WORKFORCE STUDY OF RHEUMATOLOGISTS

Final Report

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The American College of Rheumatology

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EXECUTIVE SUMMARY

The American College of Rheumatology asked The Lewin Group to conduct a workforce study of Rheumatologists. The purpose of the workforce study is to better understand the factors affecting the supply of and demand for rheumatologists, to quantify the factors where possible, to project likely paths for the evolution of workforce supply and demand, and to assess the implications.

A major source of information for this study was the Advisory Group formed by the chairman of the Committee on Training and Workforce Issues, Dr. Walter Barr, and chaired by Dr. Chad Deal. The Advisory Group was a source of institutional and clinical information relevant to the rheumatology physician workforce, as well as guidance for the study itself.

Overall this study projects that the number of practicing adult rheumatologists will remain relatively flat between 2005 and 2025 increasing only 1.2 percent. Meanwhile, this study projects a dramatic increase in demand for adult rheumatology services of 46 percent in the same period. The projected increases in demand results from population growth, increases in the elderly population, and increases in per capita income. The difference in the supply and demand trends results in substantial excess demand for rheumatologist services. This potential for excess demand can be mitigated by increasing fellowship positions, increasing the work effort of rheumatologists, practicing more efficiently, and using allied health professionals to supplement the rheumatology workforce.

In the next several sections, we provide a brief overview of the background information and assumptions that underlie these projections. We begin with a discussion of the background literature. Then, we provide an overview of the rheumatology workforce in 2005. Finally, we discuss projections of supply and demand between 2005 and 2025.

Literature Review

The literature review provides background on the current and possible future workforce environment and sets the stage for the workforce analysis. The literature review discusses the following topics:

- Prevalence of musculoskeletal diseases;
- Cost of musculoskeletal diseases;
- Technological advances in the treatment of Rheumatoid Arthritis and Lupus;
- Practice efficiency; and
- Changes in Medicare coverage and payment policies.

The prevalence rates of rheumatoid arthritis, osteoarthritis and other major diseases treated by rheumatologists are reported and provide the backdrop for the study. One can anticipate a dramatic increase in the prevalence of musculoskeletal diseases as the baby-boom population

cohorts continue to age. The population with Arthritis is expected to increase from 47.8 million in 2005 to 67.0 million in 2030.

The costs to society for these individuals with musculoskeletal diseases for medical treatment and lost labor productivity are substantial. The most recent estimates of the societal costs developed by Yelin et al. indicate costs exceeding 86 billion dollars in 1997. Significant technological advances in the treatment of RA and other musculoskeletal diseases have occurred since the 1997 period which was the focus of these estimates. Thus, when these estimates are updated there will likely be substantial increases in the direct medical care costs related to new treatments. Although the long-term cost-effectiveness of these new treatments remains to be fully evaluated, these increases in direct medical care costs should be offset to some extent with decreases in indirect costs resulting from improvements in RA patients' functional ability in later years.

Recent technologic advances in the diagnoses, monitoring and treatment of rheumatic disease have been significant. These include improvements in non-steroidal anti-inflammatory drugs to treat pain and inflammation of rheumatoid arthritis while reducing undesirable side effects, and disease modifying anti-rheumatic drugs to limit structural damage to the joint. The potential to limit structural damage to the joint through early treatment has increased the importance of finding methods for early diagnosis and monitoring of disease, including the application of magnetic resonance imagery and ultrasonography technology and the search for biological and genetic markers for rheumatic diseases. Continued advances in treatment are likely to increase demand for rheumatologist services.

Current and future innovation in practice organization and efficiency also has the potential for affecting the workforce environment. In 2001, the Institute of Medicine's (IOM) Committee on the Quality of Health Care in America published a report call "Crossing the Quality Chasm: A New Health Care System for the 21st Century." The report asserts that there is substantial inefficiency in the American health care system and charges that "a highly fragmented delivery system that largely lacks even rudimentary clinical information capabilities results in poorly designed care processes characterized by unnecessary duplication of services and long waiting times and delays."[1]

Innovative practices introduced by some rheumatologists to improve efficiency include better pre-visit screening to reduce unnecessary visits, building into the schedule some same-day access for urgent patients, appointment dates close to request dates to limit cancellations, use of advance practice nurses and physicians' assistants; and better coordination with primary care physicians who refer patients. In the future, changes that may be introduced to improve care and efficiency include financial incentives for appropriate chronic care, education to improve self-management by the patient, and better use of information technology to identify patients, monitor progress and provide feedback.

Finally, current and future reimbursement policies by Medicare and other insurers will have an important influence on practice and treatment patterns. A review of Medicare-reimbursed

[1] Institute of Medicine, Committee on the Quality of Health Care in America, Crossing the Quality Chasm: A New Health Care System for the 21st Century Ex Summary page 3.

services provided by rheumatologists indicates that innovations such as biologics resulted in a dramatic increase in reimbursement for infusions, so that infusions became the single largest source of Medicare revenue for rheumatologists. Medicare reimbursement changes expanding coverage of prescription drugs and providing payment for self-infusions are also likely to have a substantial effect on practice patterns.

Current Workforce

The rheumatology workforce is defined as those physicians who are fellowship trained and/or board certified in adult rheumatology, pediatric rheumatology, or both. By this definition, there were 4,946 adult rheumatologists and 218 pediatric rheumatologists in 2005 or 16.7 adult rheumatologists and 0.7 pediatric rheumatologists per million population. Ninety-four percent of adult rheumatologists and 92% of pediatric rheumatologists treat patients.

About 70% of adult rheumatologists are male, while pediatric rheumatologists are evenly divided between males and females. The two graphs below show the age and sex distribution of adult and pediatric rheumatologists, respectively. Note that a high proportion of adult rheumatologists are in the age range of about 50-60. The implication is that a significant proportion of the workforce will be retiring over the next 15 years, along with baby boomers in general. The age distribution of pediatric rheumatologists is somewhat less susceptible to baby boom retirements. The median age of adult rheumatologists was 51 in 2005, while for pediatric rheumatologists it was 47.

Figure E-1
Age Distribution of Adult Rheumatologists, 2005

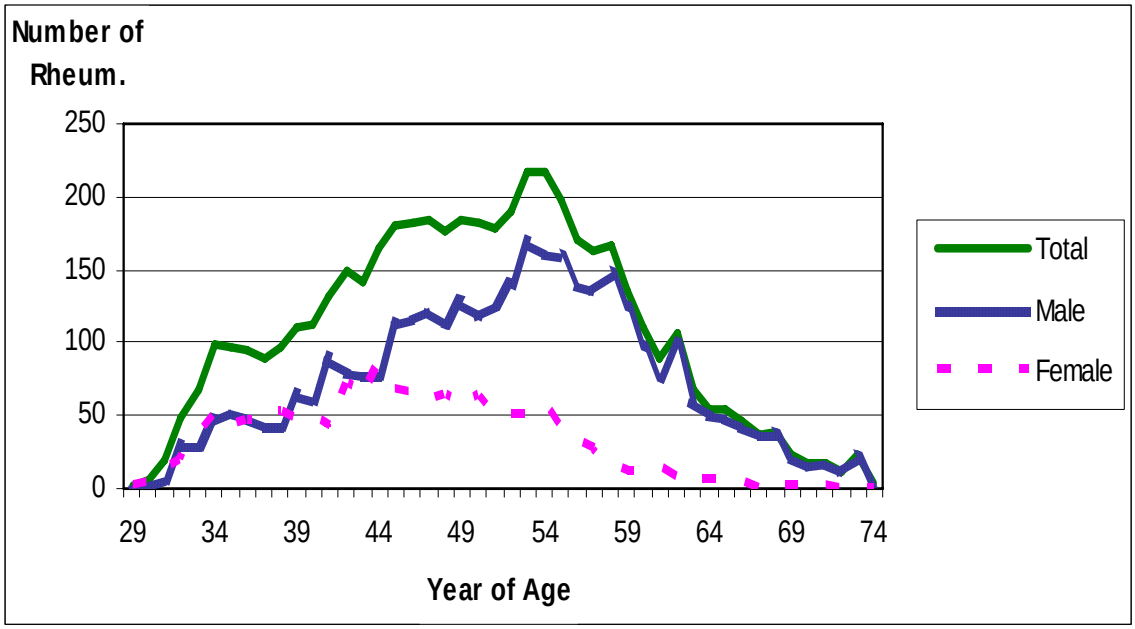
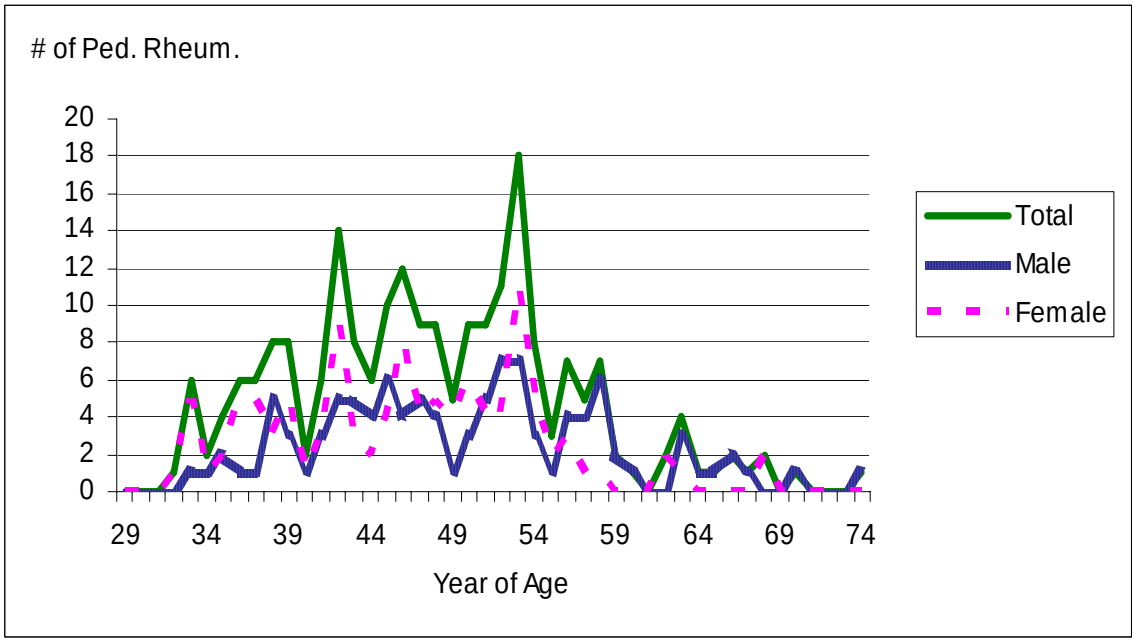


Figure E-2
Age Distribution of Pediatric Rheumatologists, 2005



Supply and Demand Projections

The future effective supply of rheumatologists will depend on the number completing fellowships each year, the number retiring from the workforce, and the number of working hours that the workforce supplies to patient care. The baseline projection assumes that the number of individuals who begin fellowship training each year remains at the 2004-2005 level, and that average hours of work by age and sex of practicing rheumatologists remain at the current levels within age and sex categories. However, because the demographic composition of the workforce shifts over time, average hours of patient care per rheumatologist declines somewhat.

Future demand for the services of rheumatologists is a function of the prevalence of disease across demographic groups, population change and shifts in the demographic composition of the population, real per capita income, insurance coverage and other factors. The two largest drivers of future demand for the services of rheumatologists are population growth—particularly the aging of the population as it grows—and growth in real per capita income. The following table shows how the population will change over the next 20 years. By far, the "old" and the "oldest old" grow at the highest rates. This will have an important effect on the demand for the services of adult rheumatologists.

Table E-1
Population Trends (Millions)

	2005	2010	2015	2020	2025	% Increase 2005 to 2025
<20	81,893	83,236	86,062	88,887	91,996	12.3%
20-64	175,986	185,456	188,871	192,285	194,656	10.6%
65-84	32,457	34,120	40,742	47,363	54,607	68.2%
85+	5,195	6,123	6,696	7,269	8,436	62.4%

Our baseline projection for future demand assumes that real per capita income increases by 1% per year. Our econometric estimates indicate that a 1% increase in real per capita income increases the demand for adult rheumatologist services by 0.85%, and that for adult rheumatologists, a 1% increase in the population over age 64 increases demand by about 0.12%.

The baseline projection of supply and demand for adult rheumatologists is shown in the figure below. Demand, driven by both demographic and economic factors, grows substantially over the period 2005-2025. Supply, on the other hand, actually declines. The decline in effective supply of adult rheumatologists is due largely to the large numbers retiring over the next 15 years, and to the assumption that fellowship positions are constant at their 2004-2005 levels.

