

**Direct and Indirect Costs of Musculoskeletal Conditions in 1997:**

**Total and Incremental Estimates**

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## Executive Summary

This report summarizes the results of a project designed to provide estimates of all direct and indirect costs among persons with chronic musculoskeletal conditions -- and for the subset with various forms of arthritis -- in the U.S. in 1997 and to estimate the increment in these costs for the adult population specifically attributable to the musculoskeletal conditions and arthritis. A secondary goal of this project was to calculate attributable fractions for the direct costs associated with chronic musculoskeletal and arthritis conditions.

The estimates in the report derive from the 1997 Medical Expenditure Panel Survey (MEPS). The 1997 MEPS is a national probability sample of 14,147 households including 34,551 persons. In the MEPS, respondents are surveyed every six months to report on medical care utilization and health care expenditures. Of the 34,551 persons in the 1997 MEPS, 6,875 reported one or more musculoskeletal conditions, of whom 4,776 reported some form of arthritis. After weighting, the 6,875 individuals with musculoskeletal conditions represent 56.368 million persons in the nation as a whole, while the 4,776 with some form of arthritis represent 38.423 million in the nation.

In order to estimate direct costs, we tabulated all medical care expenditures of the adults with musculoskeletal conditions or the subset with arthritis, stratified by comorbidity status, and then compared their expenditures to those among adults with chronic conditions other than musculoskeletal disease (or arthritis) or with none. We then used regression techniques to estimate the increment of health care expenditures attributable to the musculoskeletal conditions (or arthritis). Similarly, to estimate indirect costs, we tabulated employment status among those persons 18 – 64 with an employment history with musculoskeletal conditions (or arthritis) and, among such persons who were employed at any time during the year, their annual earnings, and compared these measures to those among persons 18 – 64 with a work history without musculoskeletal conditions (or arthritis). We then used regression techniques to estimate the increment in indirect costs attributable to the musculoskeletal conditions (or arthritis). The regression models included measures of comorbidity, demographic characteristics, and insurance status; the specific measures are listed on page 12, below.

**Direct Cost Estimates (Medical Expenditures)—Musculoskeletal Conditions**

- Per capita medical care expenditures in 1997 averaged \$4,251 among persons with musculoskeletal conditions, for a national total of \$239.6 billion, the equivalent of 2.9 percent of the Gross Domestic Product (GDP) in that year.
- The largest components of medical care expenditures among persons with musculoskeletal conditions in 1997 were hospital-related costs, including inpatient admissions (38 percent) and the use of the emergency department (another 2 percent), office and hospital outpatient costs (30 percent), and prescriptions (14 percent).
- Per capita expenditures averaged \$1,077 among persons with musculoskeletal conditions in the absence of non-musculoskeletal ones, and \$5,081 among persons with both kinds of conditions. Physician-related costs were the largest component of expenditures among persons who only had musculoskeletal conditions (\$314, 29 percent), while hospital-related costs were the largest component among persons with both musculoskeletal and non-musculoskeletal conditions (\$1,972, or 39 percent, for inpatient costs and another \$117, or 2 percent, for the use of the emergency department).
- The average per capita expenditures of \$4,251 among persons with musculoskeletal conditions were higher than the average of \$2,312 among persons with non-musculoskeletal conditions, with the difference attributable to higher expenditures among persons with comorbidity.
- Expenditures among persons with musculoskeletal conditions are highly skewed: the median was \$1,357 per year and even at the 75<sup>th</sup> percentile, expenditures were only \$3,738.
- The average increment in total medical care expenditures attributable to musculoskeletal conditions among persons 18 and older was estimated to be \$1,483. This increment translates to an attributable fraction of 15 percent, meaning that musculoskeletal conditions are responsible for 15 percent of all medical care expenditures. The increment in expenditures aggregated across all 53.292 million individuals 18 or older with a musculoskeletal condition is \$79.0 billion, the equivalent of almost one percent of the Gross Domestic Product for 1997.

**Direct Cost Estimates (Medical Expenditures)—Arthritis Conditions**

- Per capita medical care expenditures in 1997 averaged \$4,865 among persons with the various forms of arthritis, for a national total of \$186.9 billion, the equivalent of about 2.3 percent of GDP in that year.
- The largest components of medical care expenditures among persons with arthritis conditions in 1997 were hospital-related costs, including inpatient admissions (39 percent) and the use of the emergency department (another 2 percent), office and hospital outpatient costs (29 percent), and prescriptions (14 percent).
- Per capita expenditures averaged \$1,074 among persons with arthritis conditions in the absence of non-arthritis ones, and \$5,516 among persons with both kinds of conditions. Physician-related costs were the largest component of expenditures among persons who only had arthritis conditions (\$290, 27 percent), while hospital-related costs were the largest component among persons with both arthritis and non-arthritis conditions (\$2,177, or 39 percent, for inpatient costs and another \$115, or 2 percent, for the use of the emergency department).
- The average per capita expenditures of \$4,865 among persons with arthritis conditions were higher than the average of \$2,397 among persons with non-arthritis conditions, with the difference attributable to higher expenditures among persons with comorbidity.
- Expenditures among persons with arthritis conditions are highly skewed: the median was \$1,644 per year and even at the 75<sup>th</sup> percentile, expenditures were only \$4,306.
- The average increment in total medical care expenditures attributable to arthritis among persons 18 and older was estimated to be \$1,391. This increment translates to an attributable fraction of 10 percent, meaning that arthritis conditions are responsible for 10 percent of all medical care expenditures. The increment in expenditures aggregated across all 36.759 million individuals 18 or older with arthritis is \$51.1 billion, the equivalent of 0.6 percent of the Gross Domestic Product for 1997.

**Indirect Cost Estimates—Musculoskeletal Conditions**

- Of the approximately 35.3 million persons with musculoskeletal conditions who were between the ages of 18 and 64 with a work history, 82.0 percent were employed in 1997; of the approximately 114.7 million persons these ages without musculoskeletal conditions who had ever worked, 91.6 percent were employed. Thus, the raw difference in employment rates was 9.5 percent, translating to an employment gap of about 3.4 million persons with musculoskeletal conditions.
- After controlling for demographic characteristics and occupation and industry, the increment in the employment rates attributable to the musculoskeletal conditions was 5.8 percent, translating to an employment gap of about 2.1 million persons with musculoskeletal conditions.
- The raw earnings gap due to the lower employment rates of person with musculoskeletal conditions compared to those without amounted to about \$98.2 billion in 1997, or \$2,778 per person with musculoskeletal conditions. Persons with musculoskeletal conditions who were employed experienced an estimated loss in earnings of about \$5.5 billion, or \$190 per capita. The net effect of the \$98.2 billion loss due to the lower employment rate and the \$5.5 billion loss among those who were employed was, thus, \$103.7 billion, or \$2,968 per person with musculoskeletal conditions.
- After controlling for demographic characteristics and occupation and industry, the incremental aggregate net earnings gap attributable to musculoskeletal conditions was about \$90.6 billion, or \$2,563 per person with musculoskeletal conditions.

**Indirect Cost Estimates—Arthritis Conditions**

- Of the approximately 22.2 million persons with arthritis who were between the ages of 18 and 64 who had ever worked, 79.6 percent were employed in 1997; of the approximately 127.8 million persons these ages without arthritis, 91.0 percent were employed. Thus, the difference in the raw

employment rates of 11.4 percent translated to an employment gap of about 2.5 million persons with arthritis.

- After controlling for demographic characteristics and occupation and industry, the increment in the employment rates attributable to arthritis was 6.1 percent, translating to an employment gap of about 1.3 million persons with arthritis.
- The raw earnings gap due to the lower employment rates of persons with arthritis compared to those without amounted to \$73.2 billion in 1997, or \$3,293 per person with arthritis. Persons with arthritis who were employed had an aggregate net loss of \$9.2 billion in earnings compared to those without, or \$519 per capita. The net effect of the \$73.2 billion loss due to the lower employment rate and the \$9.2 billion loss among those who were employed was, thus, \$82.4 billion, or \$3,812 per person with arthritis.
- After controlling for demographic characteristics and occupation and industry, the incremental value of the aggregate net earnings gap attributable to arthritis was about \$65.2 billion, or \$2,932 per person with arthritis.

### **Synthesis**

Persons with musculoskeletal conditions incurred medical care expenditures of \$239.6 billion in 1997, and the increment in the expenditures of such persons 18 and older, at \$1,483 per capita, translates into an attributable fraction of all expenditures of 15 percent, the equivalent of \$79.0 billion. On the other hand, raw indirect costs due to lower employment rates among persons age 18-64 with musculoskeletal conditions amounted to \$98.2 billion, which when combined with \$5.5 billion in earnings losses among the employed, results in a net loss of \$103.7 billion. The increment in indirect costs attributable to the musculoskeletal conditions was \$90.6 billion. Combining the increment in direct expenditures in adults with the increment in indirect costs in the working age population yields a total of \$169.6 billion in costs attributable to musculoskeletal conditions in 1997.

Persons with some form of arthritis incurred medical care expenditures of \$186.9 billion in 1997,

and the increment in the expenditures of persons 18 and older with arthritis, at \$1,391, translates into an attributable fraction of all expenditures of 10 percent, the equivalent of \$51.1 billion. Persons with arthritis incurred raw indirect costs of \$73.2 billion due to lower employment rates, which when combined with the \$9.2 billion in lost earnings among the employed, yields a net raw loss of \$82.4 billion. The increment in indirect costs attributable to arthritis was \$65.2 billion. Combining the increment in direct expenditures in adults with the increment in indirect costs in the working age population yields a total of \$116.3 billion in costs attributable to arthritis conditions in 1997.

## Introduction

Information about the economic impact of illness has become central to health policy debates, affecting the allocation of research funding among conditions and the choice of therapies for specific conditions. Because of the growing importance of cost of illness studies in health policy, the literature concerning the cost of all forms of musculoskeletal conditions for the nation as a whole (1-7) and for other nations (8-12) as well of the cost of specific musculoskeletal conditions (13-37) has been expanding rapidly.

In general, the studies of the economic impact of all forms of musculoskeletal conditions have been derived from population-based surveys, but have not directly observed medical care expenditures or employment status and earnings on a case by case basis. In contrast, most of the studies of the impact of specific musculoskeletal conditions have been based on clinical samples, but have tracked the actual costs or expenditures for individuals. The present report uses the results of a new survey, the Medical Expenditures Panel Survey (MEPS) which melds the methods of the two kinds of studies by using a population-based sampling frame and then prospectively tracking actual expenditures and employment and earnings among respondents.

The specific goals of the study are to: 1) provide estimates of all medical care expenditures on behalf of all persons with chronic musculoskeletal conditions (and for the subset with any form of arthritis)<sup>1</sup> in the U.S. in 1997, of the increment in expenditures attributable to the musculoskeletal conditions among such persons 18 and older (raw and incremental<sup>2</sup> *direct* costs, respectively)<sup>3 4</sup>, and of

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<sup>1</sup> Musculoskeletal conditions include gout, carpal tunnel syndrome and related conditions, rheumatic fever and related conditions, some forms of peripheral vascular disease, polyarteritis nodosa and related conditions, various forms of arthritis, ankylosing spondylitis and related conditions, intervertebral disc disorders and other back disorders, rheumatism other than affecting the back, and osteopathies, chondropathies, and musculoskeletal deformities. The specific ICD-9 codes are listed below.

