side effects. Newer nonsteroidal anti-inflammatory drugs produce fewer side effects than colchicine when given for a short time, although they are not specific for gout (Medical Letter, 1976). Prevention of subsequent attacks of gout is possible with drugs intended to lower uric acid levels in the blood, but the disadvantages of such therapy may outweigh the advantages (Liang and Fries, 1978).

Physicians disagree about the wisdom of drug therapy for hyperuricemia in the absence of a history of gouty arthritis. Such therapy is now recognized as having certain risks (Liang and Fries, 1978), and the condition of hyperuricemia itself may not carry a risk that makes the drug therapy worthwhile. Several studies have found associations between hyperuricemia and other conditions (aging, alcohol abuse, vascular disease, and high blood pressure), but few have been able to isolate the details or causal direction of such associations. Most recently, among 71 men with uncomplicated high blood pressure, uric acid levels were found to be continuously and inversely related to renal blood flow measurements; hyperuricemia was associated with decreased renal blood flow (Messerli et al., 1980). The authors concluded that high uric acid levels do not contribute to high blood pressure, but, rather, when hypertension is found in combination with hyperuricemia, the combination may reflect renal damage due to hypertension. Messerli et al. recommend that the hypertension in such cases be treated, even in patients with borderline blood pressure elevations.

Treatment for bursitis and tenosynovitis varies with the stage of the disorder. Acute pain may respond to rest or aspirin, which also reduces inflammation. Persistent inflammation may require a short course of treatment with stronger drugs. Steroids can be injected directly into the bursa or the tendon sheath, but repeated injections may produce scarring and damage to joint structures. In chronic cases, any irritating residue from repeated episodes of inflammation may have to be removed surgically to produce lasting relief. Preventive measures are intended to discourage excessive stress on the joint while maintaining full range of motion (Rodnan, 1973; McCarty, 1979).

Treatment with aspirin is usually sufficient to bring relief from the pain of osteoarthritis, and local heat with massage is also helpful. When the joints are stiff, the stiffness usually passes with mild activity. Steroids are not warranted, except for rare injections into the joint to give enough relief to begin exercises for increasing mobility. Prevention of progressive joint destruction can be achieved in some cases by limiting excessive activity of the joints and preventing further stress on weight-bearing joints by the use of braces, a cane, or other
devices. For joints that have become so destroyed that mobility is severely limited even when pain is relieved, surgical reconstruction is occasionally necessary and is successful in selected cases (Rodnan, 1973; Swezey, 1974).

For the pain of rheumatoid arthritis, aspirin is still the safest and best initial treatment. Because it has no anti-inflammatory action, acetaminophen is not helpful. A variety of nonsteroidal anti-inflammatory drugs (e.g., indomethacin, ibuprofen, naproxen) have been introduced in the past several years that appear to have an anti-inflammatory action similar to that of aspirin, but with less stomach irritation than aspirin in some people. However, individual patients show varied responses to each drug (Medical Letter, 1980). Gold or steroids may be used in cases that do not respond to aspirin or to the milder anti-inflammatory drugs, but their use carries serious risks. Rarely, gold produces bone marrow depression and renal damage. Extended use of steroids can lead to peptic ulcer formation, severe osteoporosis, cataracts, and other problems. In addition to gold and steroids, several other drug therapies can be effective, including penicillamine (Medical Letter, 1978), antimalarials, and immunosuppressive agents (Rodnan, 1973), but they also have serious side effects, especially after prolonged use. These drugs are reserved for use in patients with severe, rapidly progressive disease.

As with osteoarthritis, surgical restoration of destroyed joints can be quite successful in selected cases (Erlinch, 1974). A comprehensive program of drug therapy, surgical therapy, physical therapy, and rehabilitation in a hospital setting has been notably successful for patients who have become partially or totally disabled by rheumatoid arthritis. A study of 120 men so treated found that 58 percent had returned to part- or full-time work after a followup period of over 3 years (Robinson and Walters, 1971). Another survey of 77 patients who had been confined to a wheelchair or bed at the time of admission found that 64 (83 percent) improved functionally during the hospital treatment. They advanced from bed to wheelchair or from wheelchair to independent movement. Surgical procedures were performed on 56 of the 77 patients. Eight patients (10 percent) suffered relapses following discharge, but 40 (52 percent) had maintained their improved level of function during a 4-year followup period (Conaty and Nickel, 1971).
Chapter 4

HEALTH INSURANCE STUDY METHODS

PREVALENCE OF JOINT DISORDERS

The Health Insurance Study (HIS) used three sources of information to measure the prevalence of joint disorders among its adult participants—a Medical History Questionnaire (MHQ), a medical screening examination, and health insurance claim forms. These first two pertain to prevalence at enrollment and at exit, the last only to prevalence at exit. They are described more fully below.

Medical History Questionnaire

The MHQ was a self-administered questionnaire that included several questions about joint problems. It was completed by all adults (14 years of age and older) at the time of enrollment in the HIS (1 to 3 weeks before the screening examination) and again at the time of exit, 3 or 5 years later.

The MHQ had two parts, Form A and Form B. At enrollment, Form A was to be completed by all adults in all sites; Form B was to be completed by all adults in sites other than Dayton and by a randomly selected subsample of adult enrollees in Dayton. All participants received both parts of the MHQ at exit. For all sites except Dayton, the Joint Problems battery was contained in the Form B part of the MHQ; for Dayton, it was in Form A. Thus, all adult enrollees had an opportunity to respond to it. An additional battery (on “other illnesses” including bursitis) appeared in Form B in all sites except Dayton; it was included in a separate questionnaire administered during the first year of the HIS in that site.

Two versions of the Joint Problems battery are reproduced in Appendix A. One was used at Dayton enrollment; the other was used at enrollment in all other HIS sites and at exit in all sites. Differences between the two versions are the result of minor changes in the Dayton version intended to provide better information on the timing of medical care for joint problems. The battery is introduced by the question, “During the past 12 months, have you had any pain, aching, swelling or stiffness in your joints—for example, your fingers, hip, or knee? (Do not count problems caused by an injury).” Persons who responded “yes” continued on to complete the battery, and those who
responded "no" skipped the rest of the Joint Problems battery. The single version of the portion of the Other Illnesses battery pertaining to bursitis is also reproduced in Appendix A.

The questions about joint problems related to prevalence include those pertaining to symptoms (pain, swelling, stiffness) and to previous physician diagnoses of gout, rheumatism, or arthritis. Other items refer to use of medications, visits to doctors, and adverse effects of the condition on daily life (discussed below).

**Medical Screening Examination**

The second source of data used to estimate the prevalence of joint disorders was a medical screening examination administered to a randomly selected group of participants. They represented between 50 and 75 percent of all participants (depending on the site) at enrollment. All participants receive the screening examination at exit.

The screening examination included measurements of blood urate level, grip strength, walking speed, joint size, rheumatoid factor, and x-ray evidence of joint disease in the hands and wrists. These measures are briefly described below; Smith et al. (1978) elaborate on the screening examination procedures.

Analysis of the urate level in the blood was done for all adults who were present at the screening examination. The blood was analyzed by the automated method of Sabrinho and Simoes, discussed in Chapter 2, which involves the reduction of phosphotungstate to phosphotungstite (Musser and Ortigoza, 1966). A random sample of 10 percent of the examinees was selected to have extra blood drawn for reliability testing. Duplicate blood samples from the same examinee were labeled separately (so the laboratory would not recognize them) and sent to the laboratory in different batches. Results of this split sample analysis were compared to determine the reliability of the urate level measurement.

Four other measurements were performed only for those adults who answered "yes" when asked at the screening examination, "During the past year have you had pain, aching, swelling, or stiffness in your joints (not counting injuries)?" These four measurements were for grip strength, walking speed, joint size, and rheumatoid factor.

Grip strength was measured with a sphygmomanometer that con-

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1 This random sample of participants will be used later to study the effect of undergoing the screening examination on the subsequent use of medical services and on health status at the time of exit from the Study.
sisted of an inflatable rubber bag attached to a mercury pressure gauge. With the bag already inflated to 20 mm Hg, the examinee was told to squeeze the bag as hard as possible without pinching it or touching anything except the bag with the arm and hand being tested. The pressure gauge was not visible to the examinee during the test. Each hand was tested three times and the maximum pressure was recorded for each of the six tries, except that pressures above 250 mm Hg were recorded as 250 mm Hg. Nine percent of the examinees were randomly selected to be retested after 1 hour to obtain a measure of the reliability of the grip strength measurement.

Walking speed was measured over a total distance of 50 feet, with a walk of 25 feet from the starting line, a turn, and a walk of 25 feet to return. The examinee was instructed to walk as fast as possible, without running. The recorded time was measured with a stopwatch to the nearest tenth of a second. Times exceeding 99.9 seconds were recorded as 99.9 seconds. Canes, crutches, and other mechanical aids, except wheelchairs, were allowed. People who required human assistance for the test were not required to complete the test and were assigned a recorded time of 99.9 seconds. Nine percent of all persons who took the walking test were randomly selected to repeat it after 1 hour to measure the test's reliability.

Joint size was measured with an arthrocircameter manufactured by Abbott Laboratories. This portable device consists of a flexible plastic loop that is threaded over a finger joint and allowed to tighten to its own tension. Tension on the loop is maintained by a spring attached to a take-up drum. The circumference of the plastic loop, expressed in millimeters, is read from a scale on the take-up drum that ranges from 40 to 100 mm. The arthrocircameter was used rather than jeweler's sizing rings because it was quicker and caused less discomfort to tender joints. The accuracy of a gauge similar to the Abbott arthrocircameter has been found to be equivalent to the ring method for measuring joint size (Boardman, 1967).

For all sites other than Dayton the procedure for the measurement of joint size was the same. First, the middle joint (proximal interphalangeal) of each finger and thumb was measured once, for a total of 10 measurements. Then, the left ring finger was measured a second time to obtain immediate information on the reliability of the arthrocircameter. At Dayton, the two "worst" middle joints on each hand were measured twice and the single most "normal" middle joint on each hand was measured twice, for a total of 12 measurements. This procedure was changed for all subsequent sites because it was decided that the impressions of "worst" and "normal" were too subjective. Eight percent of all examinees were randomly selected to return 1 hour later for a repeat measurement of joint size to obtain a measure of the reliability of the entire procedure.
Unlike other measurements, joint size was measured at the exit screening examination only for those adults who had had joint size measured at the enrollment screening examination. This was done because there are no reference values for normal joint sizes, and measurements for an individual are meaningful only when compared with other measurements for that individual.

Rheumatoid factor was measured in two stages. First, a screening test that is highly sensitive for rheumatoid factor was done. If the result of the screening test was positive, the second test was performed. The second test measured the exact amount of rheumatoid factor present as serum titer (the reciprocal of the most dilute blood serum sample that still shows a positive reaction). A comparative study of the many methods by which rheumatoid factor can be measured concluded that such a two-staged procedure is the best blend of sensitivity and specificity (Waller, 1969). At all examinations except the enrollment screening examination at Charleston, South Carolina, the latex fixation method was used for both the initial screening test and for the exact titer test (Singer and Plotz, 1956; 1958). The Charleston laboratory used a sheep cell agglutination method instead. A random sample of 8 percent of the examinees at all sites had their blood samples retested to determine the reliability of the rheumatoid factor test.

X-rays of both hands and wrists were taken only for those adults at the enrollment screening examination who were not pregnant and who answered "yes" when asked, "Have you had any pain, aching, swelling, or stiffness in your hands and/or wrists in the past 12 months?" The x-rays were interpreted by a board-certified radiologist. Rheumatoid arthritis was scored on a five-point scale as none (0), doubtful (1), minimal (2), moderate (3), or severe (4), according to the criteria of Kellgren and Lawrence (1957). Osteoarthritis and gout were scored as absent or present. The hand and wrist x-rays were not taken at the exit screening examination. They had been included at enrollment as an adjunct to the rheumatoid factor test to screen for cases of rheumatoid arthritis, and the yield was not sufficient to justify performing the x-rays at the exit examination.

At the exit screening examinations, a physician interview and examination was given to all participants considered to be under active treatment for a joint disorder at the time of exit from the HIS. Active treatment was defined as a minimum of three visits for a joint disorder during the preceding 18 months, as indicated by physicians' diagnoses on health insurance claim forms submitted during that period. During this interview and physical examination, the physician determined whether a joint disorder was present and whether current ther-
apy and management were adequate. To standardize the evaluation, a physician member of the Rand staff trained the examining physician to use an HIS recording form that was designed to elicit the examining physician’s evaluation and interpretation by means of specific questions and established response categories. This form is reproduced in Appendix B. In addition, the physician dictated a detailed narrative of the interview and physical examination, so that the reliability and validity of his or her judgments based on the data recorded could be assessed independently by other physicians. This direct evaluation by a physician at the exit screening examination provided data about the medical care for joint disorders that could be obtained only by interview and physical examination.