Figure E-3
Base Case: Adult Rheumatologists, 2005-2025

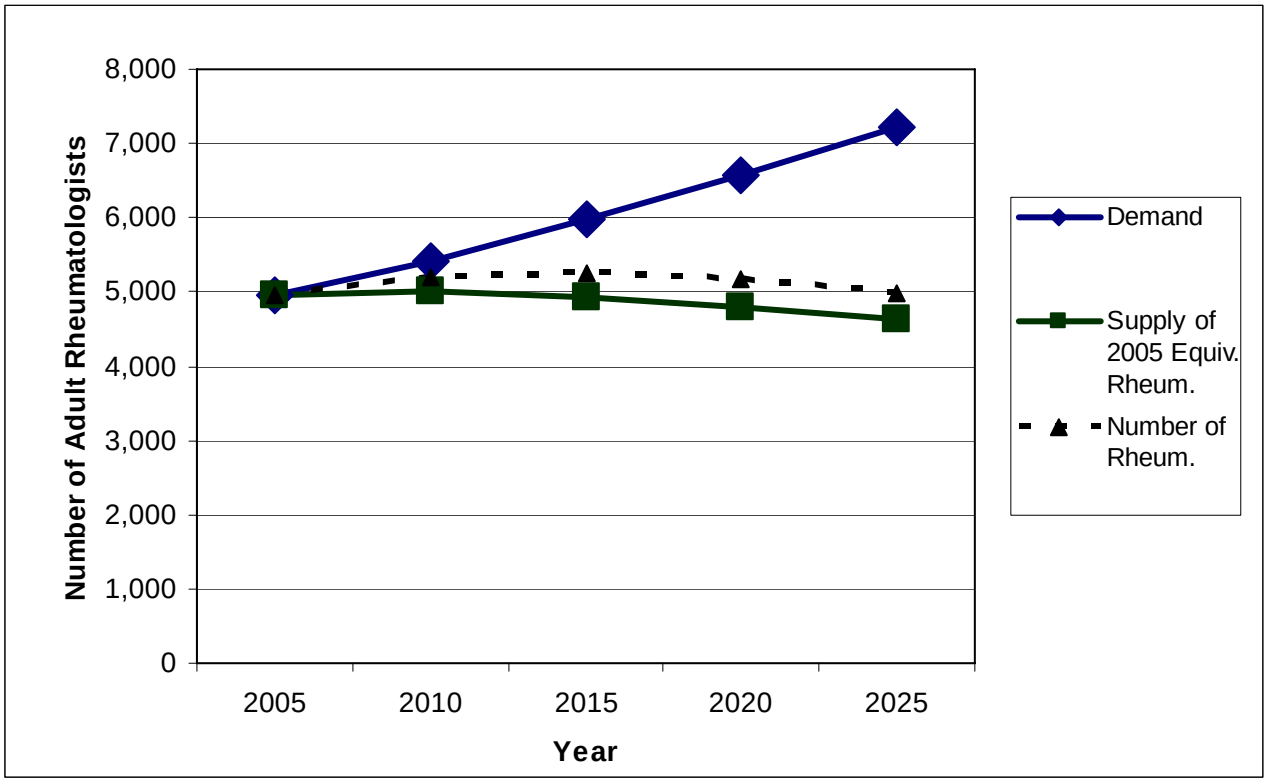


Table E-2
Excess Demand for Adult Rheumatologists, 2005-2025

	2005	2010	2015	2020	2025
Demand	4,946	5,422	5,968	6,584	7,219
Supply of 2005 Equiv. Rheum.	4,946	5,019	4,940	4,806	4,643
Difference	0	403	1,029	1,778	2,576
Number of Rheum.	4,946	5,198	5,258	5,178	5,008

The baseline case for pediatric rheumatologists is shown below. It also indicates excess demand for the services of pediatric rheumatologists, but the gap between demand and supply opens up somewhat later and is somewhat less dramatic compared to adult rheumatologists. The reason for this is that demographic changes have a smaller effect on the demand for services by pediatric patients, and because the proportion of the workforce retiring over the next 15 years is smaller for pediatric rheumatologists compared to adult rheumatologists.

Figure E-4
Base Case: Pediatric Rheumatologists, 2005-2025

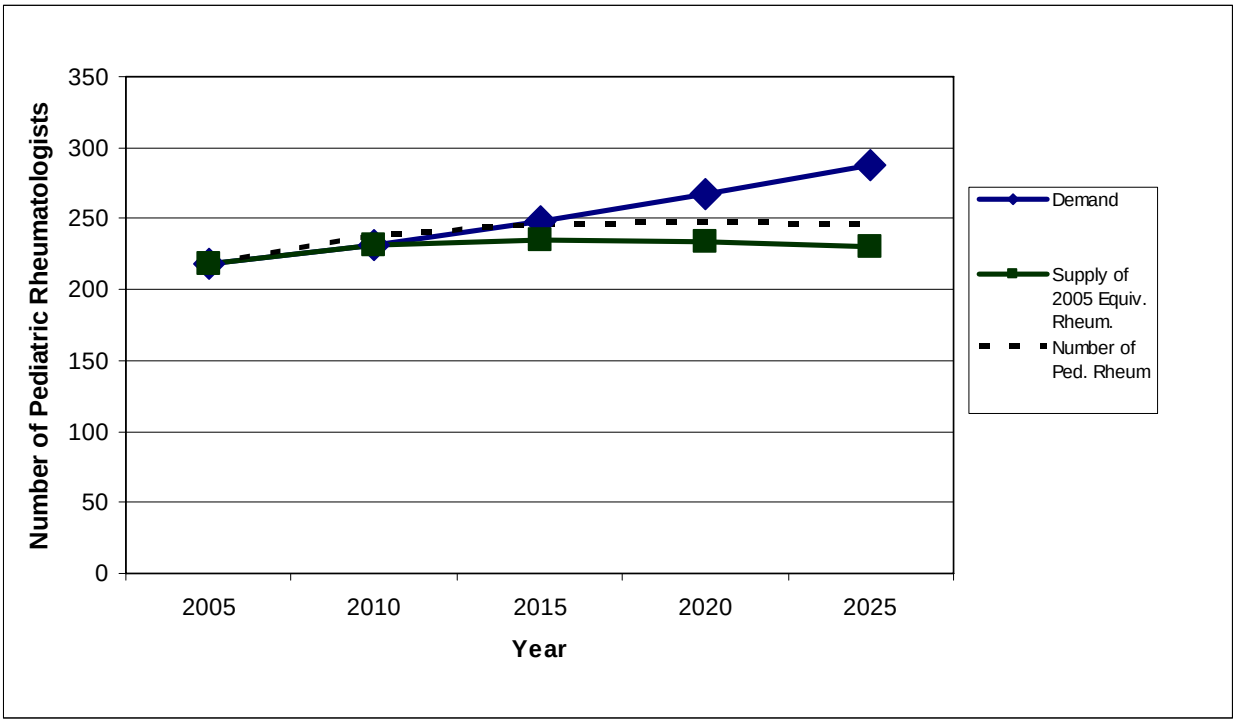


Table E-3
Excess Demand for Pediatric Rheumatologists, 2005-2025

	2005	2010	2015	2020	2025
Demand	218	231	248	267	287
Supply of 2005 Equiv. Rheum.	218	238	247	252	254
Difference	0	-7	1	15	33
Number of Rheum.	218	244	258	266	271

There will be adjustments to the excess demand on the supply side. Higher earnings in the profession will increase the demand for fellowship positions. If fellowship positions are expanded, they are likely to be filled. In addition, higher earnings may encourage some physicians to delay retirement and others to expand clinical hours. Both of these factors will work to reduce excess demand by expanding supply.

In addition, excess demand is likely to encourage the more rapid introduction of practice efficiencies. Because a physician's time will become more valuable, methods for screening patients are likely to be adopted by rheumatology practices. In addition, advanced practice nurses and physicians assistants are likely to become more common in rheumatology practices. Both of these measures will expand the effective supply of rheumatology services, reducing excess demand.

While these market factors are likely to mitigate the level of excess demand observed over the next 20 years, the level of excess predicted in these models suggests that proactive interventions on the part of the rheumatology community are warranted. These interventions might include:

- expanding the number of fellowship positions and providing information to medical school graduates about the future of rheumatology;
- disseminating information about practice efficiency methods and providing support to rheumatologists undertaking practice efficiency improvement;
- disseminating information on best practices including information on optimal lengths of follow-ups, use of information technology to encourage appropriate follow-up and optimal use of advanced practice nurses and physicians assistants to assist with chronic care patients;
- expanding training programs for nurse practitioners and physicians assistants who are interested in rheumatology; and
- advocating for reimbursement policies that encourage practice efficiency and the use of allied health personnel as appropriate.

While excess demand for rheumatologist may result in higher incomes for rheumatologists over the next 20 years, proactively taking steps to practice more efficiently, improve quality of care, and to adequately staff practices for the number of patients to be seen is likely to be essential to maintaining high levels of job satisfaction in the rheumatology community and to providing the best quality of care for patients.

1. INTRODUCTION AND BACKGROUND

1.1 Purpose

The American College of Rheumatology asked The Lewin Group to conduct a workforce study of rheumatologists. The purpose of the workforce study is to better understand the factors affecting the supply of and demand for rheumatologists, to quantify the factors where possible, to project likely paths for the evolution of the workforce, and to assess the implications. This paper presents the results of this workforce study.

Following this introduction, the report consists of four major sections. In the first section, we review related literature. In the second, we define and describe the current workforce, its training and certification status, and its demographic characteristics. Then, in the third section, we examine the factors affecting the supply of and demand for rheumatologists. Finally, in the last section, we apply the Rheumatologist Workforce Model and examine the rheumatologist workforce over the next 20 years, projecting demand and supply under alternative scenarios regarding the health care market. We provide an overall assessment of the workforce over the next 20 years.

A major source of information for this study was our Advisory Group formed by the chairman of the Committee on Training and Workforce Issues, Dr. Walter Barr, and chaired by Dr. Chad Deal. The Advisory Group was a source of institutional and clinical information relevant to the rheumatology physician workforce, as well as guidance for the study itself. Moreover, the Advisory Group's opinion and judgment of the current state of the health care market for the services of rheumatologists, its future state, and factors affecting it were useful and were integrated with objective sources of data.[2]

1.2 Workforce Studies

Interest in physician workforce issues can be traced at least to the late 1960's. The predominant concern was the adequacy of the physician workforce--ensuring that there were sufficient physicians to meet patient needs.

The Graduate Medical Education National Advisory Committee (GMENAC) was founded in 1976 by the U. S. Department of Health Education and Welfare to estimate the need for physicians, by specialty, in the year 1990. The primary concern was to insure that there would be sufficient physicians to meet the need. The Committee systematically began estimating the need for various physician specialties, using estimates based on the judgments of experts--a method that has come to be known as the "GMENAC" method.

While the notion of centralized planning of physician supply was implicit in GMENAC, it became somewhat more explicit with the establishment of the Council on Graduate Medical Education (COGME) in 1986. The emphasis shifted from concern regarding too few physicians, in general, to concern that there were too many specialists relative to generalists. Centralized

[2] The members of the Advisory Group were Walter Barr, Neal Birnbaum, Dennis Boulware, Paul Caldron, Timothy Harrington, Marc Hochberg, Roderick Hooker, Julianne Orlowski, Stephen Paget, Christy Park, Audrey Uknis, and Patience White.

planning of residency positions became explicit in the Clinton Administration's proposal for health care reform, the Health Security Act, in 1993.

The prospect of centralized planning of residency positions placed a premium on determining whether a given physician specialty was a shortage specialty or a surplus specialty. Consequently, it sparked a renewed interest in models of the physician workforce. In a particularly influential and controversial article, Weiner (1994) projected, based on the staffing patterns of staff-model health maintenance organizations (HMOs), that there would be a substantial excess supply of specialists by the year 2000. The challenge of centralized planning for physician supply diminished substantially when Congress failed to pass a major health care reform bill.

More recently, physician workforce studies by Cooper (2002), BHPr (2004) and COGME (2004) have indicated an impending shortage of physicians particularly specialists. In its most recent report (2003) COGME projected a shortage of approximately 85,000 physicians, mostly specialists, by 2020 unless there is a modest increase in U.S. medical school capacity. This shift results from changes in two assumptions. First, the 1994 projections assumed continued growth of staff model HMOs with the implication that this would restrain utilization of specialists. Second, the more recent models assume that continued economic growth will increase demand for specialty care. The premise of this argument is that advances in technology provide for an unlimited spectrum of services, particularly specialist services, providing health benefits, and use of these services is constrained only by our ability and willingness to pay.[3]

1.3 Rheumatologists as Physicians

A Rheumatologist is a specialist in the non-surgical treatment of rheumatic illnesses. These illnesses can affect virtually any part of the body and are usually associated with inflammation, pain and other symptoms that can have a profound effect on an individuals' ability to work and perform daily tasks. Rheumatologists have particular skill in the evaluation of the over 100 forms of arthritis and other conditions including systemic lupus erythematosus, gout, Kawasaki disease, fibromyalgia, Raynaud's disease, mixed connective tissue disease, and osteoporosis. The majority of rheumatologists are primarily engaged in clinical practice. However, some rheumatologists are engaged in study or research related to rheumatic diseases. Others are engaged in medical teaching. This study addresses the supply of all rheumatologists regardless of their primary employment activity, but the demand analysis focuses on demand for clinical services as those are the activities in which most rheumatologists are engaged.

1.4 Market-Based Analysis and Limitations

Two points should be made at the outset. First, there is no attempt in this study to determine the "right" number of rheumatologists in a normative or needs-based sense. The estimates of demand are based on market conditions which reflect underlying epidemiological conditions or "need". But, they also embody the market realities that generate effective demand for health care:

[3] A complementary hypothesis is simply that health care is a "normal" good. As real income per capita grows, the demand for many goods and services, including health, increases. It may be the case that the demand for specialty care increases by more than the demand for primary care as real income grows.

insurance coverage, the degree of managed care penetration, and the level and distribution of income. Hence, no necessary normative significance should be attributed to the demand estimates, nor to associated market "equilibria".[4]

Second, we provide predictions of future supply and demand over the next twenty years. While the predictions have the appearance of precision, there are too many variables to achieve such precision, in practice. Events that can not now be anticipated will undoubtedly have a significant and unpredictable influence on the demand for rheumatologists ten or twenty years from now. Thus, our point estimates should be interpreted as representing a broad range, under the assumption that all other factors are constant. Our overall market assessment is based on the systematic analysis of a number of cases or scenarios that our research indicates are likely to affect future demand and supply. Undoubtedly, there will be factors arising that will affect future markets that cannot currently be anticipated. An advantage of a workforce model is that the implications of alternative assumptions or projections regarding the future can be evaluated quickly.

[4] The only additional significance of an estimated equilibrium point--a point at which demand is approximately equal to supply--is that the number and incomes of rheumatologists will be stable at that point. If demand exceeds supply, one can anticipate rising incomes and increases in the numbers of rheumatologists, and vice versa if supply were to exceed demand.

2. REVIEW OF BACKGROUND LITERATURE

2.1 Introduction

As part of the workforce study, The Lewin Group has conducted a literature review including literature in several areas which are important to understanding the current and future demand for rheumatologist care, as well as the supply of rheumatologist care. In particular, we provide an overview of the literature in the following areas:

- Prevalence of musculoskeletal diseases;
- Cost of musculoskeletal diseases;
- Technological advances in the treatment of Rheumatoid Arthritis and Lupus;
- Practice efficiency; and
- Changes in Medicare coverage and payment policies.

The next several sections summarize the literature on each of these topics in turn.