<sup>2</sup> In the paper, we use the term “raw” to connote total costs, regardless of whether they were attributable to musculoskeletal conditions or arthritis, respectively. In contrast, the term “incremental” connotes costs attributable to the musculoskeletal conditions or arthritis.

<sup>3</sup> The increment in direct costs is estimated among persons 18 and over; owing to the small sample size of persons with musculoskeletal conditions less than this age, estimates among such persons would not meet the traditional criterion for statistical reliability. The fraction of costs attributable to musculoskeletal conditions is also estimated

the fraction of total medical care expenditures attributable to the musculoskeletal conditions; and, 2) provide estimates of lost earnings among persons with musculoskeletal conditions (and for the subset with any form of arthritis) 18 through 64 years of age and of the increment in lost earnings also attributable to the conditions among persons of these ages (raw and incremental *indirect* costs, respectively).<sup>5</sup>

## Methods

### Data Source

The present study uses data from the Medical Expenditure Panel Survey (MEPS), a joint endeavor of the Agency for Health Care Research and Quality and the National Center for Health Statistics. MEPS is designed to provide data on health care use, medical care expenditures, sources of payment, and insurance coverage for a representative sample of the non-institutionalized population of the United States. MEPS also tracks the employment status and earnings of that sample.

The full MEPS data include survey responses from this sample of households (hereafter, MEPS-H), information about their medical conditions from their providers, information about the specifics of their health plans provided by the plans themselves, and a separate sample of nursing home residents (38). The MEPS-H sample derives from the prior year's National Health Interview Survey (NHIS) respondents, who are, in turn, derived from a clustered, random sample of the non-institutionalized population, with an oversample of African-Americans and Hispanics. In the present paper, we use data from the 1997 MEPS-H. The 1997 MEPS-H derives from respondents to the 1995 and 1996 NHIS, some of whom were included in the 1996 MEPS-H. The overall sample size included 14,147 households with 34,551 persons

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among those 18 and over.

<sup>4</sup> The direct cost estimates for 1996 were presented earlier in preliminary form in reference 37.

<sup>5</sup> Indirect costs are estimated only for persons 18 through 64 both for the substantive reason that labor force participation rates decline precipitously at age 65 as individuals reach the earliest age of eligibility for full Social Security retirement benefits and for the methodological reason that estimates among persons 65 or older, based on a relatively small sample size, would not be reliable.

(39).

MEPS-H data are collected through six rounds of interviews over a two and a half year period; the first three interviews covering expenditures and employment and earnings over an entire year provide the data used in the analysis for this report. The interviews are used to collect information on health and functional status, health care utilization and expenditures, employment and earnings, as well as basic demographic information. The health status section elicits data on the specific medical conditions each respondent has; these are then coded to three-digit levels using the ICD-9 system. The utilization and expenditure and employment and earnings sections elicit information about the period since the prior interview. The frequency of interviews is designed to improve the reliability of responses.

In the MEPS, expenditure data derive from a combination of the MEPS-H interviews and information obtained from providers. Expenditures in MEPS are defined as the actual expenditures for the medical care services used, regardless of the source of payment (38, 40). In contrast to studies of the costs of illness in which costs are tabulated even if uncompensated care is provided on the assumption that resources are being consumed regardless of payment, in studies of medical care expenditures, the analyst is studying the actual exchange of money. Because MEPS is based on expenditures rather than costs, there are health care encounters for which no expenditures were made.

In an entirely fee-for-service system, one could track all expenditures among respondents. However, in many forms of managed care, charges are not rendered when services are provided and, hence, there are no expenditures specific to the medical care encounters. Accordingly, in such instances, MEPS-H imputes expenditures based on the charges incurred within the fee-for-service sector for similar services provided to similar individuals, a process germane to the present analysis because all expenditures on behalf of all persons with musculoskeletal conditions -- including those in managed care settings -- are to be enumerated.

## **Analyses**

**Data Partitions.** We first partition the 1997 MEPS-H data into the following chronic condition groups on the basis of ICD-9 codes: persons with only chronic musculoskeletal conditions (ICD-9 codes

274, 354, 390, 391, 443, 446, and 710 through 738), persons with both musculoskeletal and non-musculoskeletal chronic conditions, persons with one non-musculoskeletal condition, persons with two or more non-musculoskeletal chronic conditions, and persons with no chronic conditions. We also make estimates for those individuals with any form of arthritis, defined by ICD-9 codes 274, 354, 390, 391, 443, 446, 710-716, 719-721, and 725-729. The definition of musculoskeletal conditions and of the arthritis subset is based on the recommendation of the National Arthritis Data Task Force (7), but excludes a handful of ICD-9 codes within the Task Force's rubric for which the presence of a fourth digit is necessary. Chronic conditions in general are defined by the protocol devised by Hoffman, et al. (41). Of all 34,551 MEPS respondents, 6,875 met the study criteria for a musculoskeletal condition, while 4,776 met the criteria for any form of arthritis.

**General Considerations.** Because MEPS-H is based on a two-stage cluster sample rather than a simple random-sample of the non-institutionalized population, it is necessary to weight the data to make inferences for the U.S. population. In MEPS-H, the sampling weights also take into account non-response in the households targeted for inclusion and attrition among respondents after completion of the first interview (42).

Failure to account for the cluster sampling design will necessarily result in underestimation of the standard error of parameters. Accordingly, we use SUDAAN software for analyses requiring the calculation of the standard error of estimates (43).

**Description of Expenditures.** We begin by enumerating medical care expenditures on behalf of persons with and without musculoskeletal conditions (or with and without any form of arthritis), by category of health services, and also show the distribution of total health care expenditures. In the foregoing analysis, we tabulate all expenditures among persons in the condition groups, regardless of whether or not the condition in question accounts for the expenditures. In the tables describing the foregoing analyses, we indicate those estimates having low statistical reliability, that is a relative standard error of greater than 30 percent.

**Analysis of Increment in Health Care Expenditures.** In order to assess the incremental contribution of musculoskeletal conditions (or of any form of arthritis) to health care expenditures, we estimate a series of regressions separately for adults with and without musculoskeletal conditions (or with and without any form of arthritis). We then simulate the expected level of expenditures for the musculoskeletal (or arthritis) group as if they did not have the musculoskeletal (or arthritis) condition by applying the parameter estimates derived from the group without the condition to the data of the groups with the condition. The increment is then calculated as the difference between these two values (44). Some authors express this as calculating the predicted costs for the entire sample with the covariates at their original values and then subtracting the predicted costs for the entire sample as though none of the individuals had musculoskeletal conditions (or arthritis). For individuals without musculoskeletal conditions (or arthritis), those two predicted costs are identical and so their values cancel each other. Thus it is sufficient to calculate the increment by summing over just the musculoskeletal (or arthritis) group.

To make these calculations with respect to ambulatory care, in-patient, and prescription drug expenditures, we follow the two-stage method outlined by Duan, et al. (45). Duan and colleagues developed the method because many persons have relatively low health expenditures, or none, while a small proportion have very high expenditures. In the method of Duan, et al., one first uses a logistic regression to estimate the probability that an individual has any expenditures and then uses ordinary least squares regression on the logarithm of the expenditure to estimate the level of expenditures among those with strictly positive expenditures.

We estimated the incremental contribution of musculoskeletal conditions (or any form of arthritis) to total expenditures by a four-stage model, also described by Duan, et al. (45). The first stage was to use a logistic regression to predict the probability of any medical expenditures. The second stage was to use a separate logistic regression to predict the probability of any hospital expenditures given the presence of medical expenditures. The third stage was to use an ordinary least squares regression to predict the logarithm of the level of total costs among persons without hospitalizations, and the fourth

stage was to use ordinary least squares regression to predict the logarithm of total costs among persons with hospitalizations. Total expenditures include ambulatory and in-patient care, prescription drugs, and a residual category that includes services such as home health care and medical devices.

For both the two-stage and four-stage models, the log transformation is used in the ordinary least squares regressions to account for the skewed distribution of expenditures. The resulting estimate, when transformed back to the original units by exponentiation, is biased downward (that is, the expected value of the estimate is lower than the expected value of the population mean). Duan (46) has shown that a simple adjustment called the smearing estimate can be used to adjust for this bias. The smearing coefficient is the mean of the exponentiated residuals from the regression on the log-transformed variable. Although the average of the residuals is zero, the average of the exponentiated residuals is larger than one. By multiplying this smearing factor times the predicted value, a better predicted value is obtained.

All the regression models include independent variables for the presence or absence of musculoskeletal conditions (or any form of arthritis) and these eight other major high cost chronic conditions: hypertension, other forms of heart disease, pulmonary, stroke, other neurological conditions, diabetes, cancer, and mental illness. In the estimations for the subset of persons with any form of arthritis, an indicator variable for the presence of other forms of musculoskeletal disease was included.

In addition to the indicator variables for conditions, we include variables for age categories (45-64, 65 and over, with 18-44 as the reference category), female vs. male gender, white versus non-white race, Hispanic versus non-Hispanic status, marital status (single, widowed, separated, divorced, with currently married as the reference category), level of formal education (high school graduate, some college, college graduate, graduate school, with less than high school as the reference category), and health insurance status (presence of only public insurance, presence of no insurance, with those having any private insurance serving as the reference category). The choice of variables to be included in these estimations was made by the investigators and CDC officials.

In our models, we wanted to allow for the possibility that the presence of a musculoskeletal condition (or arthritis) affected the coefficients of all of the covariates. One way to accomplish this is to

include all of the individuals in a model and include interaction terms between each covariate and the group membership variable. In such a model, a common overall residual error is calculated. An alternative is to estimate separate models for individuals with musculoskeletal conditions (or arthritis) and those without musculoskeletal conditions, which is the approach we followed. This approach gives exactly the same parameter estimates, but the residual error is calculated separately for the two groups. The first method does allow testing hypotheses about whether there were statistically significant differences in the coefficients between groups, but those hypotheses were not of interest. We are comfortable assuming that there may be a difference in the coefficients between the groups. Indeed, we in preliminary analyses we uncovered many instances in which there were interactions between the principal independent variable, the presence of musculoskeletal conditions, and the other independent variables. Furthermore, by estimating separate models we are sure not to misspecify the model by forcing the coefficients to be equal based on an empirical test. Finally, we used the pooled residuals from both groups to calculate the smearing coefficient, thereby giving us exactly the same smearing coefficient we would have obtained from doing the combined model with all of the coefficients interacted with group.