Insurance Claim Forms

A third source of information by which the presence of joint disorders can be estimated is the HIS insurance claim form. The problem-oriented forms are submitted by the enrollee’s physician and include up to four diagnoses. They also provide data on laboratory tests ordered, procedures performed, and medications dispensed or prescribed. Additionally, pharmacy claim forms provide information on prescriptions filled. Thus, independent of responses to the MHQ or findings from the screening examination, a person can be identified as having been treated for joint problems during the course of the Study.

CRITERIA FOR CLASSIFICATION

The two main criteria by which a person can be said to have a joint disorder at the beginning or end of the Study are complex. The first criterion pertains to diagnoses on claim forms; the second, to a combination of information from the MHQ and the screening examination.

First, a person will be defined as having had a joint disorder at some time during the HIS if a physician has listed a relevant diagnosis on insurance claim forms. Table 3 lists the four main categories of joint disorders—gout, rheumatoid arthritis, acute nonspecific joint disorders, and chronic nonspecific joint disorders—together with the minimum number of claims on which the diagnosis must appear to be counted and the relevant diagnostic codes.

Second, a person will be defined as having had a joint disorder if he or she meets the criteria based on MHQ and screening examination data (at enrollment or exit) illustrated in Fig. 1 and described more fully below. Although the four main categories of disease are the same
### Table 3  
**Definition of Joint Disorders Based on Diagnoses Listed on Insurance Claims**

<table>
<thead>
<tr>
<th>Joint Disorders</th>
<th>Number of Claims&lt;sup&gt;a&lt;/sup&gt;</th>
<th>HICDA Code(s)&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Diagnoses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gout</td>
<td>2</td>
<td>274</td>
<td>Gout</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>2</td>
<td>712.0-712.9</td>
<td>Rheumatoid arthritis and allied conditions</td>
</tr>
<tr>
<td>Acute joint disorders, nonspecific&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1</td>
<td>710, 711</td>
<td>Acute pyogenic arthritis, Acute nonpyogenic arthritis</td>
</tr>
<tr>
<td>Chronic joint disorders, nonspecific&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3</td>
<td>713.0, 714.1-714.9, 715, 718, 724.1-724.9, 726, 731.1-731.9</td>
<td>Osteoarthritis, Other specific forms of arthritis, Arthritis, unspecified, Rheumatism, unspecified, Internal derangement of joint, Disorders of sacroiliac joint, Synovitis, bursitis, tenosynovitis</td>
</tr>
</tbody>
</table>

<sup>a</sup>Minimum number of claims on which the listed diagnosis must appear.

<sup>b</sup>From the *Hospital International Classification of Diseases* (H-ICDA-II), adapted for use in the United States (2d ed., 1973).

<sup>c</sup>Excluding disorders due to traumas and excluding disorders of the spine.
Fig. 1—Definition of joint disorders based on responses to MHQ questions about joint symptoms and a screening test for rheumatoid factor.
as those defined for claim forms, gradations of illness will be made for chronic nonspecific joint disorders (mild; moderate) and for rheumatoid arthritis (possible; probable).

A "yes" answer to the first question in the Joint Problems battery (refer to Fig. 1) initially discriminates between people who have had joint problems during the past year and those who have not. The people who responded "yes" to this question were subsequently asked a number of more specific questions about their joints, including, "Has a doctor ever said that you have gout?" People who answered "yes" to this item were classified as having symptomatic gout (symptomatic in the past year). People with asymptomatic gout will be identified from the analysis of insurance claims (see Table 3). The results of uric acid determinations will be analyzed as a means of further describing the Study population, but they will not be used to estimate the prevalence of gout in the HIS because a high uric acid level is not specific for this diagnosis (as explained in Chapter 2).

With the exception of gout, the MHQ and screening examination data are not expected to discriminate precisely between other joint disorders such as bursitis, osteoarthritis, and rheumatoid arthritis. We will, however, be able to separate acute from chronic disorders, and mild chronic disorders from more severe chronic disorders (see Fig. 1), using four questions about chronic joint symptoms from the battery. The group with moderate joint disease (as contrasted with mild), which is defined by having at least two of three chronic symptoms (pain, swelling, or morning stiffness), also meets the American Rheumatism Association (ARA) criteria (Table 1 in Chapter 2) for "possible" rheumatoid arthritis. If anyone in this group also has a positive screening test for rheumatoid factor, he or she is reclassified as having "probable" rheumatoid arthritis.

We originally thought that chronic morning stiffness lasting more than 15 minutes would discriminate between rheumatoid arthritis and other joint disorders. Some studies, however, have found that the stiffness of osteoarthritis may last as long as 15 minutes. Furthermore, the Cooperating Clinics (1965) study reported that stiffness associated with rheumatoid arthritis lasted at least 25 minutes among 76 percent of 491 rheumatoid arthritis patients studied, and often lasted more than an hour (69 percent of those studied). Additionally, the ARA has included morning stiffness of any duration among its criteria for rheumatoid arthritis. Consequently, in the HIS, a "yes" answer to either question about chronic stiffness, regardless of duration, is counted equally toward the definition of having a joint disorder (see Fig. 1).

X-rays of the hands and wrists were taken at enrollment for adults who reported having symptoms in the hands and/or wrists. The x-rays
contribute additional information about joint disorders among those people who had x-rays taken, and will allow us to estimate the general prevalence of positive x-ray findings among symptomatic adults. They will not, however, be used to determine the prevalence of joint disorders among the entire HIS population, for several reasons. First, as noted earlier, specific x-ray changes are seldom found in cases of bursitis or gout. Furthermore, although specific changes do occur in rheumatoid arthritis, the prevalence of that disorder among the general population being screened is expected to be so low (less than 3 percent) that the reliability of a few positive hand/wrist x-rays would be unacceptable for the definition of case prevalence. As for osteoarthritis, the HIS has decided to combine cases of osteoarthritis with other chronic nonspecific joint disorders on the basis of reported symptoms; therefore, the x-ray evidence of osteoarthritis in the hands will not be needed to discriminate cases of osteoarthritis from other joint disorders.

Measurements of joint size, grip strength, and walking speed will be used to compare an individual's functional severity of joint disorders at enrollment and at exit. They will not be used to define the prevalence of joint disorders in the HIS because, as noted earlier, the absolute values of these measurements have limited meaning.

DISEASE IMPACT

The impact of joint disorders on health comes primarily from the chronic pain they cause, and from the consequent limitations on mobility and activity. Another harmful consequence of such problems is fear of disability or deformity. Poor medical care may also result in deleterious effects, such as incorrect diagnostic labeling, unwanted side effects from prescribed therapies, or a lack of benefit (insufficient relief from pain; needless activity restriction) owing to efficacious therapies' not being prescribed.

Each of these sources of disease impact was measured in the HIS. The Joint Problems battery contained a set of questions dealing with personal mobility—for instance, whether help was required for certain activities of daily living such as bathing and eating. In addition, a separate set of four questions in another part of the battery centered on the amount of chronic joint pain, limitations on general activity (how much of the time usual activity was restricted because of joint problems, and how many days in bed were attributed to joint problems), and fear of disability or deformity as reflected in the amount of worry or concern attributed to joint problems.
The four items on pain, worry, activity restriction, and days in bed are part of a standard set of questions that appears repeatedly in the MHQ in association with various diseases and conditions. They were not specifically constructed to measure the adverse consequences of joint disorders (or any other particular condition) but rather to facilitate comparisons of similar kinds of impact among several diseases and conditions. They are meaningful, however, with respect to three major consequences of joint disorders: pain, fear of disability, and reduced physical activity.

Responses to the pain, worry, and activity restriction questions could range from "none" to "a great deal" (or equivalent wording, depending on the question). (The Dayton enrollment questionnaire had slightly different wording for the response categories.) The question about days in bed required that the respondent write either zero or the specific number of days in bed attributed to a joint disorder. In addition, a composite measure 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 of the four disease impact questions.

Additional data about mobility and activity were gathered from the physical screening examination measures of grip strength and walking speed. Joint size is well correlated with the severity and progression of osteoarthritis. All three of these outcome measures are most meaningful when used to demonstrate changes in individuals from one time to another. The data from the time of enrollment in the HIS will be reported here for interest, and to validate the questionnaire measures of personal mobility and activity. The real usefulness of these measures, however, will be in the comparisons of enrollment and exit measures for affected persons on the various health insurance plans.

Medical care for joint disorders is assessed against quality-of-care criteria developed specifically for joint disorders (see Chapter 6). An additional measure of the impact of medical care (applied to persons who were under active treatment for a joint disorder at the time of exit from the HIS) is the special physician interview scheduled during the exit medical screening examination (see "Prevalence of Joint Disorders," above). It results in an independent opinion by the examining physician of the validity of the diagnosis and the effectiveness of the current therapy for the presumed joint disorder. The physician’s opinion is recorded on a standardized form (reproduced in Appendix B) and is used to measure two possible sources of impact from the medical care for joint disorders: inappropriate diagnostic labeling and inappropriate therapy. Inappropriate diagnostic labeling is measured by the examining physician’s level of agreement with the diagnosis.
Inappropriate therapy is measured by the examining physician's estimate of two possible outcomes from changing the current therapy: the estimated level of improvement and the estimated level of reduction in side effects.
Chapter 5

HEALTH INSURANCE STUDY
ENROLLMENT RESULTS

The Health Insurance Study enrolled a total of 5835 adults (14 years and older) at 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 should reach age 65 during the experiment (the Dayton control population included two men over age 62). The Preface and Volume 1 contain additional information about the HIS sample and enrolled population.

Of the 5835 adults enrolled, 5715 (98 percent) completed Form A of the Medical History Questionnaire (MHQ). They include all adults enrolled in any of the HIS experimental health insurance plans, plus a control group from Dayton and a “pre-enrollment group” from South Carolina. A total of 5350 adults received and completed Form B, of the 5472 persons eligible to complete it (i.e., excluding the 363 people in Dayton who were not asked to complete it); thus, the true completion rate for Form B was also 98 percent (5350 of 5472 persons).

The screening examination was administered to 3321 adults at the time of enrollment in the HIS in six sites. Those who received the examination at enrollment represented a random subsample of nearly 60 percent of the entire sample. A total of 3265 individuals had a blood uric acid measurement. (All screened persons were eligible to have the uric acid test, but 53 did not because they refused to have blood drawn (43 individuals) or because blood was unobtainable or untestable.) Only persons who met certain medical history criteria received the specialized hand/wrist x-rays (348 individuals). Finally, 764 individuals were eligible to have the four other physiologic measures (rheumatoid factor test, grip strength, walking speed, and joint size), and about 760 individuals did so. (The numbers of persons with complete data varied slightly among these four tests.)

34
ALL JOINT DISORDERS

Prevalence

Of the 5835 adults enrolled, 5713 received and completed the MHQ form that contained the Joint Problems battery. Based on their responses to the first question in that battery regarding joint symptoms in the previous year, 1432 (25 percent) were classified as having a joint disorder (Table 4).

To classify these 1432 people as having gout, rheumatoid arthritis, or some nonspecific joint disorder (osteoarthritis, bursitis, etc.), we looked at each person's responses to subsequent questions, according to the algorithms presented in Fig. 1, Chapter 4. Figure 2 shows the numbers of persons falling into the several joint-disorder classifications.

Of the 1432 with recent joint symptoms, 72 (5 percent) were classifiable as having gout; the remaining 95 percent had nonspecific joint disorders. This last group was nearly evenly divided among three types: acute (33 percent), chronic mild (35 percent), and chronic moderate (27 percent). The latter group fits the American Rheumatism Association (ARA) criteria for "possible" rheumatoid arthritis. The prevalence of the different types of joint disorders is summarized in Table 5. One in four people in the HIS had some type of joint disorder. Eight percent of the entire HIS population had an acute joint problem; 17 percent, gout or another chronic joint disorder.

The prevalence rate of all types of joint disorders combined, by age and sex, is shown in Table 6. As expected, prevalence increases with age, regardless of sex, and is higher among women at all ages. The proportion of joint disorders that were labeled "acute" decreased with increasing age, from 44 percent of people 14 to 24 years of age with joint disorders to 23 percent among those 45 to 62. Conversely, chronic joint disorders accounted for an increasing proportion of joint disorders as age increased.