2.2 Prevalence

Arthritis and other musculoskeletal disorders are among the most frequently occurring chronic conditions affecting the US population. In 1986, the National Arthritis Data Workgroup was organized by the National Institute of Arthritis and Musculoskeletal and Skin Diseases of the National Institute of Health to provide a single source of national data on the prevalence and socioeconomic impact of rheumatic disorders. In 1998, this work group published updated estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. When available, estimates were based on national samples, however, for most specific musculoskeletal conditions, national population data were not available and thus smaller samples from defined populations were used. Prevalence estimates from these surveys were linked to U.S. Census data to calculate national estimates. To identify the prevalence estimates presented below, we took the National Arthritis Workgroup estimates as our starting point and updated these estimates where new research was available.

2.2.1 Arthritis

The National Arthritis Workgroup, 1998 report presented estimates on prevalence of self-reported arthritis and limitations in functioning attributed to arthritis based on the National Health Interview Survey for 1989-1991. We identified updated prevalence estimates from the National Health Interview Survey for 2003 as reported in Hootman and Helmick (2006). These estimates are presented in the table below.

Table 2.1
Prevalence of Self-Reported Arthritis and Activity Limitations Caused by Arthritis

Age Group	Self-Reported Doctor-Diagnosed Arthritis		Limitation Caused by Arthritis	
	Male	Female	Male	Female
18-44	6.1%	9.5%	1.9%	3.2%
45-64	25.8%	34.4%	8.7%	13.0%
65+	40.7%	54.9%	14.5%	23.1%

Estimates based on responses in the NHIS 2003 as reported in Hootman and Helmick, Arthritis and Rheumatism, Vol 54, No 1 pp 226-229.

Prevalence rates are greater for women than for men and increase with age. There are two important limitations to these estimates that should be noted. First, the estimates are based on self-reports and were not confirmed by a physician. Second, the survey population on which the results are based excluded certain groups including institutionalized elderly persons who are likely to have a different rate of illness.

Based on these prevalence rates and Census Bureau population projections for 2005 and 2025, Hootman and Helmick estimate that 47.8 million Americans had arthritis in 2005 and that this will rise to 67.0 million in 2030.

2.2.2 Rheumatoid Arthritis (RA) and Juvenile Rheumatoid Arthritis

RA is a chronic systemic autoimmune disorder with symmetrical joint inflammation often leading to progressive joint destruction and deformity. It is characterized by a sterile inflammatory polyarthritis which usually results in progressive functional limitation and physical disability. There is also excess mortality among patients with RA. When the National Arthritis Workgroup presented estimates of RA in 1998, the estimates were based on the 1958 ACR criteria for definite or classic RA. Estimates presented by the Workgroup from the National Health Examination Survey (NHES) of 1960-1962 are presented below by age group.

Table 2.2
Prevalence RA per 1000 Persons

Age Group	Male	Female
18-34	-	-
35-44	-	9
45-54	2	11
55-64	19	29
65-79	18	49

Estimates from the National Health Examination Survey of 1960-1962.

More recent estimates were developed for the population 60 and older based on the 1987 ACR criteria for RA from the NHANES III which was conducted between 1988 and 1994 (Rasch, 2003). These estimates suggest that the prevalence rates for women are lower than those estimated based on the NHES, 1960-1962. Results are presented below. Method I applied the “n

of k" rule such that subjects who met 3 of 6 ACR criteria were classified as having RA. In method II the ACR classification tree algorithm was applied. Lastly, in Method III, medication data were used to augment method II.

Table 2.3
Prevalence RA per 100 Persons

	Method I	Method II	Method III
Sex			
Male	1.60 (0.84-2.36)	1.59 (0.82-2.36)	1.85 (1.04-2.66)
Female	2.35 (1.35-3.35)	2.57 (1.58-3.56)	2.71 (1.73-3.69)
Age			
60-69	1.59 (0.98-2.20)	1.66 (1.04-2.28)	1.89 (1.31-2.47)
70 or older	2.46 (1.26-3.66)	2.63 (1.42-3.84)	2.80 (1.59-4.01)

Estimates based on the NHANES III, 1988-1994.

The best estimates of the number of cases of juvenile rheumatoid arthritis in the United States is between 30,000 and 50,000 in 1990 with approximately half of these cases being inactive. This estimate is based on data from the Mayo Clinic population and from Hochberg et al. (1983).

To estimate the population with RA to develop demand projections for this study, we use estimates from the 1960-62 NHES for individuals age 18-54. For individuals, 54 and older, we used estimates from the NHANES III Method II. Juvenile Arthritis prevalence was based on 40,000 cases in 1990. These prevalence rates are listed in Table 2.4.

Table 2.4
Prevalence RA per 100 Persons

Age Groups	Male	Female
<18	0.06	0.06
18-34	0.10	0.06
35-44	0.14	0.90
45-54	0.20	1.10
55-59	1.59	2.57
60-69	1.59	2.57
70+	1.59	2.57

Based on these prevalence rates and Census Bureau population projections for 2005 and 2025, we estimate that 2.1 million Americans had RA in 2005 and that this will rise to 2.8 million in 2025.

2.2.3 Osteoarthritis

Osteoarthritis is the most common type of arthritis. The National Arthritis Workgroup estimated that 12.1 percent of Americans or 21 million people in 1990 had clinical signs or symptoms of Osteoarthritis based on data from the 1971-1975 NHANES. This is a conservative estimate since

the NHANES did not include individuals over 74 years of age and studies indicate that prevalence increases with age. Based on the Tecumseh, MI Community Health Study of 1959-60 when osteoarthritis was diagnosed by history overall 4.2 and 9.0 percent of men and women respectively had osteoarthritis, but among those over age 60 prevalence rates increased to 17.0 and 29.6 percent of men and women, respectively.

To estimate the population with osteoarthritis arthritis to develop demand projections for this study, we use estimates based on the Tecumseh, MI Community Health Study 1959-60.

Table 2.5
Prevalence Osteoarthritis per 100 Persons

Age Group	Male	Female
<60	2	4
60+	17	30

Based on these prevalence rates and Census Bureau population projections for 2005 and 2025, we estimate that 20.7 million Americans had arthritis in 2005 and that this will rise to 28.1 million in 2025.

2.2.4 Other Disorders

The table below displays the population prevalence rates for several other major musculoskeletal disorders.

Table 2.6
Prevalence of Major Musculoskeletal Disorders

Disorder	Prevalence Rate Assumptions	US Persons Affected	
		2005	2025
Rheumatoid Arthritis	See Section 2.2.2 above.	2.1 million	2.8 million
Osteoarthritis	See Section 2.2.3 above	20.7 million	28.1 million
Suspected or definite SLE[1]	50 per 100,000 persons	147,000	175,000
Spondylarthropathy[2]	2.1 per 1,000 persons over 15	497,000	596,000
Polymyalgia rheumatica[3]	<50 - 0 per 100,000 persons 50-54 – 100 male/200 female per 100,000 55-59 – 130 male/140 female per 100,000 60-64 – 290 male/350 female per 100,000 65-69 – 540 male/670 female per 100,000 70+ - 860 male/1,400 female per 100,000	478,000	740,000
Gout[4]	8.8 per 1,000 persons	2.6 million	3.6 million
Frequent Low Back Pain[5]	14 per 1,000 persons 18-34 21 per 1,000 persons 35-64 18 per 1,000 persons 65+	40.2 million	48.6 million
Osteoporosis[6]	2% of Men age 50+ 4% of women 50-59 6% of women 60-69 8% of women 70-79 44% of women 80+	3.8 million	5.3 million

[1] NIAID Strategic Plan for Addressing Health Disparities, 2005 page 9.
[2] Lawrence et al. (1998) page 795.
[3] Lawrence et al. (1998) page 790 Table 6 Olmsted, MN study.
[4] Lawrence et al. (1998) page 791 Table 7 NHIS, 1992 by age applied to Census Bureau Population Data.
[5] Lawrence et al. (1998) page 794 Table 11 Citywide Population Survey of Dayton, OH.
[6] CDC New Brief at http://www.cdc.gov/nchs/data/nhanes/databriefs/osteoporosis.pdf. Estimates are based on BMD testing of the hip in the NHANES III, 1988-94. These CDC estimates are below the Osteoporosis Foundation estimates of 10 million Americans affected found at http://www.nof.org/osteoporosis/diseasefacts.htm

Overall the population needing rheumatologist services is projected to increase dramatically as a result of population growth and the aging of the U.S. population. These estimates are conservative as they assume that current age and sex specific prevalence rates will remain stable and that associated risk factors, particularly obesity, will not increase.

2.3 The Cost of Musculoskeletal Diseases

The most recent comprehensive estimates of the direct and indirect costs of arthritis and other rheumatic conditions was conducted by Yelin et al. (2004) for the Centers for Disease Control and Prevention. This study calculated the total burden at $86,245 million in 1997 with 59 percent of the costs from direct medical care services and the remainder from indirect costs such as lost wages. Patients with RA tend to be younger and predominantly female. Thus, the costs of RA in terms of lost labor force participation are substantial. RA also often affects individuals at a time in their lives when they may have young families, resulting in losses of household efforts which in contrast to labor force productivity losses may be difficult to quantify monetarily.

Pugner et al. (2000) compare disease estimates across eight industrialized countries. The study indicates that costs are comparable across the countries and discusses how RA costs vary with disease stage. The study notes that in the early stage of the disease, most of the costs will be related to direct medical expenses related to aggressive treatment regimens intended to hinder disease progression and the onset of work disability. For patients with a disease duration of more than five years, the cost profile shifts, so that indirect costs related to work limitations make-up an increasingly greater share of the disease burden. Finally, for individuals suffering from RA for more than 10 years, direct medical care costs can begin to increase. This results from the need for long-term care in residential facilities or nursing homes and from costs for surgical procedures such as knee replacements and hip arthroplasty.

As will be discussed below, in Section 2.4, significant technology advances in the treatment of RA and other musculoskeletal diseases have occurred since the 1997 period which was the focus of the Yelin cost of illness estimates. Thus, when these estimates are updated there will likely be some substantial shifts in the distribution of costs. In particular, there is now substantial evidence of the benefit of early treatment of RA. There have been recent innovations in drug therapies for RA and Lupus. The distribution of the costs related to these illnesses is likely to shift so that direct medical care costs represent a greater share of costs particularly in the early stages of the disease. Although the long-term cost-effectiveness of these new therapies remains to be fully evaluated, these increases in direct medical care costs should be offset to some extent with decreases in indirect costs resulting from improvements in RA patients' functional ability in later years.

2.4 Technological Advances

Technological advances will have an important impact on future demand for the services of rheumatologists. Here, we review recent and potential future technological advances affecting RA and Lupus.

2.4.1 Rheumatoid Arthritis

As noted above, RA is a chronic systemic autoimmune disorder with symmetrical joint inflammation often leading to progressive joint destruction and deformity. There have been rapid advances in the RA treatment in the last decade and promise for continued advances. In the February 2005, in the Journal of the Oklahoma State Medical Association, Kim-Howard et al.

authored an update on RA therapy. Their discussion classifies RA treatments into two main types:

- Anti-inflammation drugs (NSAIDs and corticosteroids) – drugs which reduce pain and inflammation, but which have not been shown to reduce disease progression.

- Disease modifying anti-rheumatic drugs (DMARDs) – drugs which limit joint erosion and structural damage.

Pharmacologic treatment of RA often includes combinations of drugs from both of these classes. Initial treatment for RA typically includes NSAIDS and low dose steroids to reduce pain and inflammation, but since these treatments do not alter the course of the disease, it is recommended by the ACR that they not be the sole form of treatment (ACR, 2002).

Most NSAIDS have been available for many years. A limitation of these medications is that they have had a tendency to damage the stomach lining sometimes leading to ulceration or in rare cases to severe bleeding. Several approaches were developed to reduce these side-effects including: 1) development of specially coated, slow release medicine, 2) compounds (misoprostol and proton pump inhibitors) that heal or protect the stomach from the NSAIDS, and 3) development of more selective medicines which only target harmful prostaglandins and do not harm the stomach lining (ABPI, 2005). The introduction of the COX-2 inhibitor Celebrex in 1999 quickly followed by the introduction of Vioxx and Bextra significantly lowered the risk of gastrointestinal side-effects with similar efficacy. However these medications can cost 15-20 times more than generic NSAIDS and have been associated with a higher rate of thrombotic events (ACR, 2002). Because of this risk of cardiovascular events, Vioxx and Bextra were withdrawn from the market and Celebrex labeling carries additional warnings.

Kim-Howard et al. note that significant advances in DMARDs used to treat RA have occurred in the last 15 years. Until recently, the majority of DMARDs used to treat RA were developed for treatment of other diseases. However, advances in understanding RA resulted in development of newer and more targeted therapies. The first controlled studies of low-dose oral methotrexate were published in 1985 and FDA approval was gained in 1988. Subsequent studies examined the value of combination therapies (Ruderman, 2005). Although a number of DMARDS are now available, "many rheumatologists select methotrexate as the initial DMARD…because of its favorable efficacy and toxicity profile, low cost, and established track record." (ACR, 2002)

In the late 1990s, a class of genetically engineered biologic agents that block cytokines and more recently lymphocytes emerged as a major advance in RA treatment (Sivakumar and Paleolog, 2005). These pharmaceuticals include three anti-TNF agents: Etanercept (Enbrel), Infliximab (Remicade), and adalimumab (Humira). Rituximab (Rituxan), a depleter of B lymphocytes on the market since 1997 for treatment of non-Hodgkins lymphoma, has recently been approved for treatment of RA. Abatacept (Orencia), a biologic which blocks T lymphocyte activation, has also received FDA approval. These biologics have produced dramatic reductions in disease scores in patients with RA relative to alternative therapies (Sivakumar and Paleolog, 2005). Unfortunately, these pharmaceuticals have several limitations including the need for parenteral administration and high cost (ACR, 2002). Also, not all patients with RA respond to these therapies and these

therapies do not cure the disease. Therefore, patients must continue treatment indefinitely to prevent flare-ups (ACR, 2002). Finally, increasing usage of anti-TNF biologicals has been associated with an increase in cases of tuberculosis and adverse effects such as non-Hodgkins-type lymphomas (Sivakumar and Paleolog, 2005).

Development of these new treatments has led to a more aggressive treatment approach in which DMARDs therapy is begun soon after diagnosis to retard or prevent joint destruction and functional loss.

Continued advancement in biologic treatment for RA is expected as many other monoclonal antibodies and fusion proteins are in various stages of preclinical and clinical trials.