For the two-stage model, the final estimated expenditure for each individual is obtained by exponentiating the predicted log of expenditures, multiplying that value by the smearing coefficient, and multiplying that in turn by the predicted probability of a positive expenditure from the logistic regression. The calculations for the four-stage model are similar. All of these analyses are limited to the 22,435 MEPS respondents 18 years of age or older with complete data for all covariates used in the multi-stage models. Of these 22,435 persons, 6,296 persons met the study criteria for a musculoskeletal condition and 4,449 met the criteria for any form of arthritis.

**Calculation of Attributable Fractions (AFs).** Although the increment of direct medical cost due to musculoskeletal conditions (or arthritis) has profound policy implications for CDC and others, there is an additional measure that is of special interest, the attributable fraction (AF). The AF has the total direct medical cost attributable to the condition as the numerator and the total direct medical cost for the entire population as the denominator. It can be thought of as the proportion of the health care dollar

spent by the entire population that would theoretically go away if nobody in the population had the condition. The creation of attributable fractions of expenditures that could be applied to state population data is particularly valuable to state health departments. A health department need only know the total amount of health expenditures and apply the AF to obtain an estimate of the amount attributable to musculoskeletal conditions (or arthritis).

Our three step process for calculating AFs produces as intermediate quantities the average increment and the average adjusted cost, which can be used to fine-tune AFs for populations with a different distribution of musculoskeletal disease (or arthritis). We calculate these values separately for the four component (outpatient, inpatient, prescriptions, and residual) and total costs by each of twelve age-gender categories, as follows:

*Step 1: Calculate the increment of expenditures associated with individuals in the musculoskeletal (or arthritis) group.* For each person in the musculoskeletal (or arthritis) group, we estimate an increment using the parameter estimates and methods described in the previous section, but with one important difference: the estimates are done separately for each age and sex category. We set the age and sex covariates to those of each category in question (i.e. first setting gender to male and all ages to 18-44, then 45-64, etc.) before obtaining the predicted values.

*Step 2: Calculate the cost for all individuals, adjusted by the non-age and non-gender covariates in the multi-stage models.* Just as for the increment, the costs are calculated for each individual observation after setting the age and sex covariates to those of the category in question. For each person in the musculoskeletal (or arthritis) group, we estimate a predicted value based on the parameter estimates obtained for the musculoskeletal (or arthritis) group, but setting the age and sex covariates to those of the category in question. Similarly, for each person in the non-musculoskeletal (or non-arthritis) group, we estimate a predicted value based on the parameter estimates obtained for the non-musculoskeletal (or arthritis) group, with age and sex covariates set appropriately.

*Step 3: Create the AF numerator and denominator.* The AF numerator, the costs attributable to musculoskeletal conditions (or arthritis), is obtained by calculating the weighted sum of the increment

over all individuals with the condition. This is the equivalent of calculating the average increment for persons with musculoskeletal conditions in the sample and then multiplying by the estimated number of individuals with the condition in the population. The AF denominator, the estimated total cost for all individuals in the age-gender category, can be obtained by calculating the weighted sum of the total cost over all individuals in the sample. Equivalently, the average cost for the sample can be multiplied by the estimated total number of individuals in that age-gender category in the population.

By providing the average increment and the average cost, it allows others to estimate the attributable fraction for populations with different prevalence of the conditions. For a different population, one can multiply the average increment by the estimated number of individuals with the condition in that population and divide by the product of the average total cost and the estimated total number of individuals in that population. This AF can then be applied to the specific population cost figures.

**Cross Validation of Attributable Fractions.** The sampling variability of the estimates presented here is mathematically intractable. In order to gain some appreciation for the sampling variability, we used cross-validation to assess variability for total expenditures among persons with arthritis. Arthritis was chosen because, with a smaller sample size, the estimate would be more prone to error than the estimate for persons with all forms of musculoskeletal disease. We randomly assigned all of the observations used in the multi-stage models to one of ten equal-sized groups. We used nine of the groups to create the parameter estimates using the multi-stage model and then applied them to the last group in order to yield the average increment, the adjusted average cost, and the attributable fraction. This was done ten times, predicting values for each of the ten groups using estimates from the other nine-tenths of the data. A summary table for each of these validation analyses comparing the mean, minimum, maximum, and range of the attributable fractions along with the attributable fraction point estimate is provided in Appendix Table 1. The large sample size of the MEPS and the fact that arthritis is a common condition lead us to expect that the sampling variability would be fairly small, as we see in the cross-validation results. In fact, the largest range of estimates for any of the 12 groups defined by age and

gender was 8 percentage points; most the estimates varied by no more than 3 percent. As sampling variability is reduced, it is increasingly important to consider potential biases. The MEPS survey, by definition, addresses only individuals with medical expenditures for arthritis, with the definition of medical expenditures including ambulatory, inpatient, RX, and a small assortment of other expenditures including those for home health services and various devices, but not including other complementary and alternative medical expenditures. Because the estimates omit persons who were institutionalized when the 1997 MEPS sample was drawn and because they omit the costs that were incurred by persons receiving uncompensated care, the estimates reported here are likely to be conservative. If, however, there are other differences between the two condition groups that are not accounted for in our models, then the estimates of the increment in costs attributable to the conditions could be either over- or underestimated here.

**Description of Employment and Earnings (Indirect Costs).** The indirect cost estimations are limited to persons 18 - 64 with a history of ever being employed as recorded in MEPS. To estimate indirect costs, we first tabulate the actual employment status of persons with and without musculoskeletal conditions (and for those with and without any form of arthritis) who are between the ages of 18 and 64, and, among those who are employed, the hours of work. The absolute level of lost wages is then calculated as the sum of two products. The first product is the cost of lost wages among those who are not working at all. This product is equal to the difference in the employment rates of persons with and without musculoskeletal conditions (or any form of arthritis) times the number of persons with musculoskeletal conditions times the mean wage among all employed persons with musculoskeletal conditions (or any form of arthritis). The second product is the cost of lost wages among those who continue to work. This product is equal to the difference in the hours of work per year of employed persons with and without musculoskeletal conditions (or any form of arthritis) divided by the mean hours of work of all persons (yielding the percentage reduction in hours) times the number of persons with musculoskeletal conditions (or any form of arthritis) times the mean wage among all employed persons with such conditions.

**Analysis of Increment in Earnings Losses.** We then estimate the increment of earnings losses in a manner analogous to the estimate of the increment in expenditures. Specifically, we begin by estimating separate logistic regressions among persons with and without musculoskeletal conditions (or any form of arthritis) of the probability of employment and then estimate separate ordinary least squares regressions of the level of annual earnings among the members of the two groups with earnings. The regressions include the following independent variables: age, gender, white vs. non-white race, Hispanic status, and education level (indicator variables for high school graduation, some college, college graduation, and some graduate school, with less than a high school education as the reference). In addition, the regressions include a series of indicator variables for combinations of occupation and industry for the longest main job held in 1997 (for persons currently employed) or the most recent job (for those no longer working). Combinations of occupations and industries are included when the relative standard error of annual earnings is less than 0.30 (a relative standard error is equal to the parameter estimate divided by the standard error). Combinations not meeting this criterion were recoded to adjacent cells in the matrix of occupations and industries until all cells met the criterion.

After the regressions were completed, we applied the parameter estimates derived from regressions on persons without conditions to the data of those with such conditions to simulate the expected level of earnings among such persons if they did not have musculoskeletal conditions (or any form of arthritis). The increment in earnings losses, the measure of incremental indirect costs used in this report, is then calculated as the difference between the musculoskeletal (or arthritis) and simulated non-musculoskeletal (non-arthritis) values. In the ordinary least squares regressions, the natural log of earnings was used; the results were then transformed back to absolute dollar amounts using separate smearing estimates calculated among persons with and without musculoskeletal conditions in a manner analogous to the direct cost estimations described above.

As it turns out, earnings levels did not differ very much between persons with and without musculoskeletal conditions (or between those with and without any form of arthritis) who were employed. Accordingly, the indirect costs associated with musculoskeletal conditions (or any form of arthritis) are

largely the result of lost employment, not lower earnings. Because of this, we present estimates of the odds ratios associated with demographic predictors of employment status among persons with musculoskeletal conditions (or any form of arthritis) calculated from models that include the demographic characteristics and occupations and industries of the MEPS respondents.

## **Results**

### **Distribution of Conditions.**

In 1997, 56.368 million persons (20.8 percent of the population) reported having at least one musculoskeletal condition, of whom 44.695 million (16.5 percent of the entire population and 79.3 percent of all persons with musculoskeletal conditions) also reported having one or more non-musculoskeletal condition (Table 1). In that same year, 113.805 million persons (42.0 percent) reported non-musculoskeletal conditions in the absence of musculoskeletal ones and another 101.106 million (37.3 percent) reported no chronic conditions whatsoever (all told, there were 214.911 million persons without musculoskeletal conditions in 1997). In 1997, 38.423 million persons (14.2 percent of the population) reported any form of arthritis, of whom 32.788 million (12.1 percent of the entire population and 85.3 percent of all persons with arthritis) also reported having one or more non-arthritis conditions (some of which are other musculoskeletal conditions)(Table 2).

A higher proportion of persons with than without musculoskeletal conditions were females and white, while a slightly smaller percentage were of Hispanic origin. Such persons were also a decade older on average and, reflecting this, they were more likely to be widowed, separated, or divorced and less likely to never have been married (data on characteristics of persons with and without musculoskeletal conditions not in tables).

### **Description of Direct Costs in the Form of Expenditures.**

**Distribution of Total Health Expenditures—Musculoskeletal conditions.** Persons with musculoskeletal conditions experience total medical care expenditures that are roughly 80 percent higher than among persons with non-musculoskeletal chronic conditions, \$4,251 versus \$2,312 (Table 3). Because persons who report only having musculoskeletal conditions have total expenditures that are of

similar magnitude as those reporting only one non-musculoskeletal condition (\$1,077 versus \$1,160), persons with both kinds of conditions account for the larger overall costs of those with musculoskeletal conditions. Accordingly, those with both musculoskeletal and non-musculoskeletal chronic conditions experience total expenditures of \$5,081 compared to \$3,339 among persons with two or more non-musculoskeletal chronic conditions.

Among persons with musculoskeletal conditions, inpatient-related costs account for 38 percent of the total (the emergency room accounts for another two percent); other large components include physician-related costs (20 percent), and prescriptions (14 percent). However, non-physician visits account for ten percent and home health care services account for seven percent of the total expenditures among persons with musculoskeletal conditions. Although inpatient-related costs are the largest component of costs for such persons, the proportion attributable to this service is smaller than for persons with non-musculoskeletal chronic conditions.

Table 4 shows the distribution of total medical care expenditures among persons with musculoskeletal and non-musculoskeletal conditions and among those with no chronic conditions. Among persons who only have musculoskeletal conditions, median medical care expenditures are only \$349, and even at the 75<sup>th</sup> percentile only reach \$924. The maximum expenditure among such persons is \$65,316 and total medical expenditures for the 11.673 million individuals in this group are only \$12.6 billion, or 2 percent of all medical care expenditures (datum on number of affected individuals from Table 1, above). Among persons with both musculoskeletal and non-musculoskeletal conditions, expenditure levels are much higher: median expenditures are \$1,839, expenditures at the 75<sup>th</sup> percentile are \$4,656, and the maximum is \$191,297.