In all sites except Dayton at enrollment, a set of questions was asked about the presence of various conditions (such as bursitis) not included in one of the disease-specific batteries of the MHQ. Of 5709 adults responding, 205 (3.6 percent) claimed to have had bursitis within the previous 12 months. (Bursitis is discussed again later in the section on "Nonspecific Chronic Joint Disorders.")
Table 4

**DISTRIBUTION OF RESPONSES TO QUESTIONS ON THE MHQ ABOUT THE SYMPTOMS OF JOINT DISORDERS**

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>During the past 12 months have you had any pain, aching, swelling, or stiffness in your joints? For example, your fingers, hip, or knee? (Do not count problems caused by an injury.)</td>
<td>Yes</td>
<td>1432</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>4277</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>48</td>
<td>(b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5713</td>
<td>100</td>
</tr>
<tr>
<td>Has a doctor ever said that you have gout or high uric acid level?</td>
<td>Yes</td>
<td>72</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1358</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>2</td>
<td>(b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1432</td>
<td>100</td>
</tr>
<tr>
<td>Have you had pain or aching in any of your joints on most days for as long as a month?</td>
<td>Yes</td>
<td>512</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>916</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>4</td>
<td>(b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1432</td>
<td>100</td>
</tr>
<tr>
<td>Have you had swelling of a joint, and pain when it was touched, on most days for as long as a month?</td>
<td>Yes</td>
<td>222</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1206</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>4</td>
<td>(b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1432</td>
<td>100</td>
</tr>
<tr>
<td>Have you had stiffness in joints or muscles when first getting out of bed on most mornings for as long as a month?</td>
<td>Yes</td>
<td>516</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>909</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>7</td>
<td>(b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1432</td>
<td>100</td>
</tr>
<tr>
<td>Have you had stiffness in joints or muscles when first getting out of bed, which lasted for as long as 15 minutes?</td>
<td>Yes</td>
<td>653</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>590</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Not applicable (Dayton)</td>
<td>178</td>
<td>100</td>
</tr>
</tbody>
</table>

*a*These respondents skipped out of the remainder of the battery.

*b*Less than 0.5 percent.

*c*In the Dayton MHQ, this question was answered only by those who had answered “yes” to the previous question; the percentage calculation is thus based on 1254 respondents in the non-Dayton sites.
Fig. 2—Numbers of persons with joint disorders based on responses to MHQ questions about joint symptoms and a screening test for rheumatoid factor.
Table 5

**Prevalence of All Joint Disorders According to Findings from the MHQ**

<table>
<thead>
<tr>
<th>Joint Disorder</th>
<th>Number</th>
<th>Percent Reporting Any Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>4277</td>
<td>75</td>
</tr>
<tr>
<td>All Joint Disorders</td>
<td>1432</td>
<td>25</td>
</tr>
<tr>
<td>Gout</td>
<td>72</td>
<td>1</td>
</tr>
<tr>
<td>Nonspecific Acute</td>
<td>468</td>
<td>8</td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td>501</td>
<td>9</td>
</tr>
<tr>
<td>Mild</td>
<td>391</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Table 6

**Prevalence Rates of All Joint Disorders Combined, per 100 Persons, by Age and Sex**

<table>
<thead>
<tr>
<th>Age Group (years)</th>
<th>Men</th>
<th>Women</th>
<th>Both Sexes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rate</td>
<td>Cases per Sample</td>
<td>Rate</td>
</tr>
<tr>
<td>14-17</td>
<td>11.2</td>
<td>42/376</td>
<td>16.5</td>
</tr>
<tr>
<td>18-24</td>
<td>13.3</td>
<td>60/451</td>
<td>18.2</td>
</tr>
<tr>
<td>25-34</td>
<td>17.2</td>
<td>141/821</td>
<td>23.3</td>
</tr>
<tr>
<td>35-44</td>
<td>24.6</td>
<td>117/476</td>
<td>33.3</td>
</tr>
<tr>
<td>45-54</td>
<td>30.8</td>
<td>105/341</td>
<td>49.0</td>
</tr>
<tr>
<td>55-62&lt;sup&gt;a&lt;/sup&gt;</td>
<td>35.4</td>
<td>68/192</td>
<td>55.7</td>
</tr>
<tr>
<td>14-62</td>
<td>20.1</td>
<td>533/2657</td>
<td>29.5</td>
</tr>
</tbody>
</table>

<sup>a</sup>This group includes two men in the Dayton control group who were 65 and 69 years of age.
Use of Medical Care and Medications

The mixture of levels of severity and chronicity of joint symptoms among the entire group of 1432 people with some kind of joint disorder is illustrated by findings related to physician care and medications (see Table 7). Less than one-third reported having ever been told by a physician that they had rheumatism or arthritis. About one-quarter reported relatively recent care from a physician (i.e., within the previous 6 months) for joint or muscle problems. Within the previous year, 32 percent of the respondents had seen a physician for joint/muscle problems; of those claiming to have had bursitis, 40 percent had seen a physician.

Of those diagnosed by a physician as having gout, 26 percent were taking relevant prescription drugs (Table 7). Of those with all types of joint problems, 44 percent were taking aspirin or aspirin-containing pills, and 27 percent were taking one or more such tablets daily.

GOUT

Prevalence Findings from the MHQ, by Age and Sex

The prevalence of symptomatic gout among the HIS population is 1.3 percent—72 of 5709 adults who answered the MHQ questions about joint problems reported a physician diagnosis of gout or high uric acid levels. This is similar to the prevalence of 1.5 percent reported by Hall et al. (1967) for 5127 adults aged 42 to 71 in the Framingham Study. When the same group was studied 14 years earlier, the prevalence had been only 0.2 percent, a figure that emphasizes the age dependence of the incidence of gout. In the HIS sample, which is a somewhat younger age range (ages 14 to 62), half of those with gout were 50 years old or older; prevalence was 0.6 percent among those aged 17 to 44 and 3.7 percent among those aged 45 to 62. The HIS population is more comparable in age to the population surveyed by the National Center for Health Statistics in the 1976 Health Interview Survey (NCHS, 1978). NCHS asked adults aged 17 to 64, "During the past 12 months, did you have gout?" One percent of all adults said "yes": 0.4 percent of those aged 17 to 44 and 1.8 percent among those aged 45 to 64. Thus, the estimated prevalence of gout in the HIS enrollment sample corresponds closely to estimates from other large-scale studies.

The ratio of men to women among those with gout was lower in the HIS sample than might have been expected from national surveys or
Table 7

**Distribution of Responses to Questions on the MHQ About the Medical Diagnosis and Treatment of Joint Disorders**

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>As far as you know, during the past 12 months, have you had bursitis?</td>
<td>Yes, and saw a doctor</td>
<td>82</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Yes, did not see doctor</td>
<td>123</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>1175</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1380</td>
<td>100</td>
</tr>
<tr>
<td>Has a doctor ever said that you have rheumatism or arthritis?</td>
<td>Yes</td>
<td>444</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>985</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>3</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1432</td>
<td>100</td>
</tr>
<tr>
<td>Are you currently taking colchicine, allopurinol, zyloprim, benemid, or colbenemid for your gout or high uric acid level?</td>
<td>Yes</td>
<td>19</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>52</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>72</td>
<td>99</td>
</tr>
<tr>
<td>How many aspirins, or pills containing aspirin, do you usually take for the problems with your joints or muscles?</td>
<td>More than 12 a day</td>
<td>7</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td>4-12 a day</td>
<td>97</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>1-3 a day</td>
<td>278</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Less than 1 a day</td>
<td>251</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>796</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>3</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1432</td>
<td>100</td>
</tr>
<tr>
<td>When was the last time you saw a doctor about your problems with your joints or muscles?</td>
<td>Within past 3 months</td>
<td>156</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>3-6 months ago</td>
<td>102</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>7-12 months ago</td>
<td>103</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>More than 1 year ago</td>
<td>487</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>239</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1104</td>
<td>100</td>
</tr>
</tbody>
</table>

*aPercentages may not sum to 100 because of rounding.

bThis question appeared on the first annual Health Care Questionnaire in Dayton, 1 year after enrollment. At other sites, it appeared on the MHQ.

cLess than 0.5 percent.

dThis question was asked only of those who answered “yes” to “Has a doctor ever said that you have gout?”

eThis question was not asked in Dayton.
other studies. NCHS (1978) reported a 7:3 ratio of men to women. Among the Framingham sample, the ratio was 7:1 (2.8 percent of the men having gout, and 0.4 percent of the women). By contrast, the HIS ratio was 6:4. Given the critical association between older age and the presence of gout, the difference between Framingham and the HIS is not too surprising, and the difference between NCHS and HIS figures is relatively small. Thus, we concluded that both the age-specific and sex-specific estimates of the prevalence of gout in the HIS were quite reasonable.

Physiologic Findings from the Screening Examination, by Age and Sex

The complete distribution of uric acid levels among 3268 HIS enrollees with relevant blood test data from the screening examination is shown in Table 8. The mean level for men was 5.7 mg/dl,\(^1\) with a standard deviation (SD) of 1.3, and for women, 4.2 mg/dl (SD, 1.1). This would suggest, for instance, that an estimated upper level of normal in the HIS sample for uric acid would be 8.3 for men and 6.4 for women (mean plus 2 SD). These are well within the upper limits commonly associated with this test (as given in Chapter 2).

The uric acid levels generally rose with age, doing so at a markedly earlier age among men than women. The mean uric acid level among all adults aged 14 to 62 without a history of gout and not on any medications intended to reduce their uric acid levels was 4.9—5.6 (SD, 1.3) for men and 4.2 (SD, 1.1) for women.

Among those who were classified as having gout, 26 percent were taking medicine intended to reduce their uric acid levels (see Table 7). Excluding the 13 individuals taking such drugs who also were screened, we calculated the mean uric acid value to be 6.1 (SD, 1.3) for men with a history of gout and 4.8 (SD, 1.6) for women with such a history. These mean values are consistently higher than those of adults without gout (not significantly higher, however, by Student's one-tailed t-test).

The hand/wrist x-ray findings for those classified as having gout were inconclusive (see Tables 9 and 10). Of the 42 people with gout who were screened, 15 (36 percent) reported having symptoms in their hands or wrists and so had x-rays taken. Half (7 of 15) were interpreted as osteoarthritis and half as normal; none was interpreted as gout.

---

\(^1\)Milligrams per deciliter.
Table 8

MEAN URIC ACID LEVELS, by AGE AND SEX

<table>
<thead>
<tr>
<th>Age Group (years)</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number Screened$^b$</td>
<td>Mean Uric Acid Level</td>
</tr>
<tr>
<td>14-17</td>
<td>214</td>
<td>5.1</td>
</tr>
<tr>
<td>18-24</td>
<td>228</td>
<td>5.5</td>
</tr>
<tr>
<td>25-31</td>
<td>452</td>
<td>5.8</td>
</tr>
<tr>
<td>35-44</td>
<td>306</td>
<td>5.8</td>
</tr>
<tr>
<td>45-54</td>
<td>185</td>
<td>5.9</td>
</tr>
<tr>
<td>55-62$^d$</td>
<td>110</td>
<td>5.9</td>
</tr>
<tr>
<td>62-69</td>
<td>1495</td>
<td>5.7</td>
</tr>
</tbody>
</table>

$^a$Milligrams per deciliter.
$^b$Of 3321 persons present at the screening examination, 53 (1.6 percent) were not tested for uric acid because they refused to have blood drawn (43 persons), blood was unobtainable, or blood was untestable for other reasons.
$^c$Standard Deviation.
$^d$This group includes one man in the Dayton control group who was 69 years of age.

Table 9

NUMBER AND PERCENTAGE OF PERSONS WHO HAD HAND/WRIST X-RAYS TAKEN AT THE SCREENING EXAMINATION, BY JOINT DISORDER

<table>
<thead>
<tr>
<th>Joint Disorder</th>
<th>Total Number of Enrollees</th>
<th>Enrollees Screened$^a$</th>
<th>Hand/Wrist X-rays Taken$^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Enrollees</td>
<td>Number</td>
</tr>
<tr>
<td>None</td>
<td>4277</td>
<td>2471</td>
<td>58</td>
</tr>
<tr>
<td>Gout</td>
<td>72</td>
<td>42</td>
<td>58</td>
</tr>
<tr>
<td>Nonspecific Acute</td>
<td>468</td>
<td>276</td>
<td>59</td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>501</td>
<td>295</td>
<td>59</td>
</tr>
<tr>
<td>Moderate</td>
<td>391</td>
<td>234</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>5709</td>
<td>3318</td>
<td>58</td>
</tr>
</tbody>
</table>

$^a$Although 3321 persons were screened, 3 persons did not answer the MHQ questions about joint problems and thus were excluded from the analysis.
$^b$Hand and wrist x-rays were taken only for examinees who reported at the screening examination that they had had symptoms of joint problems in the hands and/or wrists during the previous year.
<table>
<thead>
<tr>
<th>Joint Disorder</th>
<th>Total with X-rays</th>
<th>Normal</th>
<th></th>
<th>Osteoarthritis</th>
<th></th>
<th>Rheumatoid Arthritis</th>
<th></th>
<th>Other</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
</tr>
<tr>
<td>None</td>
<td>22</td>
<td>95</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gout</td>
<td>15</td>
<td>53</td>
<td>7</td>
<td>47</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nonspecific Acute</td>
<td>81</td>
<td>93</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>112</td>
<td>84</td>
<td>17</td>
<td>15</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Moderate</td>
<td>118</td>
<td>80</td>
<td>22</td>
<td>19</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>348</td>
<td>84</td>
<td>51</td>
<td>15</td>
<td>1</td>
<td>&lt;1</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
These results were expected because, as noted in Chapter 2, x-rays may be negative for years in patients with gout. The x-rays interpreted as osteoarthritis probably represent normal aging and/or early osteoarthritis; 6 of the 7 people whose x-rays were interpreted as showing osteoarthritis were 56 years of age or older. The results of the hand/wrist x-rays for all HIS enrollees are discussed more fully in the section on "Nonspecific Chronic Joint Disorders," below.