The ability to prevent joint destruction and disability with early treatment has lead to a desire to identify patients who would benefit from aggressive treatment early in the course of the disease. Powerful new techniques are being developed for evaluating the progression of RA. The imaging technologies that will likely be used in the future to direct patients to specific therapies and monitor treatment effectiveness are currently being refined in clinical trials. MRI technology may become more important in tracking RA in patients. New MRI systems are being developed that vary in sizes, field strengths, and are at a lower cost compared to a traditional MRI system--raising the potential for in office imaging (Peterfy 2001). Ultrasonography has also been found to be useful in identifying joint and tendon sheath effusions, making it useful in early diagnosis and management of RA (Keen, Emery 2005).

On a separate path, researchers have been searching for genetic and biological markers of patients with erosive RA. In this regard, in 2004, researchers from a collaborative alliance between Millenium and Roche Diagnostics announced that they had identified a distinct set of protein biomarkers that were elevated in the joint fluid of patients with erosive disease, but not elevated in patients with non-erosive RA. (Medical Research News Dec 14, 2004 www.news-medical.net). Also, in 2004 scientists also discovered a gene linked with increased risk for RA (Arthritis Foundation, 2005)

There has been significant progress in RA treatment over the last 15 years and many new pharmaceuticals and technologies for RA are under development. Continued advances in the treatment of RA are likely to increase the demand for rheumatologist services over the next 20 years.

2.4.2 Lupus

Lupus is an autoimmune disorder in which the body produces antibodies that attack a person's own DNA leading to inflammation and damage to body tissues.[5] These antibodies are known as autoantibodies. The most common type that develops with Lupus is an antinuclear antibody (ANA). The cause of Lupus is unknown. Scientists suspect a combination of genetic, environmental and hormonal factors cause the disease.

[5] The basic facts about Lupus discussed in the next several paragraphs are based on a booklet titled "Systemic Lupus, Erythematosus" published in 2003 by the National Institutes of Health, National Institute of Arthritis and Musculoskeletal and Skin Diseases.

Lupus is difficult to diagnose as there is no single test that can determine whether an individual has Lupus. Lupus can produce a variety of symptoms including some related to the kidneys, skin, blood, and the immune system. Most people with Lupus test positive for ANA, but infections, other autoimmune disease and even healthy individuals may have a positive ANA test. Other blood tests and biopsies of the skin and kidneys can also be used to diagnose Lupus. About 90 percent of individuals with Lupus are women. Lupus is three times more common in African American women than in Caucasian women.

There is no cure for Lupus. Individuals with Lupus typically have periods of illness, known as flares, and of wellness. There are five different class of medications used to treat Lupus:

- Corticosteroids – Corticosteroids are the primary Lupus treatment. Corticosteroids rapidly suppress inflammation. Corticosteroid treatment has many side-effects including weakened or damaged bones, high blood pressure, damage to arteries, diabetes, infections, and cataracts.
- NSAIDS – NSAIDS may be used to control pain, fever, and inflammation.
- Antimalarials – Antimalarials such as hydroxychloroquine (Plaquenil) can be used to treat fatigue, joint pain, skin rashes, and inflammation of the lungs. Clinical trials have demonstrated that continuous treatment with antimalarials can prevent flares.
- Immunosuppressives – Immunosuppressives restrain the overactive immune system by blocking production of immune cells.
- DMARDs – DMARDs, such as methotrexate, can be used to limit joint erosion and structural damage.

Most Lupus patients are diagnosed during their childbearing years. Therefore, the impact of Lupus and Lupus related medications on fertility and pregnancy are an important concern.

Despite the availability of these classes of treatments, Lupus continues to be associated with considerable morbidity and mortality. There are several areas of promising research which are likely to improve diagnosis and treatment for Lupus over the next twenty years:

- Identifying genetic factors – There are several areas of current research related to genetic factors. First, researchers are studying whether a defect in a cellar process which allows the body to eliminate cells that have fulfilled their function plays a role in Lupus. Second, researchers are studying genes for a decrease in complement which make the body less able to fight or destroy foreign substances. Finally, researchers are studying families with Lupus to identify genetic regions which may be associated with the disease.
- Identifying environmental factors – Researchers are looking at environmental agents that may trigger Lupus in individuals who are genetically susceptible. Researchers are considering viral and hormonal factors.
- Developing drugs – Because corticosteroids have serious side-effects, researchers are working to identify alternative treatments including combination therapies that will reduce the use of corticosteroids. Researchers are also working on drug treatments that will help delay or prevent kidney failure in lupus patients.

- Developing biologics – Similar to RA, lupus patients are likely to benefit from development of biologic agents that selectively block parts of the immune system. These treatments are likely to be more effective and to have fewer side-effects than current lupus treatments. Biologics that interfere with B-cell function are one area of research.

Similar to RA, there has been significant progress in Lupus treatment over the last 15 years and research continues. Continued advances in the treatment of Lupus are likely to increase the demand for rheumatologist services over the next 20 years.

2.5 Changes in Practice Efficiency

In 2001, the Institute of Medicine's (IOM) Committee on the Quality of Health Care in America published a report called "Crossing the Quality Chasm: A New Health Care System for the 21st Century." This report asserts that there is substantial inefficiency in the American health care system and charges that "a highly fragmented delivery system that largely lacks even rudimentary clinical information capabilities results in poorly designed care processes characterized by unnecessary duplication of services and long waiting times and delays. And there is substantial evidence documenting overuse of many services—services for which the potential risk of harm outweighs the potential benefits."[6] At the same time as this waste and overuse of services exist, the report charges that few clinical programs have the infrastructure required to appropriately treat common chronic conditions which "…are now the leading cause of illness, disability, and death…and account for the majority of health care expenditures." Based on these findings, the report challenges physicians and other players in the health care system to more effectively organize the process of care to better support evidence-based practice and facilitate the use of information technology thereby decreasing inefficiency and improving care for chronic conditions.

Some Rheumatologists have implemented strategies to improve health care delivery in their practices, responding to the failures of the health care system noted in the IOM report. These strategies for improvement are in the following areas:

- new patient screening;
- appointment scheduling; and
- improving quality of care for chronically ill patients.

We discuss each of these strategies in turn below.

In the article "Pre-Appointment Management of New Patient Referrals in Rheumatology: A Key Strategy for Improving Health Care Delivery," Doctors Harrington and Walsh discuss implementation of a screening process for newly referred patients. Rather than giving each referred patient the next time slot available, each case was reviewed by a rheumatologist before an appointment was provided. This reduced the number of new patients needing to be seen by 40%. Some of the patients who were not seen were referred for a more appropriate consultation

[6] Institute of Medicine, Committee on the Quality of Health Care in America, Crossing the Quality Chasm: A New Health Care System for the 21st Century Ex Summary page 3.

such as to an orthopedist or to the spine program. Others were reassured that their treatment through the primary care physician was appropriate. The review of patient records prior to the first appointment had other benefits. The review process allowed the rheumatologist more information on the patient prior to the appointment so that they could decide whether a brief or longer visit was needed. Also, with the records on hand, duplicate testing occurred less frequently.

In addition to strategies for reducing inappropriate referrals, rheumatologists have tested strategies for improving scheduling to eliminate long waiting periods between referral and the first rheumatologist visit. This was particularly motivated by research indicating that RA patients achieve better outcomes with early treatment. In the article, "The Rheumatologist Can See You Now: Successful Implementation of an Advanced Access Model in a Rheumatologist Practice," Dr. Newman and his colleagues describe how they eliminated the backlog of appointments for their Rheumatology department in central Pennsylvania. The steps in the strategy were:

- Establish longer follow-up treatment intervals as appropriate to avoid backlog;
- Use advanced practice nurses to care for patients requiring more education, coping skills, and monitoring;
- Build in to the daily schedule appointment times for patients requiring same day access;
- Schedule appointments close to the appointment date to reduce cancellations; and
- Work with primary care physicians to reduce unnecessary referrals.

Within several months of implementing this strategy the wait time for an appointment in the department fell from about 60 to 25 days. Nine months after implementation wait times declined to two days. The department also saw improvements in cancellation rates which fell from about 40 to 20 percent.

The chronic care model developed in the 1990s by Wagner et al. has also been the focus of practice changes among rheumatologists. The chronic care model suggests that care needs to be changed from episodic treatment to continuous treatment. This could include a change in the role of the patient, the physician, and a change in sites of care. Dr. Holman suggests that a chronic care curriculum be integrated into the current medical education. Through this implementation students will learn "how the biology of chronic disease evolves and the impacts of treatment," as well as "how physicians can efficiently use available treatment and other resources." Through a focused education on chronic care Holman believes that effectiveness and efficiency of care will improve (2005).

Bodenheimer et al (2002) "Improving Primary Care for Patients with Chronic Illness" suggests the following steps to improve care for patients with chronic illness:

- Providers should coordinate with community groups (e.g., exercise programs, self-help groups).
- Insurers should reward chronic care quality.
- Patients should be provided education/self-management support.
- Multidisciplinary teams, with non-physicians staff, should provide patient self-management support and periodic follow-ups.

- Practice guideline should provide the standard for care, but specialist expertise should be a phone call away.
- Information technology should be used to identify patients, assure practice guidelines are followed, and provide feedback to the physician.

In the future, these improvements in care processes are likely to disseminate across rheumatology practices improving the efficiency and efficacy of the care provided by rheumatologists. The improvements focused on patient screening and scheduling are likely to increase rheumatologist productivity resulting in a greater supply of rheumatology services for a given number of rheumatologists. These changes may also reduce demand for rheumatology services as patients are referred for more appropriate consultations or treated by their primary care physicians without referral to the rheumatologist. In contrast, the improvements related to management of chronic diseases including osteoporosis and RA are likely to increase demand for rheumatology services as patients who are currently under-treated are identified and receive appropriate care.

2.6 Medicare Coverage

Changes in Medicare payment policy and the payment policies of other insurers for rheumatologists services are an important factor in determining what services will be provided. While rheumatologists are concerned about providing efficacious treatment for their patient, they must run profitable practices to stay in business.

The Medicare Prescription Drug, Improvement and Modernization Act of 2003 included several important changes in coverage for arthritis and related illnesses. These are:

- Changes in reimbursement for on-site infusion services - The bill cut physicians' reimbursement for drug costs from 95% to 85% of the average wholesale price, beginning Jan. 1, 2004. At the same time, the legislation boosted physician reimbursement for practice expenses by 32% for 2004. Beginning in 2005, the average wholesale price will no longer be used for reimbursement, but a new formula, known as the average sales price will be used. The government will begin reimbursing physicians for drug-purchase costs at 106% of the average sales price. The new formula is expected to be tied more closely to physicians' actual acquisition costs.
- Medicare Replacement Drug Demonstration – The demonstration allows a limited number of beneficiaries with rheumatoid or psoriatic arthritis to receive coverage for self-injecting biologics. Enrollees could save approximately 75% off the cost of drug therapy which typically costs about $16,000 per year. The demonstration ended December 31, 2005 when Medicare Part D coverage of these drugs began.
- Expanded Coverage for Prescription Drugs – All Part D Medicare prescription drug plans and Medicare Advantage prescription drug plans must offer at least the standard drug coverage or its actuarial equivalent according to the Act.

The change in reimbursement for on-site infusion is likely to result in decreased reimbursement of infusion drugs for rheumatoid arthritis. This may result in rheumatologists needing to reduce

the number of sites where a patient can receive infusions as well as the size of the staff at the sites. Patients would need to travel further for care if the reduction in the sites is made.

In contrast the improvements in Medicare payment for prescription drugs and self-injecting biologics will likely increase demand for rheumatologist services as patients who could not previously afford these pharmaceuticals now have access.

2.7 Summary

The technological changes and changes in practice organization and efficiency serve as a backdrop for fundamental workforce supply and demand. The impact of these current and pending technological advances and practice efficiencies are difficult to quantify. Moreover, future changes not anticipated here will undoubtedly have effects. We turn now, however, to explicit analysis of supply and demand.

3. CURRENT WORKFORCE

3.1 Defining the Current Workforce

There are a number of ways to define the current supply of rheumatologists which lead to different current estimates. The choice is important, because this "baseline" number will permeate all subsequent analyses. The Advisory Group to our study was instrumental in helping us define the current stock.

We developed our baseline count of rheumatologist from the American Medical Association master file. In this file, we defined rheumatologists for the purposes of the workforce study as any MD or DO who meets the following criteria as self-reported to the American Medical Association:

1) Must **not** claim "Resident" as their current major professional activity. Only physicians who have completed their training and have entered the workforce should be considered.
2) Must report that they are "active" physicians, be less than 75 years of age, and working in the U.S. or Puerto Rico. We only want to consider those physicians who are actively practicing in the U.S. or Puerto Rico.
3) Must have completed graduate medical training (GMT) in rheumatology or pediatric rheumatology **or** be board-certified in rheumatology or pediatric rheumatology.

The implications of our criteria are shown in Table 3.1. Some physicians are board-certified and/or fellowship trained in both rheumatology and pediatric rheumatology. These physicians are listed in a separate column in Table 3.1. Note also that the total in the rows are not mutually exclusive. For example, the number "Board Certified" will include those with board certification and fellowship training.

Table 3.1
Baseline Count of Practicing Rheumatologists from AMA, 2005

Training	Adult Rheumatology	Pediatric Rheumatology	Adult and Pediatric Rheumatology
Board Certified	4,049	138	45
Fellowship Trained	3,856	59	46
Total (Board Certified and/or Fellowship Trained)	4,857	171	46

The counts from the AMA file are very consistent with counts of rheumatologists from the American Board of Internal Medicine (ABIM) and American Board of Pediatrics (ABP). The ABIM reports on its website that 4,074 ABIM certificates have been issued in the US in rheumatology as of January 2004. The ABP reports 192 board certificates issued in pediatric rheumatology as of 2003.

We supplemented the data from the AMA masterfile with two additional sources of information. The first is the American College of Rheumatology membership list. The second is the results of a survey of rheumatologists we conducted for ACR as a part of the workforce study.[7]

Prior to conducting the survey of rheumatologists, we received the names and addresses for about one-third of the rheumatologists listed in the AMA master file. We compared this list to the American College of Rheumatologist (ACR) membership list for pediatric and academic rheumatologist. These groups were selected for comparison because statistics from ACR suggested they might be under-represented in the AMA master list.