Median medical care expenditures among persons with one or two or more non-musculoskeletal conditions are \$336 and \$1,029, respectively, but both of the latter two groups have maximum expenditures (\$337,262 and \$351,156, respectively) that are substantially greater than the maximums among the analogous groups of persons with musculoskeletal conditions -- persons with musculoskeletal conditions only and those with both musculoskeletal and non-musculoskeletal conditions.

In contrast to the expenditure levels among persons with chronic conditions, median expenditures are only \$89 among those with no chronic conditions, and even at the 95<sup>th</sup> percentile, expenditures among such persons only reach \$1,958.

Overall, the 56.368 million persons with musculoskeletal conditions, representing 20.8 percent of the population, account for \$239.6 billion in total medical care expenditures, or about 43 percent of all medical care expenditures (The 16.5 percent of the population with musculoskeletal and non-musculoskeletal chronic conditions account for about 41 percent of total expenditures.). The 42.0 percent of the population with one or two or more non-musculoskeletal conditions account for total medical care expenditures of \$263.1 billion, or 48 percent of all expenditures. And the 37.3 percent of the population without chronic conditions only account for total medical care expenditures of \$50.5 billion, or 9 percent of all such expenditures. Thus, total medical care expenditures are concentrated disproportionately among those with chronic conditions, especially those who report both musculoskeletal and non-musculoskeletal conditions. The total expenditures among persons with musculoskeletal conditions of \$239.6 billion is equivalent to 2.9 percent of the Gross Domestic Product (GDP) for the U.S. in 1997.

**Distribution of Total Health Expenditures—Arthritis Conditions.** The 38.423 million persons with any form of arthritis had average total medical care expenditures in 1997 of \$4,865 (\$1,074 among the 5.635 million without non-arthritis conditions, \$5,516 among the 32.788 million with such conditions), much higher than the average of \$2,397 among persons with non-arthritis conditions or than the \$500 among those without chronic conditions (Table 5). Overall, in 1997, persons with any form of arthritis accounted for \$186.9 billion in expenditures, the equivalent of about 2.3 percent of the Gross Domestic Product for the U.S. in that year, with all but \$6.1 billion associated with persons reporting any form of arthritis as well as non-arthritis conditions (Table 6). The 38.423 million persons with any form of arthritis represent about 68 percent of all persons with musculoskeletal conditions but account for a slightly higher proportion (78 percent) of their total expenditures.

**Analysis of the Increment in Expenditures and Attributable fractions—Musculoskeletal Conditions.** The \$239.6 billion in expenditures among persons with musculoskeletal conditions are only

partially attributable to the musculoskeletal conditions themselves; a significant fraction is due to the other chronic conditions such persons have, as well as to their acute and well-care. In Table 7, we present the results of the analysis of the proportion of various kinds of expenditures attributable to musculoskeletal conditions among persons 18 years or older. Overall, we estimate that all adults with musculoskeletal conditions had an increment in total expenditures of \$1,483 per person beyond what would be expected of similar persons without such conditions. This is equivalent to a population attributable fraction of 15 percent, meaning that musculoskeletal conditions account for about 15 percent of all expenditures. The attributable fraction rises with age, from 13 percent among persons 18 to 44, to 18 percent among those 45 to 64, and to 24 percent among those 65 or older, as befits a set of conditions associated with aging.

The attributable fraction associated with musculoskeletal conditions is larger for men of all ages (at 17 percent) than for women of all ages (14 percent). The attributable fraction among men 65 and older is particularly pronounced, at 27 percent, suggesting that the presence of musculoskeletal disease among men these ages adds dramatically to their overall medical care expenditures.

Among all persons with musculoskeletal conditions, the attributable fraction associated with this group of conditions is highest for outpatient services, 23 percent, and lowest for prescription medications, 7 percent. The attributable fractions associated with inpatient services and the residual category are 10 and 11 percent, respectively. Thus, musculoskeletal conditions are responsible for a larger relative increment in expenditures for outpatient services than for any other kind of medical care.

Although the attributable fraction for inpatient services is only 7 percent overall, it is much higher for men, regardless of age (12 percent), particularly men who are 65 or older (21 percent). Presumably the relatively high attributable fraction among men these ages reflects the growing prevalence of total joint replacement surgery.

**Analysis of the Increment in Expenditures and Attributable Fractions—Arthritis Conditions.** Table 8 reports the analogous results for adults with any form of arthritis. Overall, arthritis was associated with an increment of \$1,391 in total expenditures, for an attributable fraction of 10

percent. As was the case for persons with all forms of musculoskeletal disease, the attributable fraction was higher among those 65 and older (18 percent) than among those 18 to 44 (6 percent) or those 45 to 64 (12 percent), respectively.

Among men, arthritis was associated with an average increment in total expenditures of \$1,762, for an attributable fraction of 11 percent, whereas among women, it was associated with an average increment of \$1,163, for an attributable fraction of 9 percent. For both genders, the attributable fraction associated with arthritis was higher for those 65 and older than the two younger age groups.

Among all persons with arthritis, the attributable fraction associated with outpatient services was 15 percent, whereas the analogous fractions for inpatient, prescription medications, and the residual categories were only 7, 5, and 8 percent, respectively. However, the attributable fraction for inpatient services associated with arthritis was much higher for men of all ages (12 percent) than women of all ages (3 percent). Among men 65 and over, the attributable fraction for inpatient services was 28 percent, representing an increment of \$1,066 beyond the level of hospital expenditures that would be expected of such men in the absence of arthritis.

Another way to visualize the magnitude of the costs attributable to musculoskeletal conditions in general and arthritis in particular is by estimating the aggregate impact of the mean increment in expenditures. Thus, the average increment of \$1,483 among each of the 53.292 million persons 18 or older with a musculoskeletal condition aggregates to \$79.0 billion, or roughly 0.9 percent of the Gross Domestic Product for 1997. Similarly, the average increment of \$1,391 among each of the 36.759 million persons 18 or older with arthritis aggregates to \$51.1 billion, or roughly 0.6 percent of GDP for that year.

### **Indirect Costs**

**Sociodemographic Characteristics—Musculoskeletal Conditions.** Table 9 shows the demographic characteristics of persons 18-64 who ever worked with and without musculoskeletal conditions. Among persons these ages, those with musculoskeletal conditions are six years older on average and more likely to be female, white, and widowed, separated, or divorced than their counterparts without musculoskeletal conditions. They do not differ significantly in the mix of their educational

attainments.<sup>6</sup>

**Employment/Earnings Losses—Musculoskeletal Conditions.** As a result of their markedly lower employment rates (82.0 percent versus 91.6 percent, for a difference of 9.5 percent), approximately 3.4 million persons with musculoskeletal conditions not currently employed would be working if they had the same employment rate as persons without such conditions (Table 11). However, after controlling for differences between the two groups in demographic characteristics and occupation and industry (for the job held the longest during the year or, if not working, at longest job held), the incremental employment gap is 5.8 percent, or approximately 2.1 million persons. The raw wage loss costs associated with the forgone earnings of the approximately 3.4 million persons with musculoskeletal conditions who would be working but are not is \$98.2 billion (\$2,778 per working age person). The wage losses of currently employed persons with musculoskeletal conditions that are associated with their higher earnings than persons without such conditions amounts to \$5.5 billion (\$190 per working age person), leaving an overall net loss associated with musculoskeletal conditions of \$103.7 billion (\$2,968 per working age person).

After controlling for demographic characteristics and occupation and industry, the increment in the net individual earnings gap attributable to musculoskeletal conditions averaged \$2,563, for a total of \$90.6 billion. Adjustment, thus, had a relatively small effect on the estimate of indirect costs, suggesting that musculoskeletal conditions, rather than the characteristics of persons with such conditions, account for most of their wage losses.

Table 12 provides estimates of the magnitude of the estimated incremental gains and losses in earnings among persons with musculoskeletal conditions. Approximately 11.2 million persons are estimated to have a gain or no change in earnings. The mean gain among such persons is \$3,020, the median gain is \$1,957, while at the 95<sup>th</sup> percentile (5<sup>th</sup> percentile of losses) the estimated gain is \$8,911;

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<sup>6</sup> Table 10 shows the demographic characteristics of persons with and without any form of arthritis. Since the differences between the latter two groups are similar to the difference between persons with and without musculoskeletal conditions displayed in Table 9, we omit the description from the text.

the maximum gain is estimated to be \$26,329. The approximately 24.1 million persons with musculoskeletal conditions with earnings losses are estimated to have losses averaging \$5,168 a year, with a median loss of \$3,579, while at the 95<sup>th</sup> percentile, the estimated loss is \$15,358; at least one individual has an estimated loss of \$41,147.

**Employment/Earnings Losses—Arthritis Conditions.** Table 13 provides estimates of indirect costs associated with any form of arthritis. Persons with arthritis are much less likely to be employed than those without (79.6 percent of the former versus 91.0 percent of the latter are employed, leaving a 11.4 percent raw employment gap, meaning that about 2.5 million persons with arthritis are not working who would be if employment rates of persons with and without arthritis were the same). After controlling for demographic characteristics and occupation and industry, the employment gap attributable to any form of arthritis was still 6.1 percent, potentially affecting as many as 1.4 million persons with arthritis who would have been working if employment rates of persons with and without arthritis were equal. We estimate that these individuals who are not employed experience an aggregate unadjusted earnings gap of \$73.2 billion. Those with arthritis who are employed experience net losses of \$9.2 billion in earnings leaving a net unadjusted earnings gap of \$82.4 billion, or \$3,812 per person 18-64 with arthritis. The \$82.4 billion figure is the equivalent of one percent of GDP for 1997. Controlling for demographic characteristics and occupation and industry, the increment in indirect costs attributable to any form of arthritis was still \$65.2 billion, or \$2,932 per person 18-64 with arthritis, the equivalent of 0.8 percent of GDP for 1997.

Table 14 provides estimates of the magnitude of the estimated incremental gains and losses in earnings among persons with any form of arthritis. Approximately 7.1 million persons with arthritis are estimated to have a gain or no change in earnings. The mean gain among such persons is \$2,963, the median gain is \$2,008, while at the 95<sup>th</sup> percentile (5<sup>th</sup> percentile of losses) the estimated gain is \$7,594; at least one individual has a gain of as much as \$33,983. The approximately 15.1 million persons with arthritis with earnings losses are estimated to have losses averaging \$5,714 a year, with a median loss of \$4,031, while at the 95<sup>th</sup> percentile, the estimated loss is \$15,900; at least one individual has an estimated

loss of \$59,236.