NONSPECIFIC ACUTE JOINT DISORDERS

Prevalence, by Age and Sex

The HIS defines a person as having an acute joint disorder if he or she has had pain, aching, swelling, or stiffness in the joints during the previous year that was not due to injury. To be classified as acute, none of these joint symptoms can be "chronic" (i.e., last as long as a month), and the person should not have had a physician diagnosis of gout. This definition is expected to include brief episodes of nonspecific joint problems, acute bursitis, acute tendinitis, acute infectious arthritis, and acute flare-ups of osteoarthritis. Defined in this way, the overall prevalence of acute joint disorders in the HIS was 8 percent when the Study began (Table 5).

Prevalence increased slightly with age, from 6 percent among people 14 to 17 years of age to 10 percent among those 45 to 54. Women had slightly higher rates than men at every age.

Medical Care

Of the 468 people classified by the HIS as having acute joint problems, 16 percent reported that they had been told by a doctor that they had rheumatism or arthritis. This is (not unexpectedly) lower than the percentage among those with chronic joint problems (including gout), 38 percent (369 of 964 such persons) having reported that those diagnoses had been made by a doctor.

Physician care in this group was minimal. For example, only 2 percent reported having seen a doctor for bursitis during the previous year.
NONSPECIFIC CHRONIC JOINT DISORDERS

Prevalence, by Age and Sex

The HIS defined chronic joint disorders on the basis of combinations of symptoms reported on the MHQ. Anyone who reported having pain, swelling, or morning stiffness on most days for at least a month (but who has not been told that they have gout) was classified as having a chronic joint disorder (see Fig. 2, above). Such problems would be expected to include bursitis, tenosynovitis, osteoarthritis, and possibly rheumatoid arthritis. Defined in this way, 16 percent of the HIS population had a chronic joint disorder at enrollment (Table 5).

This large group was subdivided into "mild" and "moderate" based on the number of chronic symptoms reported: "mild" cases reported only 1 of the 3 chronic symptoms; "moderate" cases, 2 or 3 such symptoms. Some 56 percent of the cases were mild, for a prevalence of 9 percent in the entire HIS enrolled population; the prevalence of moderate cases was, thus, 7 percent.

The 16-percent prevalence of chronic joint disorders among HIS adults is similar to the NCHS rate estimated from the 1976 Health Interview Survey of 14 percent (NCHS, 1978, Tables 12 and 17, combining arthritis or rheumatism and bursitis). A decade earlier, NCHS estimated the prevalence of "moderate" or "severe" osteoarthritis based only on x-rays of hands and feet as 9 percent among adults 18 to 79 years of age (NCHS, 1966a). This rate is similar to the HIS prevalence of 7 percent for moderate chronic joint disorders (Table 5) among a younger group (14 to 61 years of age), and based on chronic joint symptoms rather than x-rays.

As noted above for acute joint disorders, prevalence rates for chronic joint disorders increased with age and were slightly higher among women for all age groups in the HIS sample. The same trends were also noted in the NCHS survey.

Symptomatology

The pattern of joint symptoms reported by HIS adults with mild and moderate chronic joint symptoms confirms the finding by other investigators that joint swelling is a symptom that is more specific for severe joint disorders than the symptoms of pain or morning stiffness. Burch and O'Brien (1965) found the ARA criterion of joint swelling to be more valuable for correctly discriminating between people with
and without rheumatoid arthritis than were the criteria of pain or morning stiffness.

The MHQ data show that persons who report having only one of three chronic symptoms—pain, morning stiffness, or swelling—rarely report swelling as their only symptom (Table 11): only 2 percent (8 of 501 persons) did so. On the other hand, among those who reported more than 1 of the 3 symptoms, 48 percent (189 of 391 persons) reported joint swelling among their symptoms. In short, joint swelling rarely appears without pain or stiffness, and thus can be considered symptomatic of a more severe chronic joint disorder.

### Table 11

<table>
<thead>
<tr>
<th>Severity of Chronic Joint Disorder</th>
<th>Number of Persons</th>
<th>Percent Reporting</th>
<th>Pain</th>
<th>Morning Stiffness</th>
<th>Swelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild&lt;sup&gt;a&lt;/sup&gt;</td>
<td>501</td>
<td>19</td>
<td>31</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Moderate&lt;sup&gt;b&lt;/sup&gt;</td>
<td>391</td>
<td>97</td>
<td>83</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>892</td>
<td>53</td>
<td>54</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Mild defined as any 1 of 3 symptoms.

<sup>b</sup>Moderate defined as 2 or 3 of 3 symptoms.

### Physiologic Findings from the Screening Examination

X-ray changes in osteoarthritis can be interpreted with a high degree of reliability, although such changes often appear without symptoms and may be part of the normal aging process. For these reasons, the HIS did not use x-rays to determine the prevalence of osteoarthritis. Instead, we employed x-rays as an adjunct to the rheumatoid factor test to screen for cases of rheumatoid arthritis.

The x-ray data for the entire HIS sample are shown in Tables 9 and 10, above. A total of 529 persons with mild or moderate chronic joint disorders had been randomly selected (prior to our knowledge of their problem) to receive the screening examination; of these, 230 (43 percent) qualified for a hand/wrist x-ray by virtue of reporting symptoms in their hands and wrists during the previous year. By contrast, 36
percent of those with gout, 29 percent of those with acute joint disorders, and 1 percent of persons determined to have no joint disorders had claimed such symptoms (and thus had a hand/wrist x-ray taken).

Among the group with chronic joint disorders who received an x-ray (see Table 10), 188 (82 percent) had normal x-rays, 39 (17 percent) showed osteoarthritis, 1 (0.4 percent) showed signs of rheumatoid arthritis, and 2 (0.9 percent) showed signs of "other" changes. Conversely, 47 percent of those with gout had x-rays interpreted as osteoarthritis. Only 5 percent of those classified as having either no or only acute joint disorders had x-ray findings compatible with osteoarthritis.

RHEUMATOID ARTHRITIS

Prevalence

According to ARA criteria, "possible" rheumatoid arthritis requires a history of at least 2 of 3 chronic joint symptoms: pain, swelling, or morning stiffness. Defined in this way, the prevalence of possible rheumatoid arthritis in the HIS is 6.8 percent (391 of 5709 persons as shown in Table 5). "Probable" rheumatoid arthritis requires 3 or 4 of the 11 ARA criteria, and the ARA definition is somewhat more strict than that of the HIS because the ARA specifies that pain and swelling must be observed by a physician and that all symptoms must have been present for at least 6 weeks, not "at least a month" as stated on the MHQ. If we allow the chronic symptoms reported on the MHQ to satisfy the ARA criteria, then a diagnosis of probable rheumatoid arthritis can be applied to HIS enrollees with possible rheumatoid arthritis who have, in addition to their symptoms, a positive test for rheumatoid factor. Of the 391 people with possible rheumatoid arthritis, 190 were screened for rheumatoid factor, and 12 of the 190 (6 percent) were positive. Thus, the overall prevalence of probable rheumatoid arthritis in the entire Study population is 0.4 percent (12 of 3318 who were screened).

This rate is much lower than the overall rate of 3.2 percent reported by the NCHS for more than 6000 adults aged 18 to 79 (NCHS, 1966b, Table 3). The difference can be explained partly by differences in methods of measurement and partly by the smaller proportion of older people in the HIS. The NCHS tested for more of the 11 ARA criteria than did the HIS; e.g., the NCHS survey included examination for subcutaneous nodules and questions about swelling in multiple or
symmetrical joints. Hence, the likelihood of the NCHS's finding 3 or 4 of the 11 "probable" rheumatoid arthritis criteria in each person they surveyed was increased. Furthermore, the NCHS study population included a larger proportion of people older than age 44 than did the HIS sample. Because the prevalence of rheumatoid arthritis increases dramatically with age (nearly doubling with each decade of age past age 44), the older NCHS population would be expected to have a higher prevalence of rheumatoid arthritis.

Physiologic Findings from the Screening Examination

As shown in Table 10, only one person had a hand/wrist x-ray that was interpreted as rheumatoid arthritis, with a grade of "minimal" severity. That person had reported only one chronic joint symptom on the MHQ (equivalent only to mild nonspecific disorder), so had not been classified as having even possible rheumatoid arthritis.

The results of the HIS test for rheumatoid factor are given in detail in Table 12. The rheumatoid factor test was performed only when a person reported at the screening examination that he or she had suffered pain, aching, or swelling in the joints during the previous year. The symptomatic subsample—757 persons—represents 23 percent of the total number of HIS enrollees who received the screening examination.

Seven percent of those tested for rheumatoid factor (53 individuals) were positive by the initial, more sensitive slide test. Of these, 2 percent (12 of 757) showed rheumatoid factor in titer concentrations greater than 1:80.

As discussed in Chapter 2, a positive screening test for rheumatoid factor (the sensitive slide test) is an acceptable ARA criterion (contributing to the diagnosis of rheumatoid arthritis) only if it is positive among the general population at a rate of 5 percent or less. As just reported, the HIS rate was 7 percent. We do not consider this an invalid finding, however, because the tested HIS population was not representative of a general population—it was selected on the basis of recent joint symptoms. Moreover, other large studies have found the particular rheumatoid factor screening test method used in the HIS to be positive at a rate below 5 percent among the general population.

An interesting finding in Table 12 is the 14-percent rate for positive rheumatoid factor among people who we judged did not have a joint

3Only about 75 percent of the people who had reported joint problems in the MHQ also reported problems at the screening examination. Possible explanations for this inconsistency are discussed in the section entitled "Validity of the Medical History Questionnaire," below.
<table>
<thead>
<tr>
<th>Joint Disorder</th>
<th>Number of Persons Screened</th>
<th>Rheumatoid Factor Test&lt;sup&gt;a&lt;/sup&gt; Done</th>
<th>Rheumatoid Factor Test Positive</th>
<th>Titer Greater Than 1:80</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Number</td>
<td>Percent&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>None</td>
<td>2471</td>
<td>114</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Gout</td>
<td>42</td>
<td>34</td>
<td>81</td>
<td>3</td>
</tr>
<tr>
<td>Nonspecific Acute</td>
<td>276</td>
<td>186</td>
<td>67</td>
<td>10</td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>295</td>
<td>233</td>
<td>79</td>
<td>12</td>
</tr>
<tr>
<td>Moderate</td>
<td>234</td>
<td>190</td>
<td>81</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>3318</td>
<td>757</td>
<td>23</td>
<td>53</td>
</tr>
</tbody>
</table>

<sup>a</sup> The rheumatoid factor test was performed only for examinees who reported at the screening examination that they had had pain, aching, or swelling in their joints during the previous year.

<sup>b</sup> Percentage of those screened.

<sup>c</sup> Percentage of those with a test performed.
disorder according to their responses on the MHQ. At the screening examination, these people reported that they did indeed have joint symptoms, and so they were tested for rheumatoid factor. This inconsistency in reporting joint symptoms may have arisen in part from our omitting the instruction "Do not count problems caused by an injury" from the screening examination version of the question about joint symptoms. The people who had denied symptoms on the MHQ but claimed to have some at the screening examination may simply have been reporting symptoms secondary to injury.

The unusually high rate of positive rheumatoid factor tests among this presumably "normal" HIS group, 14 percent compared with 7 percent overall, also may reflect joint symptoms consequent on recent, acute inflammatory problems, perhaps generalized body aches and pains from colds and influenza. This group may simply have been reporting acute symptoms that occurred during the time interval between administration of the MHQ and the screening examination (approximately 4 to 6 weeks). The rheumatoid factor test, it will be recalled, is not specific to a particular diagnosis. It is commonly positive in many conditions not directly related to joint disorders, including minor colds and other infectious diseases that may cause general aches and pains. For example, Bartfeld (1969) found a positivity rate for rheumatoid factor of 14 percent among 42 people with viral illnesses, including influenza. Thus, although our positive rate for this test is seemingly high among those classified by the MHQ as having no joint disorders, the rate is probably not out of line with what might be expected from a subpopulation recently afflicted with the common array of acute diseases such as infections.