The survey sample included all rheumatologists who were board certified or fellowship trained in pediatric rheumatology. Thus, the AMA and ACR lists are comparable. We found that 147 pediatric rheumatologists were included in both files, 70 were only in the AMA file, and 39 were only in the ACR file. Therefore, our total count of pediatric rheumatologists was raised to 256. This includes some physicians who were board certified and/or fellowship trained in adult rheumatology as well as pediatric rheumatology.

Names and address were only available for the sample of academic physicians included in the survey. Random sampling suggested 14.8 percent of adult rheumatologists (excluding those with adult and pediatric training or certification) or 717 were in an academic setting based on the AMA master file. However, the ACR membership list included 768 adult rheumatologists in an academic setting. Therefore, we increased our count of adult rheumatologists by 51 to account for adult rheumatologists in an academic setting who were not included in the AMA masterfile.

Data from the rheumatologist survey indicated that the majority of patients for 83 percent of rheumatologists who were board certified and/or fellowship trained in both adult and pediatric rheumatology were over 18 years of age. Therefore, we considered 83 percent of the physicians who were board certified and/or fellowship trained in both pediatric and adult rheumatology to be adult rheumatologists. The remainder, we considered pediatric rheumatologists. This reduced our estimate of potential pediatric rheumatologists from 256 to 218.

The AMA master file counts with these adjustments yielded the baseline estimate of the supply of rheumatologists used in this study and listed in Table 3.2.

[7] The results of the survey of rheumatologists are presented in a separate document.

Table 3.2
Baseline Count of Practicing Rheumatologists, 2005
(AMA File Supplemented with ACR Membership List)

Training	Adult Rheumatology	Pediatric Rheumatology
Total	4,946	218

Based on the rheumatologist survey results, Table 3.3 displays the distribution of rheumatologists by whether or not they treat patients.

Table 3.3
Percentage of Adult and Pediatric Rheumatologists Who Treat Patients

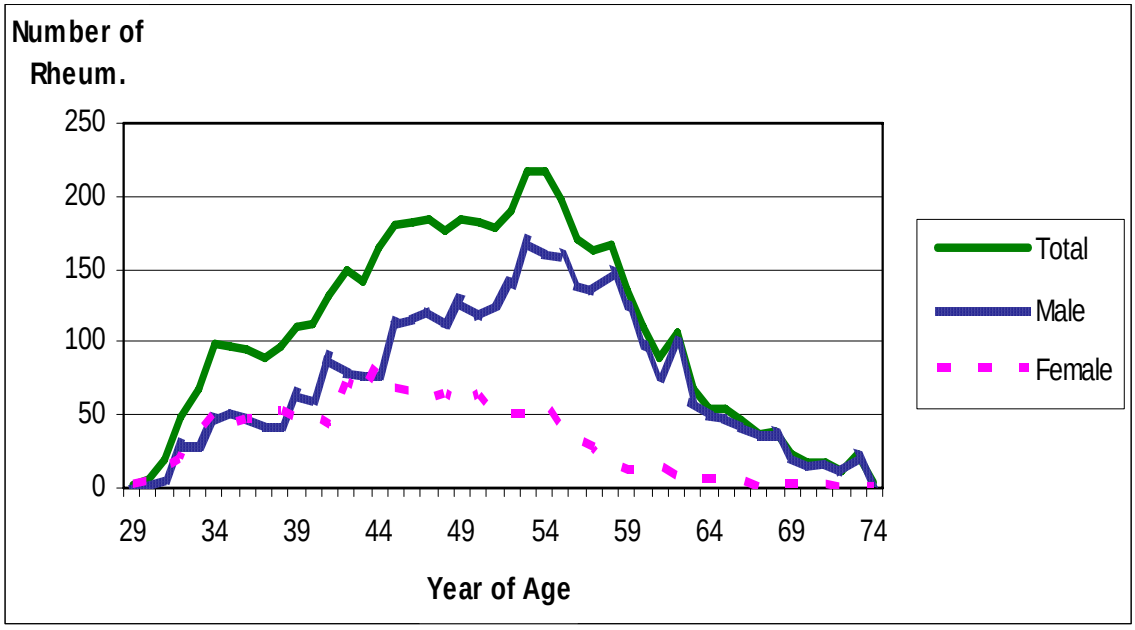
Training	Adult Rheumatology	Pediatric Rheumatology
Total	94%	92%

3.2 Demographic Characteristics of the Current Workforce

The median age for adult and pediatric rheumatologists, respectively, based on the AMA file data is 51 and 47, as of 2005. About 70% and 49% of adult and pediatric rheumatologists, respectively, are male. The median age of male rheumatologists is 53, while the median age of female rheumatologists is 46. The median age of rheumatologists is greater than for physicians as a whole, and for many specialties. This is probably because the typical path to becoming a fellowship-trained rheumatologist, which would include a residency in internal medicine or pediatrics and a two or three year fellowship program in rheumatology, suggests that there are virtually no rheumatologists under age 30. Most would not become board-certified until they are in their mid-thirties.

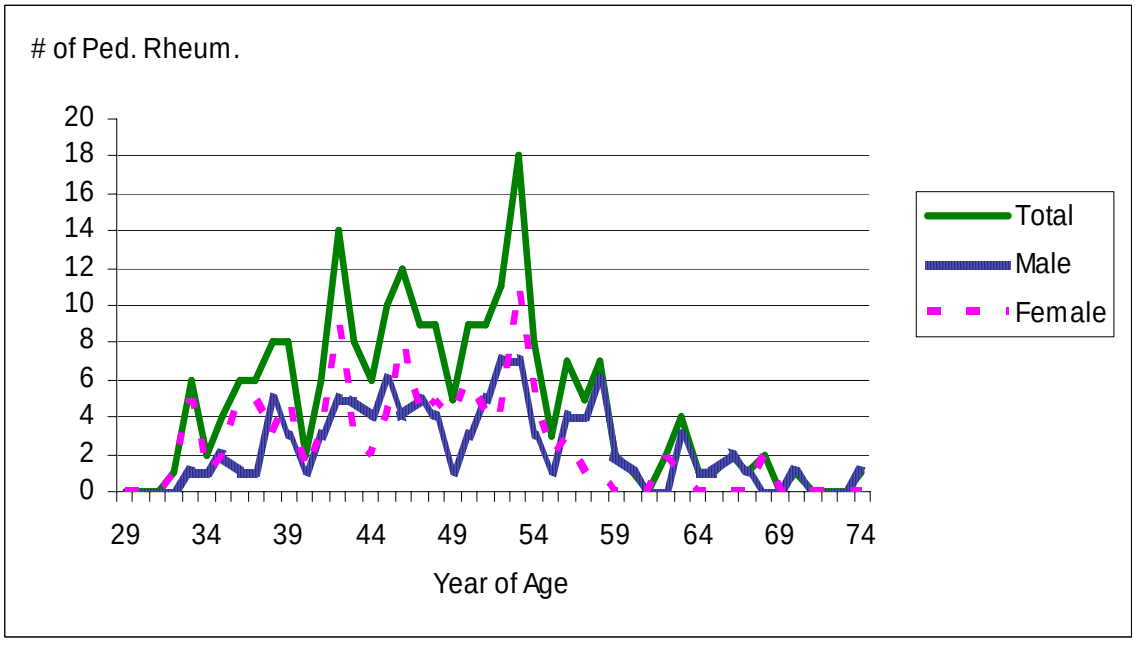
Figure 3.1 displays the age distribution of male, female, and total adult rheumatologists. This graph illustrates the points made in the previous paragraph. It is also interesting that, although in total over 70% of rheumatologists are male, the sex distribution is about even for those under age 40.

Figure 3.1
Age Distribution of Adult Rheumatologists, 2005



The next figure breaks out the age distribution for pediatric rheumatologists.

Figure 3.2
Age Distribution of Pediatric Rheumatologists, 2005



Although overall about 49 percent of pediatric rheumatologists are women, the share of females varies considerably by age with the majority of pediatric rheumatologists over age 55 being male and with 67 percent of pediatric rheumatologists under 40 being female.

3.3 Geographic Distribution of Rheumatologists

Overall, there were 16.7 and 0.7 adult and pediatric rheumatologists per million population in 2005. Approximately, one-quarter of the U.S. population is under the age of 18. This implies 22 adult rheumatologists for every million adults in the U.S. and almost 3 pediatric rheumatologists for every million children in the U.S.

Table 3.4 presents the number of rheumatologists per million population for the 15 largest metropolitan statistical areas (MSAs). Of the 15 largest metropolitan statistical areas, Boston enjoys the highest concentration of adult rheumatologists with 39.9 per million population, while Riverside-San Bernardino has the lowest ratio at 8.0 per million population. Boston also enjoys the greatest number of pediatric rheumatologists per million while Phoenix has no pediatric rheumatologists.

Table 3.4
Rheumatologists per Million Population
15 Largest MSAs

Metropolitan Area	Population	Number of Physicians		Physicians per 1 million population	
		Rheum.	Pediatric Rheum.	Rheum.	Pediatric Rheum.
New York-Northern New Jersey-Long Island, NY-NJ-PA	18,640,775	476	28	25.5	1.5
Los Angeles-Long Beach-Santa Ana, CA	12,829,272	231	10	18.0	0.8
Chicago-Naperville-Joliet, IL-IN-WI	9,333,511	159	11	17.0	1.2
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	5,772,947	161	9	27.9	1.6
Dallas-Fort Worth-Arlington, TX	5,589,670	67	6	12.0	1.1
Miami-Fort Lauderdale-Miami Beach, FL	5,288,796	101	2	19.1	0.4
Washington-Arlington-Alexandria, DC-VA-MD-WV	5,090,435	172	7	33.8	1.4
Houston-Baytown-Sugar Land, TX	5,075,733	61	5	12.0	1.0
Atlanta-Sandy Springs-Marietta, GA	4,610,032	58	3	12.6	0.7
Detroit-Warren-Livonia, MI	4,483,853	72	3	16.1	0.7
Boston-Cambridge-Quincy, MA-NH	4,439,971	177	12	39.9	2.7
San Francisco-Oakland-Fremont, CA	4,157,377	107	6	25.7	1.4
Riverside-San Bernardino-Ontario, CA	3,642,328	29	2	8.0	0.5
Phoenix-Mesa-Scottsdale, AZ	3,593,408	44	0	12.2	0.0
Seattle-Tacoma-Bellevue, WA	3,141,777	79	8	25.1	2.5

Tables 3.5 and 3.6 present the number of adult rheumatologists per million population for the 15 MSAs with the lowest concentrations and for those MSAs with more than 150,000 people and no adult rheumatologist, respectively.

Table 3.5
MSAs with the Lowest Concentrations of Adult Rheumatologists

Metropolitan Area	Population	Count	Per Million Population
Muskegon-Norton Shores, MI	173,090	1	5.8
Hickory-Lenoir-Morganton, NC	350,140	2	5.7
Fort Walton Beach-Crestview-Destin, FL	178,104	1	5.6
Baton Rouge, LA	722,646	4	5.5
Salem, OR	362,990	2	5.5
Elkhart-Goshen, IN	188,779	1	5.3
Visalia-Porterville, CA	390,791	2	5.1
Houma-Bayou Cane-Thibodaux, LA	197,388	1	5.1
Provo-Orem, UT	406,851	2	4.9
Salinas, CA	414,449	2	4.8
Waco, TX	219,807	1	4.5
Bakersfield, CA	713,087	3	4.2
Bremerton-Silverdale, WA	240,719	1	4.2
San Luis Obispo-Paso Robles, CA	253,118	1	4.0
Savannah, GA	304,325	1	3.3

There appears to be opportunity for new rheumatologist practices in these areas.

Table 3.6
MSAs with More than 150,000 people and No Adult Rheumatologists

Metropolitan Area	Population
Holland-Grand Haven, MI	249,391
Gulfport-Biloxi, MS	248,965
Clarksville, TN-KY	236,700
Merced, CA	231,574
Prescott, AZ	184,433
Anderson, SC	171,510
Abilene, TX	158,488
Hilo, HI	158,423
East Stroudsburg, PA	154,495
Ottawa-Streator, IL	153,377
Blacksburg-Christiansburg-Radford, VA	152,606
Thomasville-Lexington, NC	152,178
Monroe, MI	150,673

Table 3.7 presents the number of pediatric rheumatologists per million population for those MSAs with more than 700,000 people and no pediatric rheumatologist. Some of these MSAs are likely to be served by pediatric rheumatologists in adjacent MSAs. For example, Raleigh-Cary, NC is adjacent to the Durham, NC MSA which has one of the highest concentrations of pediatric rheumatologists. Similarly, Worcester, MA is likely served by the pediatric rheumatologists in Boston.

Table 3.7
MSAs with more than 700,000 people and No Pediatric Rheumatologists

Metropolitan Area	Population
Phoenix-Mesa-Scottsdale, AZ	3,593,408
San Antonio, TX	1,820,719
Las Vegas-Paradise, NV	1,576,541
Charlotte-Gastonia-Concord, NC-SC	1,437,427
Austin-Round Rock, TX	1,377,633
Birmingham-Hoover, AL	1,072,646
Tucson, AZ	892,798
Raleigh-Cary, NC	884,489
Fresno, CA	850,325
Dayton, OH	846,091
Oxnard-Thousand Oaks-Ventura, CA	791,130
Worcester, MA	776,610
Allentown-Bethlehem-Easton, PA-NJ	768,036
Grand Rapids-Wyoming, MI	762,035
Baton Rouge, LA	722,646
Bakersfield, CA	713,087
El Paso, TX	705,436
Akron, OH	701,643

The next two tables display the MSAs with the highest concentrations of adult and pediatric rheumatologists, respectively.