**Demographic Factors Associated with Employment Status.** Because all the earnings losses associated with musculoskeletal conditions occur among those who are not working at all, stopping work loss is essential to containing the indirect costs of this set of conditions. Table 15 shows the demographic factors associated with employment status among persons 18-64 with musculoskeletal conditions and a work history. The characteristics associated with a significantly reduced odds of employment include female gender (OR 0.48, 95% CI 0.38-0.61), increments of five years of age (OR 0.66, 95% CI 0.62-0.70), and having completed less than high school.<sup>7</sup>

### Discussion

We have made two kinds of estimates of both the direct and indirect economic impact of musculoskeletal conditions. In the first estimate of direct costs, we recorded the magnitude and distribution of all medical care expenditures among the 56.368 million persons with musculoskeletal conditions and we found that such persons experienced mean total expenditures of \$4,251, or \$239.6 billion overall. Hospital admissions accounted for 38 percent of these expenditures; physician visits (20 percent) and prescription drugs (14 percent) were the next two largest components. Although average expenditures among persons with musculoskeletal conditions at \$4,251 are substantial, most individuals avoid such high levels of expenditures. Among persons with musculoskeletal conditions alone, average expenditures are only \$1,077 and even at the 95<sup>th</sup> percentile are relatively small, \$3,779. Among persons with both musculoskeletal and non-musculoskeletal chronic conditions, median expenditures are only \$1,839 and only rise to \$4,656 at the 75<sup>th</sup> percentile.

Nevertheless, expenditures incurred on behalf of persons with musculoskeletal conditions represent a substantial drain on the nation's economy. In 1995, the National Arthritis Data Workgroup reported that both direct and indirect costs of musculoskeletal conditions for 1988 amounted to 2.5 percent of the Gross National Product in the U.S. (7). In the present study we found, however, that total

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<sup>7</sup> The demographic factors associated with a reduced odds of employment among persons 18-64 with arthritis (Table 16) were the same as among persons with musculoskeletal conditions writ large and will not be repeated here.

direct medical expenditures alone in 1997 were equivalent to about 2.9 percent of the Gross Domestic Product for that year (48), suggesting that the accounting methods used in the MEPS and the aging of the population both may have contributed to the increase in the estimated impact of these conditions.

In the second set of analyses of direct costs, we estimated the fraction of total expenditures attributable to musculoskeletal conditions among persons 18 and over. Overall, musculoskeletal conditions are associated with an attributable fraction of 15 percent, or \$1,483 per person with musculoskeletal conditions, which aggregates to \$79.0 billion, the equivalent of almost one percent of the GDP in 1997. Since in a recession, by definition, the economy retrenches by 1 percent of GDP or more for two consecutive quarters, the increment in direct expenditures attributable of musculoskeletal conditions alone has an impact slightly less than a small recession but, unlike a recession, occurs in perpetuity. The increment associated with any form of arthritis, \$1,391 per person 18 and over with arthritis, translates into an attributable fraction of 10 percent which, in turn, aggregates to about \$51.1 billion in the nation as a whole, or the equivalent of 0.6 percent of GDP.

In the unadjusted analysis, persons with musculoskeletal conditions who were not working were estimated to be responsible for \$98.2 billion in indirect costs, while those who were employed were actually estimated to have incurred losses of \$5.5 billion, resulting in a net indirect cost of \$103.7 billion. Among those with any form of arthritis, persons who were not working were responsible for \$73.2 billion in indirect costs, while those who were working were estimated to have a loss of \$9.2 billion, resulting in a net indirect cost of arthritis of \$82.4 billion. The finding that those who are not employed are responsible for the bulk of the lost income is consistent with clinical studies in specific rheumatic conditions which show total loss of employment more common than reduction in hours or change in work activities (49).

With respect to arthritis, we found that expenditures averaged \$4,865 among persons with these conditions, or \$186.9 billion among the 38.423 million with arthritis. The increment in expenditures attributable to arthritis averaged \$1,391, for a total of \$51.1 billion among the 36.759 million individuals 18 or older with arthritis, the equivalent of 0.6 percent of the Gross Domestic Product for 1997. The raw

earnings gap due to the lower employment rates of persons with arthritis compared to those without amounted to \$83.2 billion in 1997, or an average of \$3,222 for each of the approximately 22.2 million persons 18-64 with arthritis. After controlling for demographic characteristics and occupation and industry, the incremental value of the aggregate net earnings gap attributable to arthritis was about \$65.2 billion, or \$2,932 per person 18-64 with arthritis.

In a recent estimate of the economic burden of musculoskeletal conditions, Rice and colleagues (1) calculated that the indirect costs of these conditions in 1995 were about \$113.6 billion among persons 18-64, or about \$119.6 billion in 1997 terms, while indirect costs for arthritis among persons these ages were \$60.8 billion, or about \$64.0 billion in 1997 terms. The estimate of indirect costs for musculoskeletal conditions in Rice and colleagues is somewhat higher than our most comparable estimate from the current study -- \$90.6 billion for all indirect costs; our most comparable estimate of the indirect costs attributable to arthritis in the current study -- \$65.2 billion -- slightly exceeds the estimate from Rice and colleagues. The studies by Rice and colleagues were based on published labor force participation rates and earnings by principal diagnosis. The relative similarity of the estimates from the latter study and the present one suggest that the use of different methods did not have a great effect on the results, in turn providing confidence in the traditional method employed by Rice and colleagues and the new method used here. Recently, Dunlop and colleagues (including one of the authors of the present report) provided estimates of the costs of musculoskeletal conditions using the 1996 MEPS, but updated to 2001 terms (50). The latter study used similar methods to the present one, although the authors used slightly different age criteria for inclusion, included a slightly different set of conditions within the rubric of musculoskeletal disease, and employed a slightly different set of covariates with which to calculate the increment in costs associated with musculoskeletal conditions. They estimated that the increment in the direct costs of musculoskeletal conditions aggregated to \$42.6 billion (versus the \$79.0 billion from the present study) and that the increment in the indirect costs aggregated to \$82.2 billion (versus the \$90.6 billion from the present study).

The results of the present study indicate that much of indirect costs of musculoskeletal conditions

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in general and arthritis in particular are the result of the conditions rather than the characteristics of persons with these conditions, since adjustment for these characteristics only reduced the estimate of indirect costs for those with musculoskeletal conditions from \$103.7 to \$90.6 billion and for those with arthritis from \$82.4 to 65.2 billion. This finding from a population-based study of persons with a wide range of musculoskeletal conditions is consistent with studies of those with discrete rheumatic conditions (18) and indicates that the prevention of work loss and the resultant indirect costs should be central to public health policy to reduce the impact of musculoskeletal (or arthritis) conditions.

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**Table 1. Number and Percent of the Non-Institutionalized Population,  
by Musculoskeletal Condition Status, U.S., 1997**

Chronic Condition Status	<i>N</i> (in millions)	% Total Population	% Persons with Musculoskeletal Conditions
All Musculoskeletal Conditions	56.368	20.8%	100.0%
Musculoskeletal Conditions Only	11.673	4.3%	20.7%
Musculoskeletal and non Musculoskeletal Conditions	44.695	16.5%	79.3%
All non Musculoskeletal Conditions	113.805	42.0%	
One non Musculoskeletal Condition Only	53.648	19.8%	
Two or more non Musculoskeletal Conditions	60.157	22.2%	
No Chronic/Comorbid Conditions	101.106	37.3%	

**Table 2. Number and Percent of the Non-Institutionalized Population,  
by Arthritis Condition Status, U.S., 1997**

Chronic Condition Status	<i>N</i> (in millions)	% Total Population	% Persons with Arthritis Conditions
All Arthritis Conditions	38.423	14.2%	100.0%
Arthritis Conditions Only	5.635	2.1%	14.7%
Arthritis and non Arthritis Conditions	32.788	12.1%	85.3%
All non Arthritis Conditions	131.749	48.6%	
One non Arthritis Condition Only	58.609	21.6%	
Two or more non Arthritis Conditions	73.14	27.0%	
No Chronic/Comorbid Conditions	101.106	37.3%	

**Table 3. Health Care Expenditures (by Type) of the Non-Insitutionalized Population, by Musculoskeletal Condition Status, U.S., 1997.**

Condition Status	Office Based and Hospital Outpatient						ER and Inpatient				Other				Total Expenditures Mean \$		
	A. Physician Related		B. Other		C. Total		D. ER		E. Inpatient		F. Home Health		G. Prescriptions Filled			H. Other	
	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %		Mean\$	Row %
Musc. Conds.	\$861	(20%)	\$412	(10%)	\$1,273	(30%)	\$104	(2%)	\$1,617	(38%)	\$305	(7%)	\$599	(14%)	\$354	(8%)	\$4,251
Musc. Conds. Only	\$314	(29%)	\$128	(12%)	\$442	(41%)	\$55	(5%)	\$260	(24%) *	\$26	(2%) *	\$87	(8%)	\$207	(19%)	\$1,077
Musc. and Non Musc Conds.	\$1,004	(20%)	\$486	(10%)	\$1,490	(29%)	\$117	(2%)	\$1,972	(39%)	\$377	(7%)	\$732	(14%)	\$392	(8%)	\$5,081
Non Musc. Conds.	\$465	(20%)	\$170	(7%)	\$635	(27%)	\$79	(3%)	\$943	(41%)	\$98	(4%)	\$318	(14%)	\$239	(10%)	\$2,312
1 Non Musc. Cond.	\$270	(23%)	\$94	(8%)	\$363	(31%)	\$58	(5%)	\$399	(34%)	\$28	(2%)	\$125	(11%)	\$187	(16%)	\$1,160
2 or more Non Musc. Conds.	\$640	(19%)	\$238	(7%)	\$878	(26%)	\$97	(3%)	\$1,428	(43%)	\$161	(5%)	\$490	(15%)	\$286	(9%)	\$3,339
No Chronic Conditions	\$115	(23%)	\$36	(7%)	\$151	(30%)	\$30	(6%)	\$149	(30%)	\$9	(2%) *	\$23	(5%)	\$137	(27%)	\$500
All Persons	\$417	(20%)	\$170	(8%)	\$587	(29%)	\$66	(3%)	\$787	(39%)	\$108	(5%)	\$266	(13%)	\$225	(11%)	\$2,039

\* Estimate has low statistical reliability (relative standard error >30%)

- A. Includes office-based visits to physicians, physician outpatient separately billed expense and associated outpatient facility expense.
- B. Includes all non-physician office based and outpatient visits and associated facility expense, and unknown office-based and outpatient expenses.
- C. A + B
- D. Includes facility and separately-billed provider expense
- E. Includes facility and separately-billed provider expense
- H. Includes dental visits and other medical supplies and equipment