Medical Care and Medications

Of the 12 people classified as having probable rheumatoid arthritis, 7 reported taking at least some aspirin each day, and 2 were taking between 4 and 12 tablets each day. Only 6 of the 12 had ever been told by a doctor that they had rheumatism or arthritis.

DISEASE IMPACT

The impact from joint disorders comes primarily from pain and its consequent limitations on physical mobility and activity. In addition, worry or concern about the conditions—e.g., fear of disability—can contribute to the total detrimental impact of a joint disorder. These
sources of adverse impact were measured in the HIS by questionnaire and by physical measurement.

**Limitations on Personal Mobility**

Limitations of personal mobility were measured with five MHQ questions (about activities of daily living) and three physical measures (grip strength, walking speed, and finger joint size).

Among the 1432 people with joint disorders, only 1 to 2 percent reported any severe limitation of their personal mobility when measured by questions about activities of daily living (Tables 13 and 14). The presence or type of limitations did not differ among the various joint disorders (see Table 14). Altogether, 29 persons (2 percent of those responding) had at least one limitation; the respective figures by type of joint disorder were as follows: gout, 4 percent (of those responding); nonspecific acute, 1 percent; mild chronic, 2 percent; and moderate chronic, 3 percent.

The results of two physical measures of joint function—grip strength and walking speed—are given in Table 15. As with the questionnaire data on personal mobility limitations, only a very few people with joint disorders showed any limitations in their physical functioning as measured by grip strength and walking speed. Except for those with a moderate chronic disorder, who showed a greater frequency of walking speed problems than of grip strength problems, we detected no patterns of abnormal joint function by type of joint disorder or by type of test. Generally, the absolute numbers of persons with an abnormal physiologic test result were so small as to preclude our drawing any conclusions about physical functioning.

The measures of grip strength and walking speed are most meaningful when used to demonstrate changes in individuals from one time to another. We expect, therefore, that a comparison of each person's enrollment data with his or her exit data will reveal changes in joint function that may, in turn, reflect differences in health insurance coverage.

Joint size has been well correlated with the severity and progression of osteoarthritis (Acheson, 1972). As discussed earlier, the absolute values of joint size measurements have limited meaning because of the influence of individual characteristics, such as height, weight, sex, and bony frame. Like grip strength and walking speed, they are more meaningful as relative values when one is comparing serial measurements over time in the same person.

The results of finger joint measurements made at the enrollment screening examination are given by type of disorder and sex in Table 16. As expected, the mean joint sizes do not differ by joint disorder
Table 13

**Distribution of Responses to Questions on the MHQ About the Effects of Joint Disorders on the Activities of Daily Living**

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can you do the following things without the help of another person or any special device?</td>
<td>Yes</td>
<td>1400</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>5</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>Walk up and down stairs without help?</td>
<td>Yes</td>
<td>1408</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>5</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>99</strong></td>
</tr>
<tr>
<td>Get into and out of a car without help?</td>
<td>Yes</td>
<td>1406</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>5</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>99</strong></td>
</tr>
<tr>
<td>Bathe yourself without help?</td>
<td>Yes</td>
<td>1409</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>5</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>99</strong></td>
</tr>
<tr>
<td>Feed yourself without help?</td>
<td>Yes</td>
<td>1408</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>5</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>99</strong></td>
</tr>
</tbody>
</table>

*a* This table includes only the 1432 respondents who gave a “yes” response to the initial question in the Joint Problem battery.

*b* Percentages may not sum to 100 because of rounding.

*c* Less than 0.5 percent.
Table 14

NUMBER AND PERCENTAGE OF PERSONS REPORTING MOBILITY LIMITATIONS,
BY JOINT DISORDER AND AREA OF LIMITATION

<table>
<thead>
<tr>
<th>Joint Disorder</th>
<th>Total Persons</th>
<th>Stairs</th>
<th></th>
<th>Car</th>
<th></th>
<th>Bath</th>
<th></th>
<th>Meals</th>
<th></th>
<th>Bed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>Gout</td>
<td>72</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Nonspecific Acute</td>
<td>468</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>501</td>
<td>9</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>7</td>
<td>1</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Moderate</td>
<td>391</td>
<td>11</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>9</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>1432</td>
<td>27</td>
<td>2</td>
<td>19</td>
<td>1</td>
<td>21</td>
<td>1</td>
<td>18</td>
<td>1</td>
<td>19</td>
<td>1</td>
</tr>
</tbody>
</table>

*See Table 13 for the exact wording of the five questions about limitations.*
### Table 15

**RESULTS OF TWO TESTS OF JOINT FUNCTION AT THE SCREENING EXAMINATION, BY JOINT DISORDER**

<table>
<thead>
<tr>
<th>Joint Disorder</th>
<th>Number of Persons Screened</th>
<th>Number of Persons Tested</th>
<th>Persons with Abnormal Results&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Number of Persons Tested</th>
<th>Persons with Abnormal Results&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Number</td>
<td>Percent&lt;sup&gt;d&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>2471</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>97</td>
</tr>
<tr>
<td>Gout</td>
<td>42</td>
<td>38</td>
<td>1</td>
<td>2</td>
<td>38</td>
</tr>
<tr>
<td>Nonspecific Acute</td>
<td>276</td>
<td>190</td>
<td>4</td>
<td>1</td>
<td>189</td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>295</td>
<td>236</td>
<td>5</td>
<td>2</td>
<td>235</td>
</tr>
<tr>
<td>Moderate</td>
<td>234</td>
<td>200</td>
<td>9</td>
<td>4</td>
<td>197</td>
</tr>
<tr>
<td>Total</td>
<td>3318</td>
<td>764</td>
<td>19</td>
<td>1</td>
<td>756</td>
</tr>
</tbody>
</table>

<sup>a</sup>These tests of joint function were done only for examinees who reported at the screening examination that they had pain, aching, or swelling in their joints during the previous year. Numbers of persons tested differ slightly between the two tests because of missing data, scheduling problems, or other inconsistencies.

<sup>b</sup>Abnormal results were taken as less than 200 mm Hg for men and less than 150 mm Hg for women, based on the best of three tries in the weaker hand.

<sup>c</sup>Abnormal results were taken as a walking speed of greater than 12 seconds over a 50-foot distance.

<sup>d</sup>Percentage of the number of persons screened.
Table 16

MEAN SIZES OF FINGER JOINTS MEASURED AT THE SCREENING EXAMINATION, BY JOINT DISORDER AND SEX

| Joint Disorder         | Men | | | Women | | | | |
|------------------------|-----|---|---|-------|---|---|---|
|                        | Number Measured | Mean Joint Size | S.D. | Number Measured | Mean Joint Size | S.D. |
| None                   | 50  | 65.7 | 5.8 | 49    | 57.6 | 6.3 |
| Gout                   | 19  | 66.6 | 3.9 | 17    | 58.4 | 6.1 |
| Nonspecific Acute      | 66  | 66.0 | 5.0 | 122   | 57.1 | 4.5 |
| Nonspecific Chronic    |     |     |     |       |     |     |
| Mild                   | 74  | 65.8 | 5.8 | 162   | 57.9 | 5.3 |
| Moderate               | 68  | 66.1 | 5.2 | 129   | 57.8 | 5.3 |
| Total                  | 277 | 65.9 | 5.3 | 479   | 57.7 | 5.2 |

\(^a\) Joint size was measured only for examinees who reported at the screening examination that they had had pain, aching, or swelling in their joints during the previous year.

\(^b\) Mean joint size is a single mean of all finger joints measured for each person (see Chapter 4 for details).

\(^c\) Standard deviation.

Group. When these same people are measured at the end of the Study, however, we would expect to find differences between the enrollment and exit measurements for individuals. We might also anticipate differences between enrollment and exit for certain groups of enrollees. For instance, people whose acute joint swelling has decreased would have lower measures at exit. Likewise, people who have had adequate treatment designed to slow the progress of osteoarthritis may show less increase in joint size after 5 years than individuals who have not received such treatment.

Standard Disease-Impact Variables

In addition to the measures of impact from joint disorders just described, four general questions were asked about pain, worry or concern, and activity restriction (all during the previous 3 months) and days spent in bed (in the previous 30 days). They were part of the Joint Problems battery, and their scoring was detailed in Chapter 4. These questions are part of a standard set of disease impact questions used in the Study.
The distribution of responses to these MHQ questions are shown in Table 17. Not surprisingly, 89 percent of people with joint disorders reported at least “a little” pain, a common symptom of joint disorders. Altogether, 69 percent reported at least “a little” worry or concern about their joint problems. This probably represents fear of disability or fear of worsening of the joint problem. By contrast, only 32 percent reported any restriction of their activities, even “a little of the time.” Only 4 percent of those responding claimed to have spent days in bed during the previous month because of their joint problems, and half of these spent only 1 or 2 days.

Based on responses to these four questions, we compared impact between groups of people with various types of joint disorders. The percentage of people with each type of joint disorder that responded positively (answered something other than “none”) to each of the four questions is shown in Table 18. The detailed distribution of their responses to these same questions is given in Tables C.1 and C.2 in Appendix C.

Overall, almost everyone with a joint disorder reported some form of impact (91 percent). People with gout or a chronic nonspecific joint disorder were more likely than those with acute disorders to report all forms of impact. Furthermore, people with moderately severe chronic joint disorders were somewhat more likely than any other group to report these various adverse consequences of their joint problems.

When expressed as a percentage of the total number of 5709 persons who answered the MHQ (see the bottom row of Table 18), more than one-fifth of the entire HIS enrollment sample (22 percent) reported at least “a little” pain due to joint problems, 17 percent reported worry, 8 percent activity restriction, and 1 percent had recently spent at least 1 day in bed because of joint problems. Plainly, joint disorders, taken as a single condition, has substantial adverse effects among the HIS population in general, effects usually experienced as pain or worry.

The magnitude or degree of reported pain, worry, etc., from joint disorders is reflected in the median level of impact reported. Table 19 shows these median levels for persons who reported any deleterious effect of their joint disorder (i.e., gave a response other than “none”). For example, among people with acute joint disorders who reported at least “a little” pain, the median level of pain reported was “a little,” whereas the median level reported by people with gout was “some.” As shown in Table 19, the magnitude of impact reported by people with gout or a moderately severe chronic joint disorder was generally higher than that reported by people with acute or mild joint disorders. Differences between these two sets of enrollees with joint disorders
Table 17

**DISTRIBUTION OF RESPONSES TO QUESTIONS ON THE MHQ ABOUT THE IMPACT OF JOINT DISORDERS**

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Number</th>
<th>Percent(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>During the past 3 months, how much pain has the trouble with your joints caused you?</td>
<td>A lot</td>
<td>123</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Some</td>
<td>405</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>A little</td>
<td>748</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>None at all</td>
<td>154</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>2</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>During the past 3 months, how much has the trouble with your joints worried or concerned you?</td>
<td>A lot</td>
<td>111</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Somewhat</td>
<td>239</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>A little</td>
<td>635</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>None at all</td>
<td>445</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>2</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>During the past 3 months, how often has the trouble with your joints kept you from doing the kinds of activities other people your age do?</td>
<td>All of the time</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Most of the time</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Some of the time</td>
<td>121</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>A little of the time</td>
<td>271</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>None of the time</td>
<td>966</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>4</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>100</strong></td>
</tr>
<tr>
<td>During the past 30 days, how many days has the trouble with your joints kept you in bed all or most of the day? (If no days in bed, write “0”.)</td>
<td>0</td>
<td>1370</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3-5</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>6-10</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>11-20</td>
<td>2</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td>21-30</td>
<td>4</td>
<td>(c)</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>1432</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

\(^a\)This table includes only the 1432 respondents who gave a “yes” response to the initial question about joint problems in the Joint Problems battery.

\(^b\)Percentages may not sum to 100 because of rounding.