Table 3.8
15 MSAs with the Highest Concentrations of Adult Rheumatologists

Metropolitan Area	Population	Count	Per Million Population
Rochester, MN	172,459	21	121.8
Wisconsin Rapids-Marshfield, WI	75,402	9	119.4
Iowa City, IA	136,862	14	102.3
Bloomsburg-Berwick, PA	82,688	8	96.7
Ann Arbor, MI	338,562	29	85.7
Kirksville, MO	28,999	2	69.0
Oneonta, NY	62,196	4	64.3
Durham, NC	447,066	27	60.4
Columbia, MO	151,129	9	59.6
Monroe, WI	34,280	2	58.3
Greenville, NC	158,680	9	56.7
North Platte, NE	36,054	2	55.5
Portales, NM	18,107	1	55.2
Charlottesville, VA	181,631	10	55.1
Los Alamos, NM	18,802	1	53.2

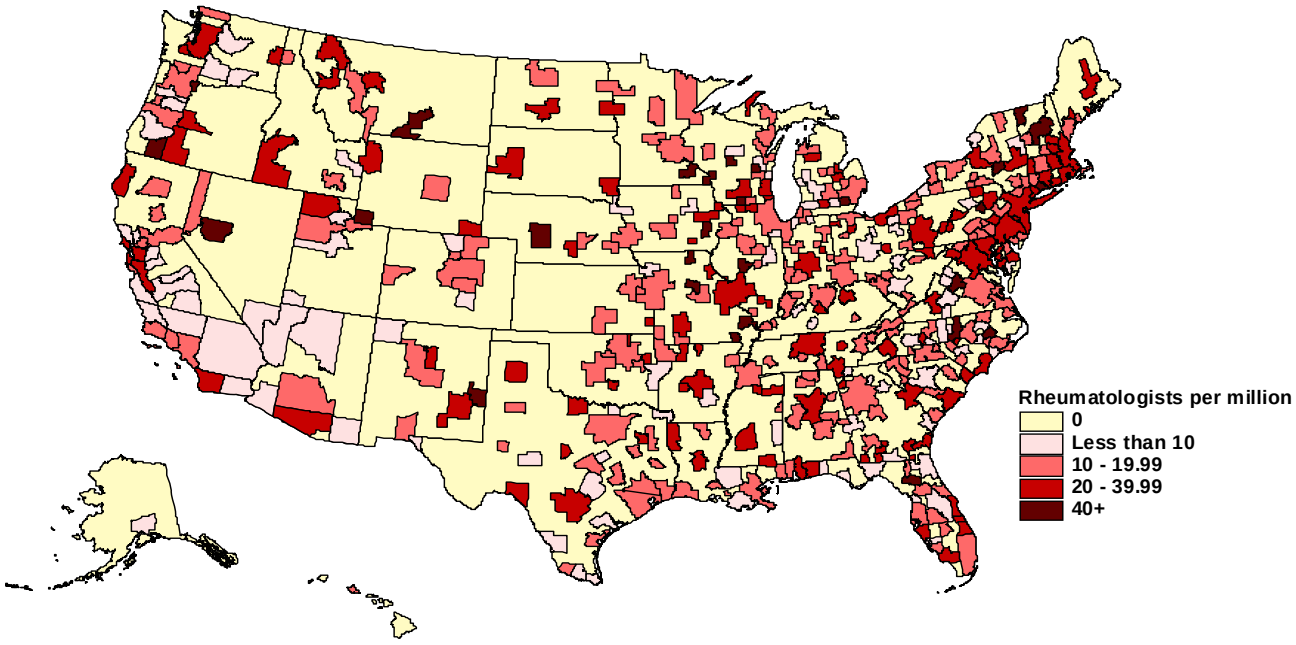
Many of these MSAs with high concentrations of adult and pediatric rheumatologists are home to academic or specialty medical centers. For example, Rochester, MN and Wisconsin Rapids-Marshfield, WI are home to the Mayo and Marshfield Clinics, respectively.

Table 3.9
15 MSAs with the Highest Concentrations of Pediatric Rheumatologists

Metropolitan Area	Population	Pediatric Rheumatologists	Pediatric Rheumatologists
Rochester, MN	172,459	2	11.6
Missoula, MT	98,616	1	10.1
Durham, NC	447,066	4	8.9
Ann Arbor, MI	338,562	3	8.9
Gainesville, FL	239,211	2	8.4
Madera, CA	133,463	1	7.5
Dover, DE	134,390	1	7.4
Iowa City, IA	136,862	1	7.3
Columbia, MO	151,129	1	6.6
Lebanon, NH-VT	171,014	1	5.8
Charlottesville, VA	181,631	1	5.5
Augusta-Richmond County, GA-SC	511,487	2	3.9
Cincinnati-Middletown, OH-KY-IN	2,047,333	8	3.9
Harrisburg-Carlisle, PA	517,468	2	3.9
Norwich-New London, CT	263,989	1	3.8

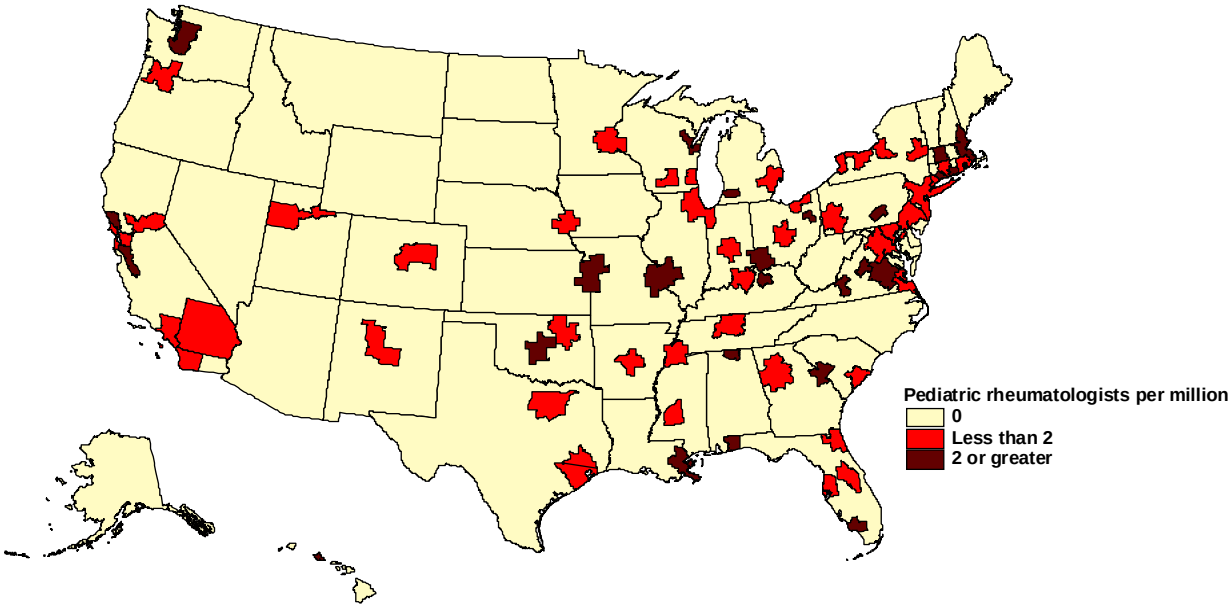
Finally, the following figures summarize the geographic distribution of adult and pediatric rheumatologists across the United States. The areas with the highest concentration of adult rheumatologists are the New England and Mid-Atlantic States. Areas of lowest concentration include the Central and Mountain states, Hawaii and Alaska.

Figure 3.3
Concentration of Adult Rheumatologists Across the U.S.



There are many states with no pediatric rheumatologists. These are: Vermont, Maine, North Dakota, Arizona, Wyoming, South Dakota, Idaho, Nevada, West Virginia, and Alaska.

Figure 3.4
Concentration of Pediatric Rheumatologists Across the U.S.



4. SUPPLY AND DEMAND ISSUES

In this section, we consider factors affecting supply. In particular, we examine the number and fill rate of fellowship positions. We also consider trends in retirement and withdrawal from the labor force. In Section 4.2, we consider factors affecting demand. In Section 4.2.1, we present estimates of the current services for which rheumatologists receive reimbursement, how they have changed over time, and the share of other providers of the services with whom rheumatologists may compete. Section 4.2.2 examines trends in population growth. Section 4.2.3 presents econometric (statistical) estimates of factors affecting the demand for the services of rheumatologists, including managed care, household income, and insurance. Section 4.2.4 presents information on the earnings of rheumatologists compared to other physician specialties. Finally, Section 4.2.5 presents data on some potential measures of excess demand (supply) for rheumatologist services.

4.1 Supply Factors

4.1.1 Trends in Residencies and Fellowships

The most important factor affecting the supply of rheumatologists is the number completing fellowships in rheumatology each year. To estimate future supply, it is important to determine how many enter the rheumatology workforce from fellowship programs each year. This will depend not only on the positions and fill rates, but also on the lengths of the programs.

Table 4.1 presents data on fellowship positions for adult rheumatology. According to the Accreditation Council for Graduate Medical Education (ACGME), there were 378 adult rheumatology fellowship positions in 105 programs offered in 2004-2005. The fill rate for these positions is about 88%.

Table 4.1
Adult Rheumatology Fellowship Positions

Academic Year	1996-1997	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005
ACGME Accredited Programs	114	107	106	105	107	108	106	105	107
Total Positions Available	329	357	351	358	368	380	370	369	378
Total Positions Filled	266	250	247	284	276	288	307	336	333
1st year Positions Available	154	167	158	161	163	182	178	179	177
1st year Positions Filled	120	117	123	141	122	121	130	165	149
Number Completing Program	116	113	120	105	122	137	156	146	161
Percent of IMGs	52%	58%	63%	59%	45%	36%	36%	35%	33%

ACGME also reports that there were 56 positions in pediatric rheumatology in 2004-2005. Of these positions only 30 were filled for a fill-rate of only 54%.

Table 4.2
Pediatric Rheumatology Fellowship Positions

	1997-1998	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005
ACGME Accredited Programs	16	18	20	20	21	21	23	25
Total Positions Available^	25	38	39	44	53	55	52	56
Total Positions Filled*	15	24	20	21	27	28	26	30
1st year Positions Available^	12	11	22	25	25	25	25	23
1st year Positions Filled*	3	4	10	7	9	8	8	12
Number Completing Program^^	0	4	5	4	7	6	12	9
Percent of IMGs*	33%	55%	50%	57%	44%	36%	31%	20%

In our supply model, our baseline assumption is that rheumatology fellowship positions and fill rates will remain constant at the 2004-2005 level. Comparing the number of first year fellows to the number completing the program between 1997 and 2005 suggests that adult and pediatric rheumatology have a high completion rate, approaching 100 percent. These data indicate that about 161 fellows in adult rheumatology and about 9 fellows in pediatric rheumatology entered the market in 2005.

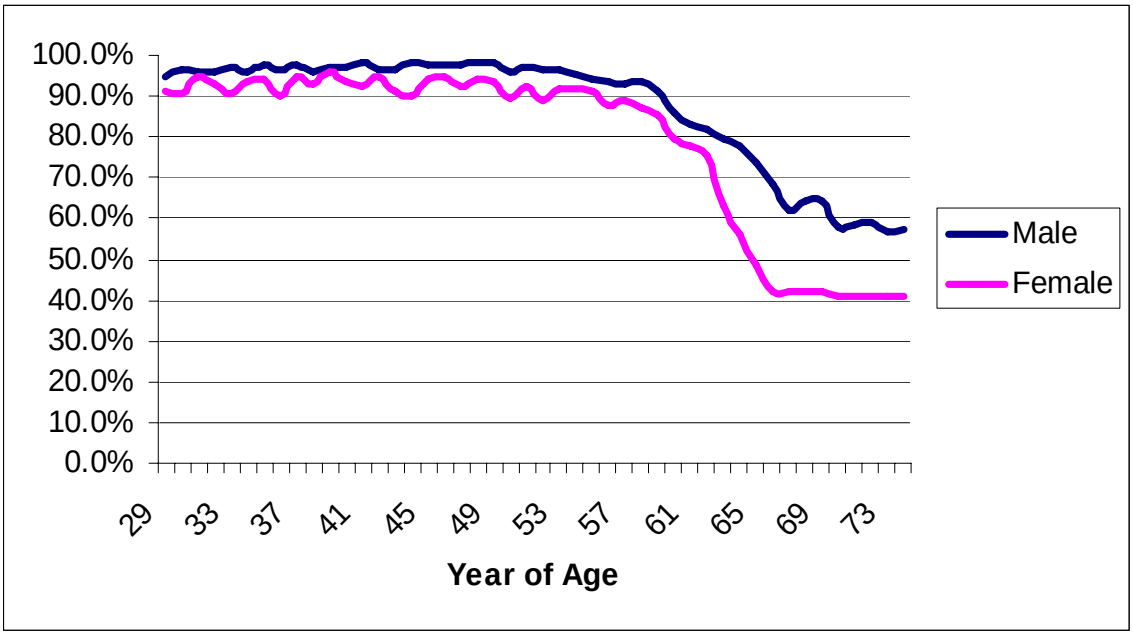
In 2004-2005, International medical school graduates (IMGs) constituted 33% of fellows in adult rheumatology programs and about 20% of fellows in pediatric rheumatology programs. An important "supply" issue is the proportion of IMG fellows who remain in the United States after graduation and practice. While we do not have detailed information concerning fellows in rheumatology, *per se*, based on data from August 2004 reported in the Journal of the American Medical Association about 50% of IMGs are, in fact, United States citizens or have permanent residency status in the United States, across all graduate medical education programs. Only about 14.4% of IMGs are in the United States with J-1/J-2 visa status.[8] Unless a waiver is granted, those who have J-1/J-2 visas to attend residency or fellowship programs in the United States must leave the United States for a period of at least two years upon completion of their training. While there is no data on precisely what proportion of IMGs do, in fact, ultimately practice in the United States, the consensus view of experts is that most ultimately do remain in the United States. Based on our discussions with experts at the Bureau of Health Professions and elsewhere, we estimate that about 80 percent of IMGs practice in the United States. Hence, most IMGs contribute to supply in the United States.

[8] *Journal of the American Medical Association*, September 2005.

4.1.2 Retirement Rates

A second factor that affects the supply of rheumatologists is the age and rate at which rheumatologists withdraw from practice. We do not have rheumatologist-specific rates. The following figure presents labor force participation rates for professionals based on data from the Census Bureau for 2000. These data suggest substantial declines occur in the labor force participation rate between about age 59 and age 68. Beyond age 68 the labor force participation rates levels off with about 60 percent of male and 40 percent of female professionals continuing to participate in the labor force through age 75. Our model assumes that all rheumatologists stop participating in the labor force at age 75.

Figure 4.1
Labor Force Participation Rates for Professionals
(CPS, 2000)



4.1.3 Hours of Work and Visit Capacity

The final factor affecting the supply of rheumatologist services is the number of visits produced by each rheumatologist. Evidence from the rheumatologist survey suggests that the average number of visits provided annually by a rheumatologist varies depending on the age and sex of the rheumatologist. Table 4.3 shows the mean number of visits provided annually by age and sex based on the rheumatologist survey.