**Table 4. Distribution of Total Health Expenditures of the Non-Institutionalized Population, US., 1997**

	Min	5%	25%	Med	75%	95%	Max	Mean	Total Billions	(Col %)
Musc. Conds.	\$0	\$20	\$461	\$1,357	\$3,738	\$18,211	\$191,297	\$4,251	\$239.6	(43%)
Musc. Conds. Only	\$0	\$0	\$94	\$349	\$924	\$3,779	\$65,316	\$1,077	\$12.6	(2%)
Musc. and Non Musc Conds.	\$0	\$131	\$733	\$1,839	\$4,656	\$20,856	\$191,297	\$5,081	\$227.1	(41%)
Non Musc. Conds.	\$0	\$0	\$215	\$602	\$1,728	\$8,946	\$351,156	\$2,312	\$263.1	(48%)
1 Non Musc. Cond.	\$0	\$0	\$110	\$336	\$850	\$4,534	\$337,262	\$1,160	\$62.2	(11%)
2 or more Non Musc. Conds.	\$0	\$85	\$412	\$1,029	\$2,745	\$12,795	\$351,156	\$3,339	\$200.9	(36%)
No Chronic Conditions	\$0	\$0	\$0	\$89	\$319	\$1,958	\$136,109	\$500	\$50.5	(9%)
All Persons	\$0	\$0	\$83	\$394	\$1,415	\$8,478	\$351,156	\$2,039	\$553.2	(100%)

**Table 5. Health Care Expenditures (by Type) of the Non-Insitutionalized Population, by Arthritis Condition Status, U.S., 1997.**

Condition Status	Office Based and Hospital Outpatient						ER and Inpatient				Other				Total Expenditures Mean \$		
	A. Physician Related		B. Other		C. Total		D. ER		E. Inpatient		F. Home Health		G. Prescriptions Filled			H. Other	
	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %	Mean\$	Row %		Mean\$	Row %
Arthritis Conds.	\$967	(20%)	\$428	(9%)	\$1,394	(29%)	\$103	(2%)	\$1,905	(39%)	\$398	(8%)	\$687	(14%)	\$377	(8%)	\$4,865
Arthritis Conds. Only	\$290	(27%)	\$123	(11%)	\$413	(38%)	\$35	(3%)	\$320	(30%) *	\$15	(1%) *	\$81	(8%)	\$210	(20%)	\$1,074
Arthritis and Non Arth. Conds.	\$1,083	(20%)	\$480	(9%)	\$1,563	(28%)	\$115	(2%)	\$2,177	(39%)	\$464	(8%)	\$792	(14%)	\$406	(7%)	\$5,516
Non Arthritis Conds.	\$488	(20%)	\$198	(8%)	\$687	(29%)	\$82	(3%)	\$951	(40%)	\$99	(4%)	\$330	(14%)	\$248	(10%)	\$2,397
1 Non Arthritis Cond.	\$269	(24%)	\$96	(8%)	\$365	(32%)	\$59	(5%)	\$379	(33%)	\$29	(3%)	\$121	(11%)	\$188	(16%)	\$1,142
2 or more Arthritis Cond.	\$664	(20%)	\$280	(8%)	\$944	(28%)	\$101	(3%)	\$1,409	(41%)	\$155	(5%)	\$498	(15%)	\$296	(9%)	\$3,403
No Chronic Conds.	\$115	(23%)	\$36	(7%)	\$151	(30%)	\$30	(6%)	\$149	(30%)	\$9	(2%) *	\$23	(5%)	\$137	(27%)	\$500
All Persons	\$417	(20%)	\$170	(8%)	\$587	(29%)	\$66	(3%)	\$787	(39%)	\$108	(5%)	\$266	(13%)	\$225	(11%)	\$2,039

\* Estimate has low statistical reliability (relative standard error >30%)

- A. Includes office-based visits to physicians, physician outpatient separately billed expense and associated outpatient facility expense.
- B. Includes all non-physician office based and outpatient visits and associated facility expense, and unknown officed-based and outpatient expenses.
- C. A + B
- D. Includes facility and separately-billed provider expense
- E. Includes facility and separately-billed provider expense
- H. Includes dental visits and other medical supplies and equipment

**Table 6. Distribution of Total Health Expenditures of the Non-Institutionalized Population, by Arthritis Condition Status, U.S., 1997.**

	Min	5%	25%	Med	75%	95%	Max	Mean	Total Billions (Col %)
Arthritis Conds.	\$0	\$60	\$575	\$1,644	\$4,306	\$20,041	\$191,297	\$4,865	\$186.9 (34%)
Arthritis Conds. Only	\$0	\$0	\$98	\$349	\$910	\$3,703	\$65,316	\$1,074	\$6.1 (1%)
Arthritis and Non Musc Conds.	\$0	\$154	\$799	\$2,004	\$5,114	\$22,332	\$191,297	\$5,516	\$180.9 (33%)
Non Arthritis Conds.	\$0	\$0	\$223	\$635	\$1,847	\$9,644	\$351,156	\$2,397	\$315.8 (57%)
1 Non Arthritis Cond.	\$0	\$0	\$108	\$337	\$854	\$4,494	\$337,262	\$1,142	\$66.9 (12%)
2 or more Arthritis Cond.	\$0	\$78	\$424	\$1,068	\$2,870	\$13,735	\$351,156	\$3,403	\$248.9 (45%)
No Chronic Conds.	\$0	\$0	\$0	\$89	\$319	\$1,958	\$136,109	\$500	\$50.5 (9%)
All Persons	\$0	\$0	\$83	\$394	\$1,415	\$8,478	\$351,156	\$2,039	\$553.2 (100%)

Table 7  
Increment in Expenditures and Attributable Fractions for Musculoskeletal Conditions for the Adult U.S. Population, 1997  
by Age-Gender Groups and Expenditure Type

Group		# MEPS Respondents		Estimated Population (1,000s)		Kind of Expenditures														
Gender	Age	Total	Musc Conditions	Total	Musc Conditions	Outpatient			Inpatient			RX			Residual			Total		
						Increment*	Adjusted Cost**	Attributable Fraction	Increment*	Adjusted Cost**	Attributable Fraction	Increment*	Adjusted Cost**	Attributable Fraction	Increment*	Adjusted Cost**	Attributable Fraction	Increment*	Adjusted Cost**	Attributable Fraction
Both	All	22,435	6,296	196,329	53,292	\$637	\$764	23%	\$287	\$1,040	7%	\$174	\$455	10%	\$174	\$417	11%	\$1,483	\$2,678	15%
Both	18 to 44	12,199	2,156	108,997	19,550	\$481	\$659	13%	\$362	\$880	7%	\$115	\$292	7%	\$177	\$353	9%	\$1,590	\$2,221	13%
Both	45 to 64	6,455	2,334	54,515	18,470	\$735	\$814	31%	\$185	\$934	7%	\$221	\$485	15%	\$141	\$466	10%	\$1,418	\$2,733	18%
Both	65 and over	3,781	1,806	32,817	15,272	\$698	\$860	38%	\$392	\$1,258	15%	\$198	\$566	16%	\$197	\$493	19%	\$1,666	\$3,207	24%
Female	All	12,187	3,777	102,026	30,404	\$715	\$880	24%	\$149	\$1,052	4%	\$173	\$522	10%	\$183	\$444	12%	\$1,345	\$2,882	14%
Female	18 to 44	6,482	1,209	55,063	10,361	\$542	\$765	13%	\$245	\$893	5%	\$117	\$338	7%	\$187	\$378	9%	\$1,472	\$2,391	12%
Female	45 to 64	3,464	1,391	28,207	10,609	\$825	\$938	33%	\$55	\$953	2%	\$226	\$558	15%	\$149	\$496	11%	\$1,297	\$2,964	16%
Female	65 and over	2,241	1,177	18,756	9,433	\$783	\$988	40%	\$227	\$1,278	9%	\$194	\$652	15%	\$207	\$525	20%	\$1,502	\$3,463	22%
Male	All	10,248	2,519	94,303	22,888	\$520	\$621	20%	\$499	\$1,031	12%	\$173	\$369	11%	\$159	\$384	10%	\$1,703	\$2,444	17%
Male	18 to 44	5,717	947	53,934	9,189	\$392	\$531	13%	\$538	\$871	11%	\$111	\$234	8%	\$162	\$325	9%	\$1,776	\$2,029	15%
Male	45 to 64	2,991	943	26,308	7,861	\$604	\$662	27%	\$380	\$918	12%	\$212	\$390	16%	\$127	\$431	9%	\$1,609	\$2,467	19%
Male	65 and over	1,540	629	14,062	5,839	\$573	\$704	34%	\$641	\$1,242	21%	\$204	\$455	19%	\$181	\$455	17%	\$1,922	\$2,914	27%

\* Per person with condition (average)

\*\* Per person whether or not they have the condition

**Table 8**  
**Increment in Expenditures and Attributable Fractions for Arthritis Conditions for the Adult U.S. Population, 1997**  
**by Age-Gender Groups and Expenditure Type**

Group		# MEPS Respondents		Estimated Population (1,000s)		Attributable Fractions by Expenditure Type														
Gender	Age	Total	Arthritis	Total	Arthritis	Outpatient			Inpatient			RX			Residual			Total		
						Increment*	Adjusted Cost**	Attributable Fraction	Increment*	Adjusted Cost**	Attributable Fraction	Increment*	Adjusted Cost**	Attributable Fraction	Increment*	Adjusted Cost**	Attributable Fraction	Increment*	Adjusted Cost**	Attributable Fraction
Both	All	22,435	4,449	196,329	36,759	\$598	\$768	15%	\$401	\$1,042	7%	\$112	\$456	5%	\$176	\$418	8%	\$1,391	\$2,689	10%
Both	18 to 44	12,199	1,193	108,997	10,674	\$453	\$668	7%	\$407	\$895	4%	\$86	\$295	3%	\$149	\$350	4%	\$1,467	\$2,238	6%
Both	45 to 64	6,455	1,717	54,515	13,458	\$698	\$812	21%	\$195	\$930	5%	\$190	\$483	10%	\$185	\$467	10%	\$1,377	\$2,728	12%
Both	65 and over	3,781	1,539	32,817	12,628	\$627	\$867	28%	\$605	\$1,241	19%	\$85	\$567	6%	\$177	\$498	14%	\$1,539	\$3,209	18%
Female	All	12,187	2,783	102,026	21,862	\$649	\$882	16%	\$150	\$1,045	3%	\$107	\$522	4%	\$181	\$444	9%	\$1,163	\$2,886	9%
Female	18 to 44	6,482	722	55,063	6,075	\$491	\$771	7%	\$196	\$902	2%	\$86	\$341	3%	\$154	\$373	5%	\$1,268	\$2,405	6%
Female	45 to 64	3,464	1,044	28,207	7,813	\$757	\$932	23%	(\$22)	\$942	-1%	\$194	\$557	10%	\$192	\$496	11%	\$1,182	\$2,949	11%
Female	65 and over	2,241	1,017	18,756	7,973	\$680	\$993	29%	\$310	\$1,248	11%	\$74	\$654	5%	\$182	\$530	15%	\$1,278	\$3,456	16%
Male	All	10,248	1,666	94,303	14,897	\$514	\$629	13%	\$795	\$1,050	12%	\$121	\$369	5%	\$165	\$387	7%	\$1,762	\$2,465	11%
Male	18 to 44	5,717	471	53,934	4,599	\$391	\$543	6%	\$734	\$899	7%	\$87	\$236	3%	\$140	\$323	4%	\$1,788	\$2,051	7%
Male	45 to 64	2,991	673	26,308	5,644	\$599	\$665	19%	\$535	\$927	12%	\$186	\$388	10%	\$172	\$433	9%	\$1,695	\$2,474	15%
Male	65 and over	1,540	522	14,062	4,654	\$539	\$715	25%	\$1,066	\$1,248	28%	\$108	\$456	8%	\$168	\$462	12%	\$1,962	\$2,931	22%