\(^c\)Less than 0.5 percent.
Table 18

PERCENTAGE OF HIS ENROLLEES REPORTING PAIN, WORRY, ACTIVITY RESTRICTION, AND DAYS IN BED BECAUSE OF JOINT DISORDERS, BY JOINT DISORDER

<table>
<thead>
<tr>
<th>Joint Disorder</th>
<th>Total Persons&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Percent Reporting Pain</th>
<th>Percent Reporting Worry</th>
<th>Percent Reporting Activity Restriction</th>
<th>Percent Reporting Days in Bed</th>
<th>Percent Reporting Any Kind of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gout</td>
<td>72</td>
<td>90</td>
<td>82</td>
<td>49</td>
<td>9</td>
<td>93</td>
</tr>
<tr>
<td>Nonspecific Acute</td>
<td>468</td>
<td>81</td>
<td>53</td>
<td>15</td>
<td>2</td>
<td>84</td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>501</td>
<td>91</td>
<td>68</td>
<td>30</td>
<td>1</td>
<td>93</td>
</tr>
<tr>
<td>Moderate</td>
<td>391</td>
<td>97</td>
<td>87</td>
<td>54</td>
<td>8</td>
<td>97</td>
</tr>
<tr>
<td>Total joint disorder</td>
<td>1432</td>
<td>89</td>
<td>69</td>
<td>32</td>
<td>4</td>
<td>91</td>
</tr>
<tr>
<td>Total HIS sample</td>
<td>5709</td>
<td>22</td>
<td>17</td>
<td>8</td>
<td>1</td>
<td>23</td>
</tr>
</tbody>
</table>

<sup>a</sup>See Appendix C for the detailed distribution of responses to these questions.
Table 19

**Median Categories of Pain, Worry, Activity Restriction, and Days in Bed, by Joint Disorder**

<table>
<thead>
<tr>
<th>Joint Disordera</th>
<th>Painb</th>
<th>Worryb</th>
<th>Activity Restrictionb</th>
<th>Days in Bedb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gout</td>
<td>Some</td>
<td>Little</td>
<td>Some</td>
<td>7/8c</td>
</tr>
<tr>
<td>Nonspecific Acute</td>
<td>Little</td>
<td>Little</td>
<td>Little</td>
<td>2</td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td>Little</td>
<td>Little</td>
<td>Little</td>
<td>1/2c</td>
</tr>
<tr>
<td>Mild</td>
<td>Some</td>
<td>Little</td>
<td>Some</td>
<td>5</td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Little</td>
<td>Little</td>
<td>Little</td>
<td>3</td>
</tr>
</tbody>
</table>

a Among those who had a positive response to the disease impact item under consideration.
b See Appendix C for the response categories and the distribution of responses on which these medians are based.
c Dual median.

(gout plus moderate chronic versus acute plus mild chronic) were tested\(^3\) and found to be statistically significant (\(p < 0.0001\)) for all four types of adverse consequences measured.

In summary, nearly everyone with a joint disorder is affected adversely by it, usually by suffering pain or experiencing mental distress. People with gout or moderate nonspecific joint disorders are more frequently and more intensely affected than people with acute or mild chronic joint disorders.

**Validity of the Medical History Questionnaire**

Validity refers to the extent to which a measure assesses what it purports to assess. Certain issues pertaining to the validity of the

\(^3\) Differences in reported levels of impact were tested by means of the Wilcoxon Two-Sample test, which is equivalent to the Mann-Whitney U test. 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. An adjustment to the variance for tied responses (tied ranks) was made as suggested in Hays (1973).
various measures used by the HIS to determine the presence and severity of joint disorders were discussed in Chapter 2.

To estimate the actual validity of the MHQ, we can compare the results based on MHQ responses with the results of tests conducted at the screening examination. That is, we can look to see whether people who were judged to have a joint disorder on the basis of their MHQ responses demonstrated at the screening examination that they did in fact have some measurable signs of a joint disorder. For example, the uric acid levels of people classified by the MHQ as having gout were, as expected, higher than those of people not suffering from gout. In addition, x-rays, rheumatoid factor, grip strength, and walking speed were shown to be abnormal more often among people who had been classified by the MHQ as having a joint disorder than among those who had been classified by the MHQ as not having a joint disorder (see Tables 11, 12, and 15).

Another indication of the validity of the HIS classification of joint disorders based on joint symptoms reported on the MHQ was mentioned earlier. Classification based on the number of symptoms was compared with the pattern of reported symptoms. People who reported having only one chronic joint symptom rarely reported joint swelling (only 2 percent did). Joint swelling is associated with more severe joint disorders, so the MHQ classification based on the number of symptoms reported was validated by the type of symptoms reported.

An interesting finding concerning the validity of the MHQ is that only about 75 percent of people who reported having joint problems on the MHQ also reported joint problems at the screening examination. This was noted earlier in data from the screening examination for rheumatoid factor, grip strength, walking speed, and joint size (Tables 12, 15, and 16). This finding suggests that people report symptoms more readily on a self-administered questionnaire, and also that they may be reluctant to report symptoms in a setting such as an examination center where they realize that they will receive an additional screening test as a consequence of reporting symptoms.

Not reporting joint symptoms at the screening examination occurred more often among people classified by the MHQ as having an acute joint disorder than among those with a chronic disorder. Only 68 percent of those with acute disorders reported their joint symptoms on the MHQ and also at the screening examination, whereas 83 percent of those with gout or a nonspecific chronic disorder were consistent in their reporting. This phenomenon suggests that the MHQ will validly separate acute from chronic joint disorders.
RELIABILITY OF THE SCREENING EXAMINATION MEASURES

Reliability refers to the ability of a measure to produce the same results when the same object is measured. To estimate the reliability of measurements for joint disorders, a random subsample of 8 to 10 percent of all persons tested was retested. The five measurements subjected to reliability analysis were uric acid, rheumatoid factor, joint size, grip strength, and walking speed. This section gives the mean differences in measures, the standard deviation (SD), the standard error of the mean difference (SEM), and the 95-percent confidence interval calculated around that mean difference.

Repeat uric acid measurements were done for 319 of the 3268 people originally tested (10 percent). The difference between the original and the repeat measurement for these 319 people ranged from $-3.7$ mg/dl to $+3.1$ mg/dl, with an average difference of zero (SD, $0.4$ mg/dl; SEM, $0.02$ mg/dl; and 95-percent confidence interval, $-0.04$ to $+0.04$ mg/dl). These findings are well within acceptable limits for this test.

Repeat rheumatoid factor measurements were done for 57 of the 757 people originally tested (8 percent). None of the original repeated measurements changed from the original result of "positive" or "negative," reflecting remarkable reliability for this sensitive screening test.

Repeated measurements of joint size were performed on 63 of the 756 people originally measured (8 percent). The difference between the original joint size and the repeated measurement of the same joint (for 698 joints) ranged from $-10.0$ mm to $+9.0$ mm, with an average difference of $0.04$ mm (SD, $1.3$ mm; SEM, $0.05$ mm; 95-percent confidence interval, $-0.06$ to $+0.14$ mm). These results compare quite favorably with those of Boardman (1967), who reported a mean difference of $2.12$ mm (SD, $1.4$) for repeated measures of the same joint after 1 week.

Grip strength was retested for 71 of the 764 people originally tested (9 percent). The best grip of three tries in the weaker hand was compared between the retest and the original test. People with the maximum (ceiling) value of 250 mm for both tests were excluded, leaving 18 people with truly different results on retesting. The difference ranged from $-28.0$ to $+40.0$ mm Hg, with an average difference of $0.17$ mm Hg (SD, $17.0$; SEM, $4.0$; 95-percent confidence interval, $-7.8$ to $+8.2$ mm Hg). These results compare favorably with the average difference of $3.0$ mm Hg reported by Boardman between repeated measures of grip strength after an interval of 1 week.

Walking speed over a distance of 50 feet (turn around at 25 feet)
was remeasured for 68 of the 756 people originally evaluated (9 percent). The difference in time taken to walk the 50-foot distance at the repeat test, compared with the original time for the same people, ranged from -1.2 to +2.6 seconds, with an average difference of 0.3 seconds (SD, 0.7; SEM, 0.09; 95-percent confidence interval, 0.2 to 0.5 second). These outcomes are well below the variation reported in other studies (Bowers, 1975).

PREVALENCE OF JOINT DISORDERS ACCORDING TO THE HIS INSURANCE PLANS

The distribution of persons with joint disorders at the time of enrollment in the HIS are shown in Table 20 according to HIS experimental health insurance plans. The 16 plans, described in more detail in the Preface, have been grouped into four kinds of fee-for-service plans, based on their levels of coinsurance or maximum dollar expenditure. The two prepaid plans are both located at the Group Health Cooperative of Puget Sound (GHC) in Seattle, Washington. Only the 4982 persons who were assigned to one of these 16 experimental plans, and who could also be classified as to the presence of a joint disorder, are included in the analysis of prevalence by plan. Classification of joint disorders was based on symptoms reported on the MHQ, as defined in Chapter 4.

Differences in the prevalence of joint disorders among the four types of fee-for-service plans were not statistically significant. This is as expected, and reflects the unbiased assignment of people to these plans at the time of enrollment into the HIS, before data from the MHQ or screening examination were collected. Not shown in Table 20 is the prevalence of joint disorders among people assigned to the fee-for-service plans in Seattle, counted separately from other locations. It was 24 percent (204 of 866 persons classified), which is the same as the 24 percent prevalence rate in the prepaid experimental plan in Seattle (GHC).

The prepaid control plan in Seattle (also at GHC) is not strictly comparable to any other HIS plan, even in Seattle, because it was

---

4For more information on the process of assigning families to plans, see Morris (1979). Of the original 5715 people who completed the MHQ, 729 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. An additional 4 people were not classified as to joint disorder status because they did not answer the MHQ questions about joint problems.
Table 20

**Prevalence of Joint Disorders, by HIS Experimental Insurance Plan**

<table>
<thead>
<tr>
<th>HIS Experimental Insurance Plan</th>
<th>Number of Persons Classifiable</th>
<th>Number of Persons with Joint Disorders</th>
<th>Percent with Joint Disorders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fee-for-service plans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free care</td>
<td>1182</td>
<td>281</td>
<td>24</td>
</tr>
<tr>
<td>25- or 50-percent coinsurance</td>
<td>955</td>
<td>242</td>
<td>25</td>
</tr>
<tr>
<td>95-percent coinsurance</td>
<td>704</td>
<td>181</td>
<td>26</td>
</tr>
<tr>
<td>Individual/family deductible</td>
<td>821</td>
<td>193</td>
<td>24</td>
</tr>
<tr>
<td>Prepaid group practice plans c</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>784</td>
<td>185</td>
<td>24</td>
</tr>
<tr>
<td>Control</td>
<td>536</td>
<td>158</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>4982</td>
<td>1240</td>
<td>25</td>
</tr>
</tbody>
</table>

aFor definitions, see the Preface (insurance plan) and Chapter 4 (joint disorders).
bIncludes persons who answered the questions about joint disorders on the enrollment MHQ.
cSeattle only. For a comparison of the prepaid group practice and fee-for-service plans in Seattle, see the text.

composed of people who had already been participating in GHC before the HIS began in Seattle. As a point of interest, however, the difference in prevalence of joint disorders between the experimental and control GHC plans, 24 and 29 percent, respectively, was statistically significant (chi-square 5.7, p < 0.02). The two groups do not differ in the distribution of types of joint disorder; acute disorders account for about one-third of all joint disorders in both groups. The cause of this difference in prevalence among the two GHC samples remains unclear. These findings demonstrate that the assignment of families to the HIS experimental health insurance plans was not biased at enrollment with respect to the presence of joint disorders. Thus, the HIS should be able to determine whether the course of joint disorders—among those who have them—differs as a function of differences in the amount or type of medical care associated with the various levels of insurance coverage.
POTENTIAL EFFECTS OF HEALTH INSURANCE ON JOINT DISORDERS

Generous health insurance could have positive effects on joint disorders at several points in the diagnostic and treatment processes. For example, 22 percent of the 1432 people in the HIS who had some form of joint disorder at enrollment had never seen a doctor about their joints, and 44 percent had not seen a doctor about their joints for more than a year. Generous insurance might induce these people to see a doctor more often and thereby receive the benefits of diagnostic and therapeutic services for their specific conditions: drugs, physical therapy, braces or other aids, referral to specialists. All of these extra benefits would be expected to decrease pain and increase mobility and activity. Worry or concern about joint problems may decrease as a result of reassurance and improvement in physical activity.

Greater use of medical services may, of course, increase a person’s mental distress about his or her health because of greater diagnostic labeling and consequent reminders of the condition from periodic drug usage and medical appointments. Overall, however, we expect that the total deleterious effect of joint disorders would be lessened by more generous health insurance, shown primarily by decreased pain and activity restriction.

We would also anticipate that generous health insurance would lead to positive outcomes more among persons with chronic joint disorders than among those with acute disorders. The reasons are that acute disorders are often well treated at home with rest and nonprescription drugs, whereas chronic disorders may show more improvement with prescription drugs and physical therapy programs. These latter treatments would probably be more accessible to people with generous health insurance, for whom financial considerations would be less of a barrier to care.