Table 4.3
Mean Number of Visits Provided Annually
by Rheumatologists in Clinical Practice by Age and Sex, 2005

Age/Sex Category	Mean Number of Visits Annually
Female	
<40	2,754
40-49	3,018
50 or Older	2,543
Male	
<40	3,515
40-49	3,661
50-59	4,166
60+	3,243

These means are for rheumatologists who spend at least part of their time seeing patients. About 94 and 92 percent of adult and pediatric rheumatologists, respectively, see patients. When these means are applied to the age/sex distribution of the rheumatologist population in 2005 and non-clinical rheumatologists are averaged in as providing no visits, we find that the average number of visits provided by female and male rheumatologists, respectively, is 2,624 and 3,548 visits per year. This implies that the average male rheumatologist provides about 35 percent more visits annually than the average female. Since the share of women rheumatologist is expected to increase over the next 20 years, this will imply that the average number of visits produced annually by rheumatologists will decline.

It is also important to note that male rheumatologists over 60 provide 22 percent fewer visits than their colleagues 50-59. Figure 3.1 indicates that there is a large cohort of rheumatologists who were between 45 and 59 years of age in 2005. Many of these rheumatologists are in their most productive years. As this large cohort ages, the survey data indicates that they will likely reduce their work effort resulting in a decline in the mean number of visits produced by the average rheumatologist.

4.2 Demand Issues

4.2.1 Demand for Services

In this section, we examine two sources of information regarding the services performed by rheumatologists. From these data, we will obtain insights regarding reimbursement for services, how demand has changed over time, and providers who, potentially, compete with rheumatologists.

Medicare Data

Data from the Medicare program is limited in that it applies only to Medicare beneficiaries--typically those age 65 or over. But, this is an important population and one that is expected to grow from 14.2% of the population in 2000 to 18.6% of the population by 2020. Moreover, it is a group for which detailed and relatively complete claims data is available.

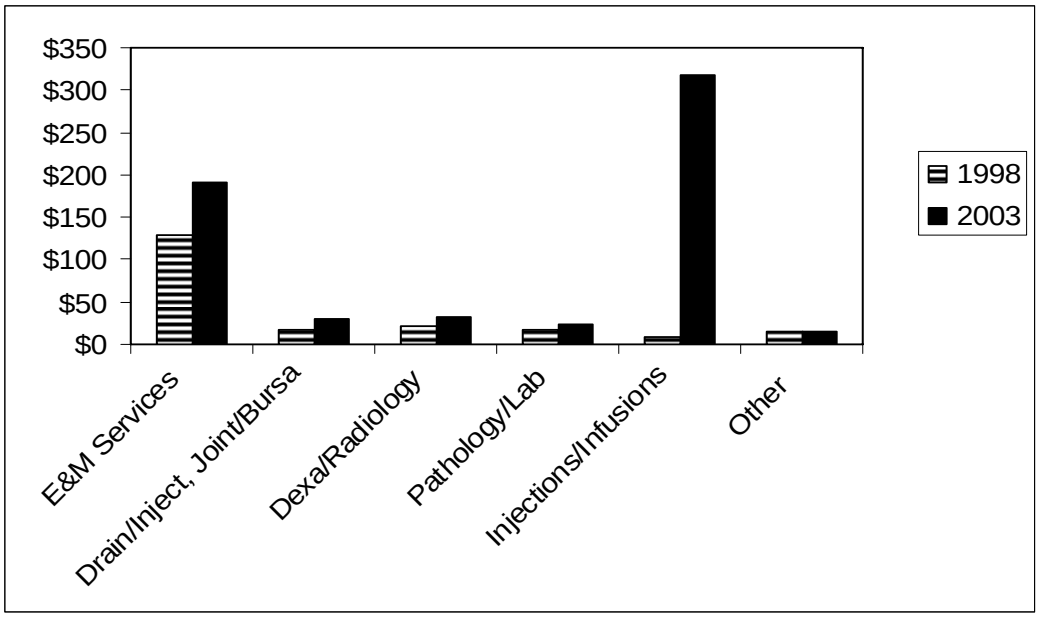
The Medicare BMAD Beneficiary file, which includes data regarding reimbursement for physicians office visits, procedures, and other outpatient services, indicates that while total Medicare Part B reimbursements increased by 37.6% across all part B providers between 1998 and 2003, it increased substantially, by 192.5%, for rheumatologists.

Table 4.4
Reimbursement for Medicare Part B Services 1998-2003 Comparison

	Medicare Part B Reimbursement	Rheumatology Reimbursement	As Share of Part B Total
1998	$44,367,066,279	$208,598,534	0.5%
2003	$61,028,989,141	$610,115,629	1.0%
Change	37.6%	192.5%	112.6%

In Figure 4.2, we compare the dollar volumes of the services provided by rheumatologists by type of service in 1998 and 2003. Office visits were the most important rheumatologist service based on dollar values in 1998. However, by 2003, after the introduction of biologics in 1999, infusions became the most important source of revenue for rheumatologists.

Figure 4.2
Medicare Spending on Rheumatologist Services by Type of Service



National Ambulatory Medical Care Survey (NAMCS)

The NAMCS data is more general than the Medicare data in that it includes all patients, not just those who are eligible for Medicare. It is a survey that is based on a sample of providers. It captures office visits by provider type and, most importantly, reason for visit. Moreover, it has weights which permit generalization to the U.S. population. A weakness of the data, however, is that there are very few rheumatologists in the survey.[9]

We analyzed NAMCS data from 1998 through 2003. Data beyond 2003 is not yet available. Because few rheumatologists are captured in the survey each year, our analysis compares two three-year periods: 1998, 1999, and 2000 are compared to 2001, 2002, and 2003. Combining the data into two three-year periods will improve the precision relative to annual comparisons.

We examine, first, the distribution of office visits by reason for visit. In the period 1998-2000, the reason for visit for slightly more than 10 percent of office visits was arthritis. This percentage rose dramatically, such that in 2001-2003 arthritis represented the reason for the visit in over 20 percent of visits.

Figure 4.3
Changes in the Distribution of Reasons for Rheumatologist Office Visits
1998-2000 Compared to 2001-2003

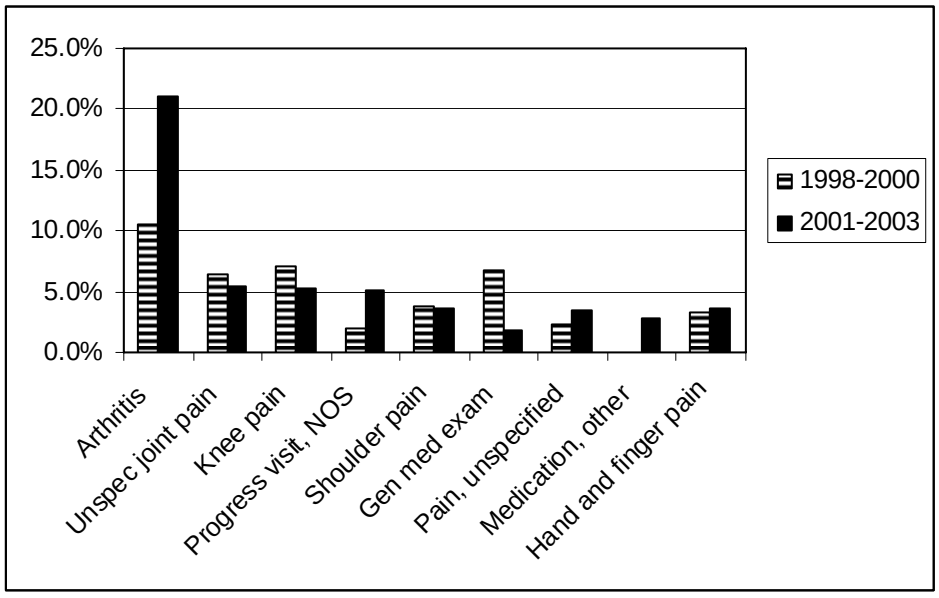


Table 4.5 combines data from 1998 through 2003 to assess the share of visits for a given diagnosis that are provided by a rheumatologist as opposed to a primary care physician or other specialist. It should be noted that the NAMCS classifies physicians based on their self-reported primary specialty while this study has classified physicians as rheumatologists based on training

[9] Because it is a random sample, the results for rheumatologists will be "unbiased" in the statistical sense of that term. However, because there are relatively few rheumatologists, the sampling variance may be high and the results imprecise.

and board certification. If a physician reports their primary specialty as internal medicine to the NAMCS they will be included in the primary care physician column, however, they may be trained or board certified as a rheumatologist.

Table 4.5
Distribution of Office Visits, 1998-2003
by Diagnosis and Physician Specialty

	Rheumatologist	Primary Care Physician	Other
Rheumatoid Arthritis	52.0%	30.9%	17.0%
Osteoarthritis	7.0%	52.7%	40.3%
Spondylarthropathies	77.3%	14.8%	7.9%
Polymyalgia Rheumatica	48.3%	43.4%	8.3%
Lupus	29.9%	35.0%	35.1%
Low Back Pain	2.9%	74.6%	22.5%
Gout	11.7%	79.9%	8.4%
Osteoporosis	5.1%	79.2%	15.7%

The majority of RA visits and visits for spondylarthropathies were provided by a rheumatologist. The majority of osteoarthritis, low back pain, and osteoporosis visits were provided by primary care physicians.

4.2.2 Population Dynamics

A major factor affecting the future demand for health care services is the aging population. In 2005, there were 37.5 million people age 65 or over, constituting about 12.7% of the total population. By 2015, the number over age 65 will increase to 46.9 million, which is about 14.6% of the total population. By 2025, the age 65 or over population will number 62.5 million, or 17.9% of the population.

Table 4.6 shows the trends in population by major age group. The table indicates that the population over age 64 is expected to increase by more than 60 percent over the 20 year period while the population under age 65 is expected to increase by only a little over 10 percent.

Table 4.6
Population Trends (Millions)

	2005	2010	2015	2020	2025	% Increase 2005 to 2025
<20	81,893	83,236	86,062	88,887	91,996	12.3%
20-64	175,986	185,456	188,871	192,285	194,656	10.6%
65-84	32,457	34,120	40,742	47,363	54,607	68.2%
85+	5,195	6,123	6,696	7,269	8,436	62.4%

Because the prevalence of many of the diseases treated by rheumatologists increases with age, the dramatic growth in the population over age 64 will exert a major influence on the demand for rheumatologist services.

4.2.3 Econometric Estimates of Factors Affecting Demand

We hypothesize that several factors will have an impact on demand. In this section, we develop a model to test the impact of these factors on demand holding other factors the same. That is, the model attempts to account for all or most of the factors affecting demand isolating the impact of each factor on demand.

Estimating the effect of factors affecting the demand for a particular physician specialty, particularly the smaller specialties, is typically stymied by a paucity of data regarding the quantity of services provided. Here, we use an alternative, stylized approach to demand that avoids this difficulty.

We estimate a model of the "demand" for rheumatologists using data on the geographic distribution of rheumatologists across the United States. The fundamental hypothesis underlying the estimates is that, at the margin, rheumatologists will migrate into areas where demand is relatively strong and away from areas where demand is relatively weak. In effect, we use "number of physicians" as a proxy for services provided. Hence, using this hypothesis, we attempt to explain the variation in the rheumatologist to population ratio across various geographical areas by the variation in factors affecting the demand for services. Based on this relationship, we infer the effects that various factors, such as insurance coverage, managed care, and per capita income, have on the demand for the services of rheumatologists.

The model is of the general form:

$$\Delta(R^d / pop) = f(\Delta I, \Delta UI, \Delta MC, \Delta P65)$$

where the change in the population ratio of rheumatologists (R), interpreted as the "demand", is a function of the change in real per capita income in the area (I), the change in the percent uninsured (UI), the change in managed care penetration rate (MC), and the change in the percentage of the population over age 65 (P65). The percentage of the population over age 65 is only included in the adult rheumatologist demand model and is excluded from the pediatric model.

Data

The number of adult and pediatric rheumatologists in each MSA was calculated based on the AMA masterfile for 1998 and 2005. Mean per capita personal income for each MSA for 1998 through 2003 were obtained from the Bureau of Economic Analysis.[10] Per capita personal income for 2005 was estimated by assuming that the income growth rate for each MSA would continue at the average annual growth rate observed between 1998 and 2003. The level of managed care penetration and the percentage uninsured in each MSA was obtained from the Interstudy Competitive Edge Part III reports for 1998 and 2005.

[10] http://www.bea.gov/bea/regional/reis/ accessed March 29, 2006.

For 1998, estimates of the total population and the population under 18 and over 65 by MSA were derived from the Area Resource file. Population estimates overall and by age for each MSA in 2004 were obtained directly from the Census Bureau.[11]

Results

We estimated two sets of regressions: one for all non-pediatric rheumatologists and one for pediatric rheumatologists. Each model had as its dependent variable the number of (relevant) rheumatologist physicians per million population (population 18 or under for pediatric rheumatologist regression) by MSA. Independent variables were:

- Managed care penetration rates, defined as total managed care enrolled population divided by total population;
- Percent uninsured population, defined as the number of uninsured persons divided by total population;
- Mean real per capita personal income; and
- Share of the population over 64 (non-pediatric rheumatologist regression only)

The dependent variable(s) were the ratio of rheumatologists to population by MSA.

Table 4.7 presents the results for non-pediatric rheumatologists.[12] The mean rheumatologists per million population in the MSAs with sufficient data to be included in the regression was 19.1.

Table 4.7
Factors Affecting Demand - Adult Rheumatologists

	Parameter Estimate	P Value
Intercept	-0.37	0.58
Change in % of Population Greater than 64	0.19	0.65
Change in % of Population Uninsured	-0.11	0.32
Change in % of Population Enrolled in MC	0.02	0.48
Change in Per Capita Income ($1,000)	0.46	0.00
South	-0.33	0.65
Northeast	1.54	0.07
West	-0.43	0.58
R Square		0.068
Adjusted R Square		0.045

[11] http://www.census.gov/popest/counties/asrh/CC-EST2004-agesex.html accessed March 29, 2006.

[12] The standard way to present regression results is to include the regression coefficient, its standard error or a t-statistic, and an overall measure of goodness of fit, such as the “”R-square” which indicates the proportion of the variation in the physician-to-population ration that is explained by the regression equation.