\* Per person with condition (average)

\*\* Per person whether or not they have the condition

**Table 9. Demographic Characteristics of Persons 18-64 who ever worked with and without Musculoskeletal Conditions, U.S., 1997**

Characteristic	Persons with Musc. Conditions				Persons without Musc. Conditions				Comp Test Stat (p-value)
	Pop N	%	Mean	SE	Pop N	%	Mean	SE	
Female	19,072,997	54.0%			55,771,065	48.6%			25.16 (<.0001) *
Age			44	0.25			38	0.15	-23.82 (<.0001) **
White	30,451,674	86.2%			95,068,215	82.9%			14.95 (.0001) *
Hispanic	2,894,733	8.2%			12,264,919	10.7%			19.50 (<.0001) *
Education									5.45 (.2448) *
Less than high school	5,893,080	16.7%			17,427,521	15.2%			
High school grad	11,504,030	32.5%			39,603,803	34.5%			
Some college	9,116,073	25.8%			28,333,003	24.7%			
College grad	5,489,576	15.5%			18,497,957	16.1%			
Some graduate school	3,340,990	9.5%			10,793,869	9.4%			
Marital Status									25.59 (<.0001) *
Married	21,984,325	62.2%			64,902,384	56.6%			
Widowed, Separated, Divorced	7,260,541	20.5%			16,607,805	14.5%			
Never Married	6,098,882	17.3%			33,145,965	28.9%			

\* Chi-square test

\*\* Independent Samples t-test

**Table 10. Demographic Characteristics of Persons 18-64 who ever worked with and without Arthritis Conditions, U.S., 1997**

Characteristic	Persons with Arth. Conditions				Persons without Arth. Conditions				Comp Test Stat (p-value)
	Pop N	%	Mean	SE	Pop N	%	Mean	SE	
Female	12,540,633	56.4%			62,303,429	48.8%			35.27 (<.0001) *
Age			46	0.30			38	0.14	-26.03 (<.0001) **
White	19,062,695	85.7%			106,457,193	83.3%			6.31 (.0122) *
Hispanic	1,558,138	7.0%			13,601,515	10.6%			36.94 (<.0001) *
Education									2.80 (.5912) *
Less than high school	3,926,157	17.7%			19,394,445	15.2%			
High school grad	7,547,839	33.9%			43,559,994	34.1%			
Some college	5,431,703	24.4%			32,017,373	25.1%			
College grad	3,229,264	14.5%			20,758,269	16.2%			
Some graduate school	2,100,622	9.4%			12,034,236	9.4%			
Marital Status									28.75 (.0001) *
Married	13,800,103	62.1%			73,086,607	57.2%			
Widowed, Separated, Divorced	4,981,891	22.4%			18,886,455	14.8%			
Never Married	3,453,592	15.5%			35,791,255	28.0%			

\* Chi-square test

\*\* Independent Samples t-test

**Table 11. Individual and Aggregate Employment and Earnings Losses  
of Persons 18-64 with Musculoskeletal Conditions,  
Raw Differences and Increments Attributable to the Musculoskeletal Conditions, U.S., 1997**

<b>Employment</b>	<b>%</b>
Employment Rate of Persons without Musculoskeletal Conditions-Raw	91.6%
Employment Rate of Persons with Musculoskeletal Conditions-Raw	82.0%
Individual Employment Rate Gap-Raw***	9.5%
Aggregate Employment Gap-Raw*	3,370,264
Individual Incremental Employment Rate Gap Attributable to Musculoskeletal Conditions	5.8%
Aggregate Incremental Employment Gap Attributable to Musculoskeletal Conditions*	2,062,661
<b>Earnings</b>	<b>\$'s</b>
Aggregate Lost Earnings due to Lower Employment Rates Among Persons with Musculoskeletal Conditions-Raw **	98.2
Per Capita Earnings Gap due to Lower Employment Rates Among Persons with Musculoskeletal Conditions-Raw	\$2,778
Aggregate Lost Earnings among Employed Persons with Musculoskeletal Conditions-Raw **	\$5.5
Per capita Lost Earnings among Employed Persons with Musculoskeletal Conditions-Raw	\$190
Net Aggregate Earnings Gap-Raw **	\$103.7
Net Per Capita Net Earnings Gap-Raw	\$2,968
Aggregate Incremental Net Earnings Gap Attributable to Musculoskeletal Conditions **	\$90.6
Per Capita Incremental Net Earnings Gap Attributable to Musculoskeletal Conditions	\$2,563

Note: \* Equals number of affected individuals -- about 35.3 million -- times individual employment or earnings gap

\*\* billions \$s

\*\*\* Individual employment gap does not equal the difference of the the two employment rates due to rounding error.

**Table 12. Distribution of Estimated Incremental Earnings Gains and Losses among Persons 18-64 with Musculoskeletal Conditions, U.S., 1997**

	Distribution of Losses (Gains)							Mean
	Percentile							
	Minimum	5th	25th	Median	75th	95th	Maximum	
<b>With an Estimated Gain or No Change in Earnings</b> N=11.246 million (31.8%)	-\$26,329	-\$8,911	-\$3,936	-\$1,957	-\$871	-\$170	-\$1	-\$3,020
<b>With an Estimated Loss in Earnings</b> N= 24.098 million (68.2%)	\$5	\$311	\$1,663	\$3,579	\$7,130	\$15,358	\$41,147	\$5,168
<b>Total</b> N=35.344 million (100%)	-\$26,329	-\$5,279	-\$716	\$1,768	\$5,180	\$13,336	\$41,147	\$2,563

**Table 13. Individual and Aggregate Employment and Earnings Losses  
of Persons 18-64 with Arthritis Conditions,  
Raw Differences and Increments Attributable to the Arthritis Conditions, U.S., 1997**

<b>Employment</b>	<b>%</b>
Employment Rate of Persons without Arthritis Conditions-Raw	91.0%
Employment Rate of Persons with Arthritis Conditions-Raw	79.6%
Individual Employment Rate Gap-Raw***	11.4%
Aggregate Employment Gap-Raw*	2,542,603
Individual Incremental Employment Rate Gap Attributable to Arthritis Conditions	6.1%
Aggregate Incremental Employment Gap Attributable to Arthritis Conditions*	1,361,529
<b>Earnings</b>	<b>\$'s</b>
Aggregate Lost Earnings due to Lower Employment Rates Among Persons with Arthritis Conditions-Raw **	\$73.2
Per Capita Earnings Gap due to Lower Employment Rates Among Persons with Arthritis Conditions-Raw	\$3,293
Aggregate Lost Earnings among Employed Persons with Arthritis Conditions-Raw **	\$9.2
Per capita Lost Earnings among Employed Persons with Arthritis Conditions-Raw	\$519
Net Aggregate Earnings Gap-Raw **	\$82.4
Net Per Capita Net Earnings Gap-Raw	\$3,812
Aggregate Incremental Net Earnings Gap Attributable to Arthritis Conditions **	\$65.2
Per Capita Incremental Net Earnings Gap Attributable to Arthritis Conditions	\$2,932

Note: \* Equals number of affected individuals -- about 22.2 million -- times individual employment or earnings gap

\*\* billions \$s

\*\*\* Individual employment gap does not equal the difference of the the two employment rates due to rounding error.

**Table 14. Distribution of Estimated Incremental Earnings Gains and Losses among Persons 18-64 with Arthritis Conditions, U.S., 1997**

	Distribution of Losses (Gains)							Mean
	Percentile							
	Minimum	5th	25th	Median	75th	95th	Maximum	
<b>With an Estimated Gain or No Change in Earnings</b> N=7.128 million (32.1%)	-\$33,983	-\$7,594	-\$3,518	-\$2,008	-\$886	-\$144	-\$4	-\$2,963
<b>With an Estimated Loss in Earnings</b> N=15.107 million (67.9%)	\$12	\$342	\$1,875	\$4,031	\$7,840	\$15,900	\$59,236	\$5,714
<b>Total</b> N=22.236 million (100%)	-\$33,983	-\$4,453	-\$762	\$2,027	\$5,711	\$14,171	\$59,236	\$2,932

**Table 15. Factors Associated with Employment  
of Persons 18-64 with Musculoskeletal Conditions, Controlling for  
Demographic Characteristics, Occupation and Industry, U.S., 1997**

<b>Characteristic</b>	<b>Odds Ratio</b>	<b>95% CI for Odds Ratio</b>
Female	0.48	(0.38, 0.61)
Age, per 5 years	0.66	(0.62, 0.70)
Race		
Non-White	<i>ref.</i>	
White	1.50	(1.12, 2.02)
Ethnicity		
Non-Hispanic	<i>ref.</i>	
Hispanic	1.02	(0.74, 1.40)
Education		
Less than high school	<i>ref.</i>	
High school grad	1.82	(1.40, 2.36)
Some college	2.58	(1.87, 3.56)
College grad	3.21	(2.04, 5.04)
Some graduate school	3.61	(1.96, 6.62)
Marital Status		
Married	<i>ref.</i>	
Widowed, Separated, Divorced	1.02	(0.81, 1.29)
Never married	0.79	(0.55, 1.12)

**Table 16. Factors Associated with Employment  
of Persons 18-64 with Arthritis Conditions, Controlling for  
Demographic Characteristics, Occupation and Industry, U.S., 1997**

<b>Characteristic</b>	<b>Odds Ratio</b>	<b>95% CI for Odds Ratio</b>
Female	0.54	(0.41, 0.71)
Age, per 5 years	0.64	(0.60, 0.69)
Race		
Non-White	<i>ref.</i>	
White	1.56	(1.13, 2.16)
Ethnicity		
Non-Hispanic	<i>ref.</i>	
Hispanic	0.97	(0.67, 1.41)
Education		
Less than high school	<i>ref.</i>	
High school grad	1.85	(1.35, 2.53)
Some college	2.49	(1.65, 3.74)
College grad	3.66	(2.12, 6.30)
Some graduate school	4.57	(2.26, 9.24)
Marital Status		
Married	<i>ref.</i>	
Widowed, Separated, Divorced	0.87	(0.67, 1.13)
Never married	0.7	(0.45, 1.07)

**Appendix Table 1**  
**Cross-Validation of Total Expenditures for Persons 18 and Over with Arthritis, by Gender and Age**