The overall prevalence of joint disorders as measured in the HIS may rise among persons with general health insurance simply because of greater numbers of visits to doctors and consequent increases in diagnostic labeling. This phenomenon would be detected by analysis of diagnoses noted on the insurance claim forms. However, we would expect the overall spectrum of joint disorders, as measured by the MHQ questions about symptoms, to shift toward less serious problems among those who are generously insured. The reason is that increased medical care should reduce symptoms, shifting people from moderate-chronic disorders (at least two chronic symptoms) to mild-chronic (only one such symptom) or even to acute joint problems (episodic, no chronic symptoms). Thus, we would expect to find a larger proportion of acute or mildly severe chronic problems among the gen-
erously insured group than among those with only minimal insurance coverage. People with less generous insurance would be expected to show either no change in the spectrum of joint ailments or a shift in the other direction, toward more severe conditions, as they may obtain less medical care for their joint problems than those with free care.
Chapter 6

QUALITY-OF-CARE CRITERIA FOR JOINT DISORDERS

Criteria for the quality of care for joint disorders often focus on the results of laboratory tests used to monitor the level of disease activity and on general treatment plans. Constructing specific criteria that can be usefully applied to care given to people with joint disorders is difficult for two reasons. First, the symptoms of joint disorders are diverse, in kind and in degree, among different patients with the same joint disorder. Second, individual patients show variable responses to the same treatment, particularly for drug therapy with nonsteroidal anti-inflammatory agents.

The quality-of-care criteria used by the Health Insurance Study (HIS) to assess the care for joint disorders emphasize outcomes of care rather than processes, i.e., results rather than methods. The criteria are outlined in Appendix D. Disease-specific criteria are applied to only two joint disorders, gout and rheumatoid arthritis. Criteria for other joint disorders, such as bursitis and osteoarthritis, will be less specific. They will be used to test hypotheses regarding the relationship between the level of insurance coverage and the quality of care provided. The criteria are expressed in a form that assumes that the quality of care has been high.

To evaluate quality of care, the HIS uses data from the problem-oriented health insurance claim forms filed during the Study. These forms record patient's diagnoses, diagnostic tests performed (although not their results), and medicines prescribed or dispensed. Pharmacy claims provide information on prescriptions filled. The MHQs and medical screening examinations administered at the time of enrollment and again at exit also provide outcome data pertinent to the various joint problems whose care will be evaluated.
Appendix A

JOINT PROBLEMS BATTERY FROM THE MEDICAL HISTORY QUESTIONNAIRE

ENROLLMENT MEDICAL HISTORY QUESTIONNAIRE

<table>
<thead>
<tr>
<th>JOINT PROBLEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>64. DURING THE PAST 12 MONTHS, HAVE YOU HAD ANY PAIN, ACHING, SWELLING OR STIFFNESS IN YOUR JOINTS—FOR EXAMPLE, YOUR FINGERS, HIP OR KNEE? (Do not count problems caused by an injury.)</td>
</tr>
<tr>
<td>Yes .............................................. 1 —Answer 64-A-B</td>
</tr>
<tr>
<td>No .............................................. 2 —Go to 74, page 21</td>
</tr>
</tbody>
</table>

64-A. HAVE YOU HAD PAIN OR ACHING IN ANY OF YOUR JOINTS ON MOST DAYS FOR AS LONG AS A MONTH?

| Yes .............................................. 1 |
| No .............................................. 2 |

64-B. HAVE YOU HAD SWELLING OF A JOINT, AND PAIN WHEN IT WAS TOUCHED, ON MOST DAYS FOR AS LONG AS A MONTH?

| Yes .............................................. 1 |
| No .............................................. 2 |

64-C. HAVE YOU HAD STIFFNESS IN JOINTS OR MUSCLES WHEN FIRST GETTING OUT OF BED ON MOST MORNINGS FOR AS LONG AS A MONTH?

| Yes .............................................. 1 |
| No .............................................. 2 |

64-D. HAVE YOU HAD STIFFNESS IN JOINTS OR MUSCLES WHEN FIRST GETTING OUT OF BED, WHICH LASTED AS LONG AS 15 MINUTES?

| Yes .............................................. 1 |
| 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.
65. CAN YOU DO THE FOLLOWING THINGS WITHOUT THE HELP OF ANOTHER PERSON OR ANY SPECIAL DEVICE? (Circle one number on each line.)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Walk up and down stairs without help</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B. Get into and out of a car without help</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C. Bathe yourself without help</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D. Feed yourself without help</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>E. Get into bed without help</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

66. HOW MANY ASPIRINS, OR PILLS CONTAINING ASPIRIN, DO YOU USUALLY TAKE FOR THE PROBLEMS WITH YOUR JOINTS OR MUSCLES? (Circle one)

- None ............................................ 1
- Less than 1 a day .............................. 2
- 1-3 a day ....................................... 3
- 4-12 a day ..................................... 4
- More than 12 a day ............................ 5

67. HAS A DOCTOR EVER SAID THAT YOU HAVE RHEUMATISM (ROO-muh-tiz-um) OR ARTHRITIS (AR-thry-tis)?

- Yes ........................................... 1
- No ............................................. 2

68. HAS A DOCTOR EVER SAID THAT YOU HAVE GOUT OR HIGH URIC ACID LEVEL?

- Yes ........................................... 1 —Answer 68-A
- No ............................................. 2 —Go to 69

68-A. ARE YOU CURRENTLY TAKING ANY OF THESE MEDICATIONS FOR YOUR GOUT OR HIGH URIC ACID LEVEL?

- COLCHICINE (COLE-chis-see-n)
- ALLOPURINOL (AI-lo-PURE-in-all)
- ZYLOPRIM (ZYE-lo-prim)
- BENEMID (BEN-eh-mid)
- COBENEMID (COLE-ben-eh-mid)

- Yes, one or more of these ............................. 1
- No, not taking any of these ............................ 2

69. WHEN WAS THE LAST TIME YOU SAW A DOCTOR ABOUT YOUR PROBLEMS WITH YOUR JOINTS OR MUSCLES? (Circle one)

- Within past 3 months ............................ 1
- 3-6 months ago ................................... 2
- 7-12 months ago .................................. 3
- More than 1 year ago .............................. 4
70. DURING THE PAST 3 MONTHS, HOW MUCH PAIN HAS THE TROUBLE WITH YOUR JOINTS OR MUSCLES CAUSED YOU?  
(Circle one)  
A great deal of pain .................................. 1  
Some pain ............................................. 2  
A little pain .......................................... 3  
No pain at all ......................................... 4  

71. DURING THE PAST 3 MONTHS, HOW MUCH HAS THE TROUBLE WITH YOUR JOINTS OR MUSCLES WORRIED OR CONCERNED YOU?  
(Circle one)  
A great deal .......................................... 1  
Somewhat .............................................. 2  
A little .................................................. 3  
Not at all .............................................. 4  

72. DURING THE PAST 3 MONTHS, HOW MUCH OF THE TIME HAS THE TROUBLE WITH YOUR JOINTS OR MUSCLES KEPT YOU FROM DOING THE KINDS OF THINGS OTHER PEOPLE YOUR AGE DO?  
(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  

73. DURING THE PAST 30 DAYS, HOW MANY DAYS HAS THE TROUBLE WITH YOUR JOINTS OR MUSCLES KEPT YOU IN BED ALL DAY OR MOST OF THE DAY? (If none, write in "0").  
_____ days in bed last month
55. **DURING THE PAST 12 MONTHS HAVE YOU HAD PAIN, ACHING, SWELLING OR STIFFNESS IN YOUR JOINTS? FOR EXAMPLE, YOUR FINGERS, HIP, KNEE? (DO NOT COUNT PROBLEMS DUE TO INJURY.)**

<table>
<thead>
<tr>
<th>NO</th>
<th>2</th>
<th>(GO to q. 66, page 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>1</td>
<td>(GO to q. 56)</td>
</tr>
</tbody>
</table>

56. Have you had any of these problems in the last 12 months? Answers “Yes” or “No” for each problem.

a. **Pain or aching in any of your joints on most days for at least one month?**
   - Yes .. 1
   - No .. 2

b. **Swelling of a joint with pain present when the joint was touched on most days for at least one month?**
   - Yes .. 1
   - No .. 2

c. **Stiffness in the joints and muscles when first getting out of the bed in the morning on most mornings for at least one month?**
   - Yes .. 1
   - No .. 2

   (GO to part d below)

57. **CAN YOU DO THESE THINGS WITHOUT THE HELP OF ANOTHER PERSON OR A SPECIAL DEVICE?** Answer “Yes” or “No” for each thing.

   (Circle one for each.)

**Walk up and down stairs without help?**
- Yes .. 1
- No .. 2

**Get into and out of a car without help?**
- Yes .. 1
- No .. 2

**Bathe yourself without help?**
- Yes .. 1
- No .. 2

**Feed yourself without help?**
- Yes .. 1
- No .. 2

**Get into bed without help?**
- Yes .. 1
- No .. 2
58. Has a doctor ever said you have rheumatism or arthritis?
   ("Rheumatism" pronounced "ROO-muh-tiz-um")
   ("Arthritis" pronounced "AHR-thrice")
   (Circle one.)
   No .................................... 2
   Yes .................................... 1

59. How many aspirins do you usually take for the problems with your joints or muscles?
   (Circle one.)
   None .................................... 1
   Less than 1 a day ........................ 2
   1 - 3 a day .............................. 3
   4 - 12 a day ............................. 4
   13 or more a day ......................... 5

60. Has a doctor ever said that you have gout?
   No ........................................ 2  (GO to q. 62)
   Yes ....................................... 1  (GO to q. 61)

61. Are you currently taking colchicine, allopurinol (zylopri), or benemid for your gout or high uric acid level?
   ("Colchicine" pronounced "KOOL-chiz-een")
   ("Allopurinol" pronounced "AL-low-poor-zin-all")
   ("Zylopri" pronounced "ZY-low-priz")
   ("Benemid" pronounced "BEN eh mid")
   Yes .................................... 1
   No ........................................ 2

62. During the past 3 months how much pain has the trouble with your joints caused you?
   (Circle one.)
   A lot .................................... 1
   Some .................................... 2
   A little .................................. 3
   None at all .............................. 4

63. During the past 3 months, how much has the trouble with your joints worried or concerned you?
   (Circle one.)
   A lot .................................... 1
   Somewhat ............................... 2
   A little .................................. 3
   Not at all .............................. 4

64. During the past 3 months, how often has the trouble with your joints kept you from doing the kinds of activities other people your age do?
   (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
65. During the past 30 days, how many days has the trouble with your joints kept you in bed all or most of the day? (If NO DAYS IN BED, WRITE IN "0".)

______ Days in bed
BURSITIS QUESTION
as it appeared on the
ENROLLMENT AND EXIT MEDICAL HISTORY QUESTIONNAIRE
for all sites except Dayton, Ohio
(In Dayton it appeared on the first annual Health Questionnaire instead of on the Enrollment Medical History Questionnaire.)

OTHER ILLNESSES

255. AS FAR AS YOU KNOW, DURING THE PAST 12 MONTHS, HAVE YOU HAD ANY OF THE FOLLOWING CONDITIONS?

IF YES, DID YOU SEE A DOCTOR ABOUT IT DURING THE PAST 12 MONTHS?

PLEASE CIRCLE ONE NUMBER ON EACH LINE:

1 — You have not had the condition at all in the past 12 months
2 — You have had it, but have not seen a doctor about it in the past 12 months
3 — You have had it, and you have seen a doctor about it in the past 12 months

<table>
<thead>
<tr>
<th>Condition</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Bursitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Arteriosclerosis, hardening of the arteries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Allergies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Frequent digestive upsets, stomach trouble, or intestinal trouble</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Chronic hepatitis or yellow jaundice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Chronic gall bladder trouble or gallstones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Phlebitis (thrombophlebitis)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Any foot pain or infection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Women only: Any disease of the uterus or ovary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Women only: Any lumps in your breasts</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

PHYSICIAN EVALUATION QUESTIONNAIRE

This questionnaire was completed by a physician for all adults who were under active treatment for a joint disorder at the time of exit from the HIS

INSTRUCTIONS

For all questions with numbered responses, please circle the number beside the response you select.

Presumed Tracer Condition: ______________________

DIAGNOSIS

1. In your opinion, does the participant have the tracer condition?
   1. Definitely
   2. Probably
   3. Possibly
   4. Probably not
   5. Definitely not

   Please go to Question 2.

   Please answer Question 1A, below.

1A. In your opinion, is it likely that the patient has a condition, other than the tracer condition, which more adequately explains the findings on your history and your examination?

   1. No, the tracer condition is the most likely explanation.
   2. Yes, but I am unable to diagnose the condition.
   3. Yes, and I think the other condition is: ______________________
   4. No, in my opinion, no pathological condition exists at all.

2. Please list the decisive points (e.g., history, symptoms, signs) that lead to your conclusion about the diagnosis of the tracer condition and the other condition, if any. List a maximum of five points:

   __________________________________________

   __________________________________________

   __________________________________________

   __________________________________________

   __________________________________________

PLEASE CONTINUE WITH QUESTION 3, NEXT PAGE.