Category		Validation Subset	Estimated Population (1,000s)		Increment*	Adjusted Cost*	Attributable Fraction	Point Estimate	Mean (AF)	Min (AF)	Max (AF)	Range
Gender	Age		Total	Arthritis								
Both	All	1	196,329	36,759	\$1,369	\$2,711	9%					
Both	All	2	196,329	36,759	\$1,280	\$2,605	9%					
Both	All	3	196,329	36,759	\$1,420	\$2,806	9%					
Both	All	4	196,329	36,759	\$1,299	\$2,695	9%					
Both	All	5	196,329	36,759	\$1,284	\$2,735	9%					
Both	All	6	196,329	36,759	\$1,564	\$2,588	11%					
Both	All	7	196,329	36,759	\$1,519	\$2,775	10%					
Both	All	8	196,329	36,759	\$1,369	\$2,580	10%					
Both	All	9	196,329	36,759	\$1,348	\$2,679	9%					
Both	All	10	196,329	36,759	\$1,377	\$2,709	10%	10%	10%	9%	11%	3%
Both	18-44	1	108,997	10,674	\$1,661	\$2,268	7%					
Both	18-44	2	108,997	10,674	\$1,446	\$2,183	6%					
Both	18-44	3	108,997	10,674	\$1,343	\$2,345	6%					
Both	18-44	4	108,997	10,674	\$1,317	\$2,225	6%					
Both	18-44	5	108,997	10,674	\$1,282	\$2,281	6%					
Both	18-44	6	108,997	10,674	\$1,666	\$2,114	8%					
Both	18-44	7	108,997	10,674	\$1,598	\$2,335	7%					
Both	18-44	8	108,997	10,674	\$1,254	\$2,103	6%					
Both	18-44	9	108,997	10,674	\$1,560	\$2,264	7%					
Both	18-44	10	108,997	10,674	\$1,407	\$2,252	6%	6%	6%	6%	8%	2%
Both	45-64	1	54,515	13,458	\$1,328	\$2,798	12%					
Both	45-64	2	54,515	13,458	\$1,359	\$2,675	13%					
Both	45-64	3	54,515	13,458	\$1,505	\$2,820	13%					
Both	45-64	4	54,515	13,458	\$1,267	\$2,756	11%					
Both	45-64	5	54,515	13,458	\$1,265	\$2,744	11%					
Both	45-64	6	54,515	13,458	\$1,419	\$2,649	13%					
Both	45-64	7	54,515	13,458	\$1,316	\$2,701	12%					
Both	45-64	8	54,515	13,458	\$1,385	\$2,682	13%					
Both	45-64	9	54,515	13,458	\$1,405	\$2,696	13%					
Both	45-64	10	54,515	13,458	\$1,429	\$2,750	13%	12%	12%	11%	13%	2%

**Appendix Table 1 (cont.)**  
**Cross-Validation of Total Expenditures for Persons 18 and Over with Arthritis, by Gender and Age**

Category		Validation Subset	Estimated Population (1,000s)		Increment*	Adjusted Cost*	Attributable Fraction	Point Estimate	Mean (AF)	Min (AF)	Max (AF)	Range
Gender	Age		Total	Arthritis								
Both	65 and over	1	32,817	12,628	\$1,409	\$3,230	17%					
Both	65 and over	2	32,817	12,628	\$1,326	\$3,110	16%					
Both	65 and over	3	32,817	12,628	\$1,542	\$3,284	18%					
Both	65 and over	4	32,817	12,628	\$1,502	\$3,195	18%					
Both	65 and over	5	32,817	12,628	\$1,457	\$3,223	17%					
Both	65 and over	6	32,817	12,628	\$1,777	\$3,115	22%					
Both	65 and over	7	32,817	12,628	\$1,791	\$3,340	21%					
Both	65 and over	8	32,817	12,628	\$1,630	\$3,126	20%					
Both	65 and over	9	32,817	12,628	\$1,365	\$3,214	16%					
Both	65 and over	10	32,817	12,628	\$1,485	\$3,246	18%	18%	18%	16%	22%	6%
Female	All	1	102,026	21,862	\$1,145	\$2,918	8%					
Female	All	2	102,026	21,862	\$1,119	\$2,836	8%					
Female	All	3	102,026	21,862	\$1,129	\$2,972	8%					
Female	All	4	102,026	21,862	\$1,039	\$2,899	8%					
Female	All	5	102,026	21,862	\$1,133	\$2,932	8%					
Female	All	6	102,026	21,862	\$1,227	\$2,778	9%					
Female	All	7	102,026	21,862	\$1,295	\$2,973	9%					
Female	All	8	102,026	21,862	\$1,237	\$2,777	10%					
Female	All	9	102,026	21,862	\$1,123	\$2,860	8%					
Female	All	10	102,026	21,862	\$1,126	\$2,909	8%	9%	9%	8%	10%	2%
Female	18-44	1	55,063	6,075	\$1,472	\$2,441	7%					
Female	18-44	2	55,063	6,075	\$1,309	\$2,378	6%					
Female	18-44	3	55,063	6,075	\$1,087	\$2,489	5%					
Female	18-44	4	55,063	6,075	\$1,093	\$2,398	5%					
Female	18-44	5	55,063	6,075	\$1,140	\$2,448	5%					
Female	18-44	6	55,063	6,075	\$1,380	\$2,274	7%					
Female	18-44	7	55,063	6,075	\$1,377	\$2,500	6%					
Female	18-44	8	55,063	6,075	\$1,155	\$2,273	6%					
Female	18-44	9	55,063	6,075	\$1,361	\$2,418	6%					
Female	18-44	10	55,063	6,075	\$1,187	\$2,420	5%	6%	6%	5%	7%	2%

**Appendix Table 1 (cont.)**  
**Cross-Validation of Total Expenditures for Persons 18 and Over with Arthritis, by Gender and Age**

Category		Validation Subset	Estimated Population (1,000s)		Increment*	Adjusted Cost*	Attributable Fraction	Point Estimate	Mean (AF)	Min (AF)	Max (AF)	Range
Gender	Age		Total	Arthritis								
Female	45-64	1	28,207	7,813	\$1,124	\$3,029	10%					
Female	45-64	2	28,207	7,813	\$1,227	\$2,928	12%					
Female	45-64	3	28,207	7,813	\$1,250	\$3,008	12%					
Female	45-64	4	28,207	7,813	\$1,029	\$2,982	10%					
Female	45-64	5	28,207	7,813	\$1,145	\$2,964	11%					
Female	45-64	6	28,207	7,813	\$1,123	\$2,872	11%					
Female	45-64	7	28,207	7,813	\$1,145	\$2,930	11%					
Female	45-64	8	28,207	7,813	\$1,270	\$2,901	12%					
Female	45-64	9	28,207	7,813	\$1,211	\$2,901	12%					
Female	45-64	10	28,207	7,813	\$1,212	\$2,975	11%	11%	11%	10%	12%	3%
Female	65 and over	1	18,756	7,973	\$1,156	\$3,491	14%					
Female	65 and over	2	18,756	7,973	\$1,149	\$3,397	14%					
Female	65 and over	3	18,756	7,973	\$1,211	\$3,490	15%					
Female	65 and over	4	18,756	7,973	\$1,199	\$3,443	15%					
Female	65 and over	5	18,756	7,973	\$1,287	\$3,467	16%					
Female	65 and over	6	18,756	7,973	\$1,390	\$3,358	18%					
Female	65 and over	7	18,756	7,973	\$1,528	\$3,592	18%					
Female	65 and over	8	18,756	7,973	\$1,464	\$3,373	18%					
Female	65 and over	9	18,756	7,973	\$1,106	\$3,447	14%					
Female	65 and over	10	18,756	7,973	\$1,195	\$3,495	15%	16%	16%	14%	18%	5%
Male	All	1	94,303	14,897	\$1,602	\$2,443	10%					
Male	All	2	94,303	14,897	\$1,730	\$2,384	11%					
Male	All	3	94,303	14,897	\$1,837	\$2,605	11%					
Male	All	4	94,303	14,897	\$1,749	\$2,460	11%					
Male	All	5	94,303	14,897	\$1,578	\$2,494	10%					
Male	All	6	94,303	14,897	\$2,078	\$2,402	14%					
Male	All	7	94,303	14,897	\$1,884	\$2,567	12%					
Male	All	8	94,303	14,897	\$1,699	\$2,332	12%					
Male	All	9	94,303	14,897	\$1,671	\$2,470	11%					
Male	All	10	94,303	14,897	\$1,726	\$2,483	11%	11%	11%	10%	14%	4%

**Appendix Table 1 (cont.)**  
**Cross-Validation of Total Expenditures for Persons 18 and Over with Arthritis, by Gender and Age**

Category		Validation Subset	Estimated Population (1,000s)		Increment*	Adjusted Cost*	Attributable Fraction	Point Estimate	Mean (AF)	Min (AF)	Max (AF)	Range
Gender	Age		Total	Arthritis								
Male	18-44	1	53,934	4,599	\$1,851	\$2,045	8%					
Male	18-44	2	53,934	4,599	\$1,840	\$1,999	8%					
Male	18-44	3	53,934	4,599	\$1,709	\$2,177	7%					
Male	18-44	4	53,934	4,599	\$1,691	\$2,028	7%					
Male	18-44	5	53,934	4,599	\$1,552	\$2,084	6%					
Male	18-44	6	53,934	4,599	\$2,103	\$1,960	9%					
Male	18-44	7	53,934	4,599	\$1,945	\$2,169	8%					
Male	18-44	8	53,934	4,599	\$1,484	\$1,886	7%					
Male	18-44	9	53,934	4,599	\$1,847	\$2,092	8%					
Male	18-44	10	53,934	4,599	\$1,711	\$2,060	7%	7%	7%	6%	9%	3%
Male	45-64	1	26,308	5,644	\$1,540	\$2,503	13%					
Male	45-64	2	26,308	5,644	\$1,756	\$2,426	16%					
Male	45-64	3	26,308	5,644	\$1,870	\$2,594	15%					
Male	45-64	4	26,308	5,644	\$1,664	\$2,489	14%					
Male	45-64	5	26,308	5,644	\$1,510	\$2,476	13%					
Male	45-64	6	26,308	5,644	\$1,872	\$2,427	17%					
Male	45-64	7	26,308	5,644	\$1,585	\$2,461	14%					
Male	45-64	8	26,308	5,644	\$1,664	\$2,398	15%					
Male	45-64	9	26,308	5,644	\$1,683	\$2,461	15%					
Male	45-64	10	26,308	5,644	\$1,727	\$2,493	15%	15%	15%	13%	17%	3%
Male	65 and over	1	14,062	4,654	\$1,685	\$2,898	19%					
Male	65 and over	2	14,062	4,654	\$1,825	\$2,831	21%					
Male	65 and over	3	14,062	4,654	\$2,013	\$3,040	22%					
Male	65 and over	4	14,062	4,654	\$2,007	\$2,910	23%					
Male	65 and over	5	14,062	4,654	\$1,788	\$2,932	20%					
Male	65 and over	6	14,062	4,654	\$2,351	\$2,876	27%					
Male	65 and over	7	14,062	4,654	\$2,204	\$3,082	24%					
Male	65 and over	8	14,062	4,654	\$2,013	\$2,815	24%					
Male	65 and over	9	14,062	4,654	\$1,740	\$2,951	20%					
Male	65 and over	10	14,062	4,654	\$1,898	\$2,962	21%	22%	22%	19%	27%	8%

\* Per person with condition (average)