NAME OF PARTICIPANT ______________________
3. How comfortable are you with your diagnosis?
   1. Entirely comfortable — Please go to Question 4, below.
   2. Very comfortable
   3. Moderately comfortable
   4. Somewhat comfortable
   5. Only slightly comfortable
   6. Not at all comfortable

3A. If you are not totally comfortable with your diagnosis, please tell us why, or please tell us what additional information you would need to help you reach greater certainty:

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

THERAPY

4. In your opinion, if the treatment for the participant's condition were changed in an effort to improve his/her health, what additional improvement in health could be achieved?
   1. Virtually no improvement — Please go to Question 5, next page.
   2. Minimal improvement
   3. Minor but definite improvement
   4. Moderate improvement
   5. Substantial improvement

   Please answer Question 4A, next page.

PLEASE CONTINUE WITH QUESTION 4A, NEXT PAGE.

OFFICE USE ONLY:
4A. In your opinion, what is the major reason for the participant's failure to achieve optimal health status (so far as the participant's condition is concerned)?

1. **Physician's quality of care is low (e.g., ill-advised therapeutic plan, misdiagnosis).**
   Specify exact problem(s) you see.

2. **Participant's contribution to own care is inadequate (e.g., noncompliance with prescribed regimen).**
   Specify exact problem(s) you see.

3. **Other:**
   Specify problem area:
   (e.g., problem with family, environment, "health care system."
   Specify exact problem(s) you see.

5. In your opinion, is the participant experiencing side effects from the current therapy?

   1. Yes → Please answer Questions 5A and 5B.
   2. No
   3. There is no current therapy for the participant's condition.} Please go to Question 6, next page.

5A. **What are the side effects? Please list them.**

PLEASÉ CONTINUE WITH QUESTION 5B, NEXT PAGE.
58. In your opinion, what reduction in side effects is possible, while achieving the same therapeutic benefit from medical care?

1. Virtually no reduction.
2. Slight (~10%) reduction.
3. Minor (~25%) reduction.
4. Moderate (~50%) reduction.
5. Major (~75%) reduction.
6. Virtually total (90-100%) reduction.

Please provide medical justification for your answer to this question:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

6. How would you change the current therapeutic regimen? Please be specific:

☐ I would not change the current therapeutic regimen.

Changes I would make: ____________________________

Alteration in the participant's functioning (change in symptoms, signs, or functional ability) that I would expect to see because of the change(s): ____________________________
Appendix C

DISTRIBUTION OF RESPONSES TO DISEASE IMPACT QUESTIONS

Tables C.1 and C.2 present the number and percentages of responses to the disease impact questions from the Medical History Questionnaire (MHQ) for the same categories of joint disorders that were summarized earlier in Tables 17 through 19.

The total number of enrollees in each category is shown in parentheses. The numbers given for each response may not sum to these totals because missing responses (from individuals who should have

Table C.1

<table>
<thead>
<tr>
<th>Joint Disorder &amp; Joint Disorder Mild (n = 501)</th>
<th>Pain</th>
<th>Worry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Impact No. Percent</td>
<td>Level of Impact No. Percent</td>
<td></td>
</tr>
<tr>
<td>Gout (n = 72)</td>
<td>Pain</td>
<td>Worry</td>
</tr>
<tr>
<td>None</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Little</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>Some</td>
<td>27</td>
<td>38</td>
</tr>
<tr>
<td>Great</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>Nonspecific Acute (n = 468)</td>
<td>None</td>
<td>19</td>
</tr>
<tr>
<td>Little</td>
<td>314</td>
<td>67</td>
</tr>
<tr>
<td>Some</td>
<td>62</td>
<td>13</td>
</tr>
<tr>
<td>Great</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Nonspecific Chronic</td>
<td>None</td>
<td>9</td>
</tr>
<tr>
<td>Mild (n = 501)</td>
<td>Little</td>
<td>293</td>
</tr>
<tr>
<td>Some</td>
<td>139</td>
<td>28</td>
</tr>
<tr>
<td>Great</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Moderate (n = 391)</td>
<td>None</td>
<td>13</td>
</tr>
<tr>
<td>Little</td>
<td>116</td>
<td>30</td>
</tr>
<tr>
<td>Some</td>
<td>177</td>
<td>45</td>
</tr>
<tr>
<td>Great</td>
<td>84</td>
<td>21</td>
</tr>
<tr>
<td>Total (n = 1432)</td>
<td>None</td>
<td>154</td>
</tr>
<tr>
<td>Little</td>
<td>748</td>
<td>52</td>
</tr>
<tr>
<td>Some</td>
<td>405</td>
<td>25</td>
</tr>
<tr>
<td>Great</td>
<td>123</td>
<td>9</td>
</tr>
</tbody>
</table>

*aNumber of people are shown in parentheses. Missing responses are not shown.
provided an answer to a specific question and did not) are not shown. Missing data amounted to less than 1 percent of all responses.

The entries in the "level of impact" columns are given in abbreviated form only. The full wording of the questions and responses can be found in the MHQ batteries reproduced in Appendix A.

Table C.2

<table>
<thead>
<tr>
<th>Joint Disorder*</th>
<th>Activity Restriction</th>
<th>Days in Bed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level of Impact</td>
<td>No.</td>
</tr>
<tr>
<td>Gout (n = 72)</td>
<td>None</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Little</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Some</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Most</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonspecific Acute (n = 468)</td>
<td>None</td>
<td>399</td>
</tr>
<tr>
<td></td>
<td>Little</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Some</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Most</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonspecific Chronic Mild (n = 501)</td>
<td>None</td>
<td>351</td>
</tr>
<tr>
<td></td>
<td>Little</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Some</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Most</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate (n = 391)</td>
<td>None</td>
<td>179</td>
</tr>
<tr>
<td></td>
<td>Little</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>Some</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Most</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>15</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (n = 1432)</td>
<td>None</td>
<td>966</td>
</tr>
<tr>
<td></td>
<td>Little</td>
<td>271</td>
</tr>
<tr>
<td></td>
<td>Some</td>
<td>121</td>
</tr>
<tr>
<td></td>
<td>Most</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Number of people are shown in parentheses. Missing responses are not shown.

bLess than 0.5 percent.
Appendix D

QUALITY-OF-CARE CRITERIA FOR
JOINT DISORDERS

All criteria listed, unless otherwise specified, refer only to people who have joint disorders at the time of exit from the HIS, according to the definitions outlined in Chapter 4 of this volume. Alternative criteria will occasionally be tested to see if the effect of level of health insurance differs for slight variations in the threshold value of the criterion and are so designated. "He" refers to both men and women.

PATIENT OUTCOMES

1. When asked on the exit Medical History Questionnaire (MHQ), "During the past three months how much pain has the trouble with your joints caused you?" the enrollee reports:
   a. "None at all"; or, alternatively,
   b. "None at all" or "a little"; or, alternatively,
   c. No greater pain than was reported at enrollment.

2. When asked on the exit MHQ, "During the past three months how much has the trouble with your joints worried or concerned you?" the enrollee reports:
   a. "Not at all"; or, alternatively,
   b. "Not at all" or "a little"; or, alternatively,
   c. No greater worry than was reported at enrollment.

3. When asked on the exit MHQ, "During the past three months how often has the trouble with your joints kept you from doing the kinds of activities other people your age do?" the enrollee reports:
   a. "None of the time"; or, alternatively,
   b. "None of the time" or "a little of the time"; or, alternatively,
   c. No greater amount of time than was reported at enrollment.

4. When asked on the exit MHQ, "During the past three months how many days has the trouble with your joints kept you in bed all or most of the day?" the enrollee reports:
   a. Zero days; or, alternatively,
b. No greater number of days than was reported at enrollment.

5. The enrollee reports on the exit MHQ that he can perform each of the following activities without the help of another person or any special device, or that he can perform at least as many of them as he could at enrollment:
   a. Walk up and down stairs.
   b. Get into and out of a car.
   c. Bathe himself.
   d. Feed himself.
   e. Get into bed.

6. Grip strength measured at the exit screening examination
   a. Is normal (greater than 200 mm for men, 150 mm for women); or, alternatively,
   b. Is improved since enrollment; or, alternatively,
   c. Is not diminished since enrollment.

7. Walking speed measured at the exit screening examination
   a. Is normal (less than 12 seconds for 50 feet); or, alternatively,
   b. Is faster since enrollment; or, alternatively,
   c. Is not slower since enrollment.

8. If the enrollee had joint-size measurements taken at both the enrollment and the exit screening examinations, then the measurements at exit are no greater than the measurements at enrollment.

PROCESS OF CARE—GENERAL

1. If the enrollee reported "a great deal of pain" or "some pain," or restriction of activity "all of the time," because of a joint disorder during the 3 months prior to exit, then the enrollee visited a physician for his joint problems within the 6-month period prior to exit. Or, alternatively, if the enrollee reported "a great deal of pain," or "some pain," or restriction of activity "all of the time" or "most of the time," because of a joint disorder during the 3 months prior to exit, then the enrollee visited a physician for his joint problems within the 6-month period prior to exit.

2. If the enrollee has had at least three visits during the HIS for a primary diagnosis of rheumatoid arthritis or gout, then he reports on the exit MHQ that he has been told by a doctor that he has rheumatism or arthritis, or gout, or, alternatively, he has written a corresponding reason for at least one of the visits.
3. If the enrollee receives an injection for a joint disorder, then the injected drug
   a. Is specified by name; or, alternatively,
   b. Is a steroid; or, alternatively,
   c. Is among the following: triamcinolone hexacetonide, hydrocortisone acetate, prednisolone acetate, or prednisolone tertiary butylacetate.

4. If the enrollee receives a prescribed oral drug for a joint disorder other than gout or rheumatoid arthritis, then
   a. The prescribed drug is either a nonnarcotic analgesic or a nonsteroidal anti-inflammatory agent. (This includes aspirin, phenylbutazone, oxyphenbutazone, indomethacin, ibuprofen, fenoprofen, naproxen, and tolmetin.)
   b. He visits a physician for his joint disorder within 6 months following the date on which the prescription was filled.

PROCESS OF CARE—GOUT

1. If the enrollee was diagnosed for the first time during the HIS as having gout, then the following should have been performed within 1 month of the appearance of the diagnosis on a claim form:
   a. Uric acid (or multiple channel chemistry screen).
   b. Blood urea nitrogen or creatinine (or multiple channel chemistry screen).
   c. Urinalysis.
   d. Joint fluid analysis.

2. If the enrollee had an acute gouty attack, and a medication was prescribed at that time for the attack, then the medication was colchicine, phenylbutazone, oxyphenbutazone, or indomethacin.

3. If the enrollee with gout is taking probenecid or sulfinpyrazone for gout (or for hyperuricemia), then he is not also taking salicylates.

4. If the enrollee reports on the exit MIQ that he is currently taking allopurinol, colchicine, or probenecid, then he has visited a physician for gout (or for hyperuricemia) during the year prior to exit from the HIS.

PROCESS OF CARE—RHEUMATOID ARTHRITIS

1. If the enrollee was diagnosed for the first time during the HIS as having rheumatoid arthritis, then all of the following should have
been performed within 2 months of the appearance of the diagnosis on a claim form:

a. Complete blood count.
b. Sedimentation rate.
c. LE prep or antinuclear antibody test.
d. Rheumatoid factor test.
e. X-ray of the affected area(s).
f. Urinalysis.

2. If the enrollee receives oral corticosteroids, gold, or penicillamine for rheumatoid arthritis, then he has previously been treated with aspirin or a nonsteroidal anti-inflammatory drug.

3. If the enrollee receives azathioprine or cyclophosphamide for rheumatoid arthritis, then he has previously been treated with gold, oral corticosteroids, or penicillamine.

4. If the enrollee is receiving penicillamine, azathioprine, cyclophosphamide, or gold therapy for rheumatoid arthritis, then he receives the following at least once a month:

a. Complete blood count.
b. Platelet count.
c. Urinalysis.

5. If the enrollee reports on the exit MHQ that he is taking 12 or more aspirin tablets (4 grams) daily for rheumatoid arthritis, he visits a physician for his rheumatoid arthritis at least every 6 months.

**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 a joint disorder. Active treatment is defined as at least three visits for a joint disorder within the past 18 months. (See Physician Evaluation Questionnaire in Appendix B.)

1. The examinee “definitely” or “probably” has a joint disorder.

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, alternatively,

b. Either "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, if the therapeutic regimen were changed, only a "slight reduction" or "virtually no reduction" in side effects would be possible (with maintenance of the same therapeutic benefit from medical care).

4. No change in the current therapeutic regimen for the joint disorder is suggested.
REFERENCES


NCHS, Basic Data on Arthritis. Knee, Hip, and Sacroiliac Joints in