The managed care penetration rate is estimated to have a very small positive effect on rheumatologists per population. This effect is statistically insignificant. Because the effect is small and insignificant, as we model supply and demand scenarios, we will assume the impact of managed care is negligible. The percentage of the population that is uninsured has a negative effect on the number of rheumatologists demanded implying that expansion of insurance coverage results in increased demand for rheumatologists. This parameter is insignificant as there was too much variation in the data to estimate it precisely. We will test the impact of changes in insurance coverage in the supply and demand scenarios discussed below.

Table 4.8 translates the regression results into elasticities. The "elasticity" of –0.09 for the percentage uninsured below indicates that a 10% increase in the percentage uninsured results in a 0.9% decline in the demand for rheumatologists.

Table 4.8
Elasticity of Demand - Adult Rheumatologists

	Mean 2005	Elasticity
% of Population Greater Than 64	11.8%	0.12
% of Population Uninsured	15.3%	-0.09
% of Population Enrolled in MC	41.1%	0.03
Per Capita Income ($1,000)	$35,159	0.85

The regression model also indicates that increases in the percentage of the population over age 64 results in a positive impact on demand for rheumatologists. This parameter is also insignificant as there was too much variation in the data to estimate it precisely. We will discuss the impact of changes in the share of the population over 64 in the supply and demand scenarios discussed below. The "elasticity" of 0.12 for the percentage of the population over 64 indicates that a 10% increase in the percentage of the population over 64 results in a 1.2% increase in the demand for rheumatologists.

Per capita personal income has the largest effect on demand and this result is statistically significant. The "elasticity" of 0.85 for personal income per capita indicates that a 10% increase in the personal real income per capita results in an 8.5% increase in the demand for rheumatologists.

In Table 4.9, the results for the same model specification are shown, except that the dependent variable is pediatric rheumatologists per population 18 or younger. Mean rheumatologists per million population in the MSAs with sufficient data to be included in the regression was 4.2

Table 4.9
Factors Affecting Demand - Pediatric Rheumatologists

	Parameter Estimate	P Value
Intercept	0.37	<.0001
Change in % of Population Uninsured	0.04	0.01
Change in % of Population Enrolled in MC	0.00	0.53
Change in Per Capita Income ($1,000)	0.09	<.0001
South	-0.20	0.02
Northeast	0.05	0.58
West	-0.15	0.11
R Square		0.126
Adjusted R Square		0.118

The managed care penetration rate is estimated to have no effect on rheumatologists per population. Thus, as we model supply and demand scenarios, we will assume the impact of managed care is negligible. The percentage of the population that is uninsured has a small positive effect on the number of rheumatologists. This result is counterintuitive as we would expect an increase in the percent of the population that is uninsured to result in decreased demand for rheumatologists. In the supply and demand scenarios discussed below we will assume the impact of this factor in the pediatric model is negligible.

Table 4.10 translates the regression results into elasticities. The "elasticity" of 0.02 for the percentage of the population enrolled in managed care indicates that a 10% increase in the percentage of the population enrolled in managed care results in a 0.2% increase in the demand for pediatric rheumatologists.

Table 4.10
Elasticity of Demand - Pediatric Rheumatologists

	Mean 2005	Elasticity
% of Population Uninsured	15.3%	0.14
% of Population Enrolled in MC	41.1%	0.02
Per Capita Income ($1,000)	$35,159	0.79

Similar to the adult model per capita personal income has the largest effect on demand and this result is statistically significant. The "elasticity" of .79 for personal income per capita indicates that a 10% increase in the personal income per capita results in a 7.9% increase in the demand for pediatric rheumatologists.

Summary and Limitations

Using the geographic variation in the physician to population ratio, we are able to estimate the effects that various factors have on the demand for rheumatologists. In particular, we have found a strong positive association between real per capita personal income and demand for rheumatologists.

Some caution should be used however when interpreting these results. We base our results on the hypothesis that, at the margin, physicians make location decisions based on demand and that demand in a particular MSA is related to the characteristics of the population residing in that area. This allows us to use the geographic distribution of physicians as a demand proxy. First, however, the number of rheumatologists in a particular geographic area is not a perfect proxy for the level of demand in that area. Some rheumatologists may have research and teaching responsibilities that limit their clinical time. A preferred specification would be estimates based on actual services provided. Data limitations, again, are a major impediment to this approach. Second, certain academic medical centers attract patients from outside their MSA. In these locations the characteristics of population residing in the MSA do not provide a good characterization of the population demanding services in that location. This is probably more of an issue in the pediatric model because of the small number of pediatric rheumatologists.

4.2.4 Earnings of Rheumatologists

The earnings of rheumatologists are not a factor affecting the demand for rheumatologists. Rather, they are the outcome of the demand for and supply of rheumatologists. When demand exceeds supply, we would expect earnings to rise. Conversely when supply exceeds demand, we would anticipate that earnings would begin to fall, or at least not rise as fast as they otherwise might.

In general, there is a paucity of data on the earnings of physician specialists, especially in the smaller specialties. The two primary sources for these data are from the American Medical Association's Socioeconomic Monitoring System, a survey of non-federal physicians, and the Medical Group Management Association (MGMA) Physician Compensation and Productivity Survey. The AMA data do not provide specific information on rheumatologists. Therefore, only data from the MGMA survey is reported here.

Earnings comparisons can be very treacherous. Physicians in private practice typically earn more than those who are salaried, and those who are in large group practices earn more than those who are in solo practice, other things being equal. Further, physicians who work longer hours will typically earn more than those who work shorter hours, other factors held constant. Moreover, physicians who are more experienced—in the age range of 45-60—typically earn more than others. These simple comparisons of median responses from a survey of physicians' earnings do not adjust for these factors. For these reasons, as well as issues regarding the collection of earnings data in surveys, the estimates should be interpreted cautiously.

Table 4.11 shows median compensation for rheumatology and other select non-surgical specialties for 1998 and 2002. These data are from the MGMA.[13] The sample of respondents includes only private MGMA member practices. MGMA produces separate reports for academic physicians which are discussed below.

[13] The data are taken from *Physician Compensation and Production Survey*, Medical Group Management Association, 1999 and 2003 reports. The reader is cautioned that the sample sizes are small, particularly for the smaller specialties.

Rheumatologists' median earnings in 1998 are about 7% greater than general internal medicine specialists. They exceed the earnings of endocrinologists, geriatric and occupational medicine specialists, but not those of allergy and immunology specialists.

Table 4.11
Median Compensation of Private Practice Physicians by Physician Specialty
MGMA Estimates*

	Rheumatologists	Internal Medicine	Endocrin.	Allergy/ Immun.	Geriatrics	Occup. Medicine
1998	$151,017	$140,951	$153,821	$205,000	$140,385	$145,588
2002	$193,410	$154,756	$170,000	$235,316	$146,016	$164,783
% Increase	28.1%	9.8%	10.5%	14.8%	4.0%	13.2%

* There was insufficient sample size in the MGMA survey for pediatric rheumatology.

Growth in earnings of rheumatologists between 1998 and 2002 was substantially greater than for the other specialties listed. With the exception of geriatrics, which showed only a 4 percent increase in earnings, the earnings increase for the other specialties was close to the inflation increase of 10 percent for this period based on the Consumer Price Index. In contrast, rheumatologist earnings increase 28.1 percent. Rheumatologist earnings during this period are likely to have increase so substantially because of the introduction of the first biologic treatment for rheumatoid arthritis, infliximab, in 1999.

Table 4.12 displays median compensation for academic facility based on MGMA's survey of medical schools in the United States.[14] The compensation for rheumatologists on academic faculties did not rise as substantially as the compensation of private practice rheumatologists. It may take more time for physician salaries in academic practices to respond to the increases in revenue generated by rheumatologists related to the introduction of biologic treatments.

Table 4.12
Median Total Compensation for Academic Faculty
MGMA Estimates

	Rheum.	Ped. Rheum.	Internal Medicine	Endocrin.	Allergy/ Immun.	Geriatrics
1998	$124,425	$106,844	$118,275	$125,661	$114,645	$124,298
2002	$138,529	$116,723	$132,327	$134,708	$146,288	$134,538
% Increase	11.3%	9.2%	11.9%	7.2%	27.6%	8.2%

4.2.5 Measures of Excess Demand

Growth in the earnings of rheumatologists at rates which exceed inflation is one indication of strong demand for rheumatologists, in this section we present several other indicators of demand

[14] The data are taken from *Academic Practice Faculty Compensation and Production Survey*, Medical Group Management Association, 1999 and 2003 reports. The reader is cautioned that the sample sizes are small, particularly for the smaller specialties.

for rheumatologists that were derived from the survey of rheumatologists conducted by The Lewin Group in 2005-6.

First, survey respondents were asked if their practices were accepting new patients or if they limited patients to those who received a referral from a primary care physician. Only 3 percent of rheumatologists indicated that their practices were closed to new patients, but 48 percent restricted access by requiring a referral from a primary care physician. This suggests that nearly half of rheumatologists have excess demand for their services and are using referrals to limit access.

Rheumatologists were also asked about mean wait times for appointments among early arthritis and non-urgent patients. Since the introduction of pharmaceuticals with the ability to prevent joint destruction and disability with early treatment, the benefits of identifying early arthritis patients and beginning treatment promptly has been demonstrated, therefore we expected much shorter wait times for early arthritis patients than for non-urgent patients.

Figure 4.4 presents the distribution of wait times for early arthritis patients. The mean wait time for early arthritis patients among the physicians sampled was 18 days. About 38.6% of early arthritis patients were seen within 7 days. This demonstrates that many rheumatologists see early arthritis patient quickly in an effort to prevent joint damage. Unfortunately, 15.2% of rheumatologists said early arthritis patients wait a month or more for their first visit.

Figure 4.4
Wait Time to First Appoint for Early Arthritis Patients

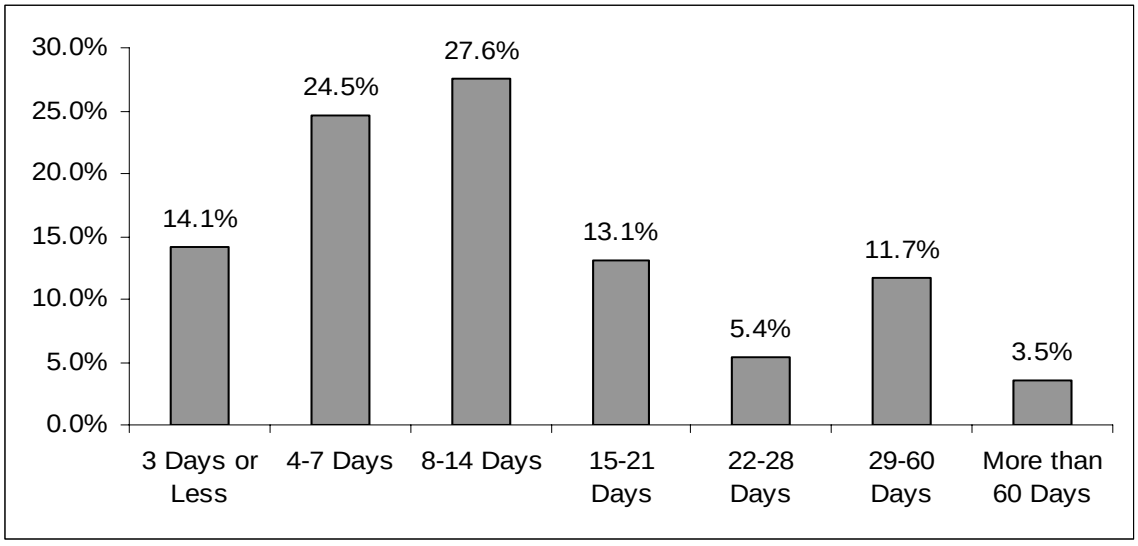
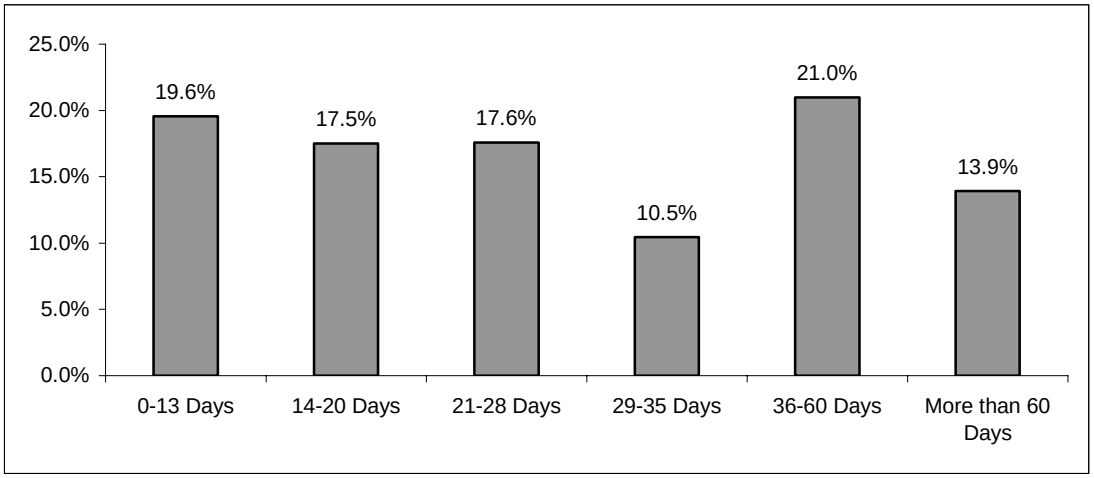


Figure 4.5 presents wait times for non-urgent patients. These wait times are substantially longer than for early arthritis patients. The mean wait time for a non-urgent patient is 37 days. Almost half of rheumatologists reported that their non-urgent patients wait more than four weeks to be seen.

Figure 4.5
Wait Time to First Appoint for Non-Urgent Patients



For comparison purposes Table 4.13 below compares these wait times to mean wait times for non-surgical internal medicine generalists and subspecialists. Although wait times for internal medicine physicians increased between 1999 and 2001. The wait time for early arthritis patients is similar to the mean wait time for all new patients and the mean wait time for non-urgent patients substantially exceeds the wait times reported for internal medicine overall.

Table 4.13
Mean Wait Times for New Patients

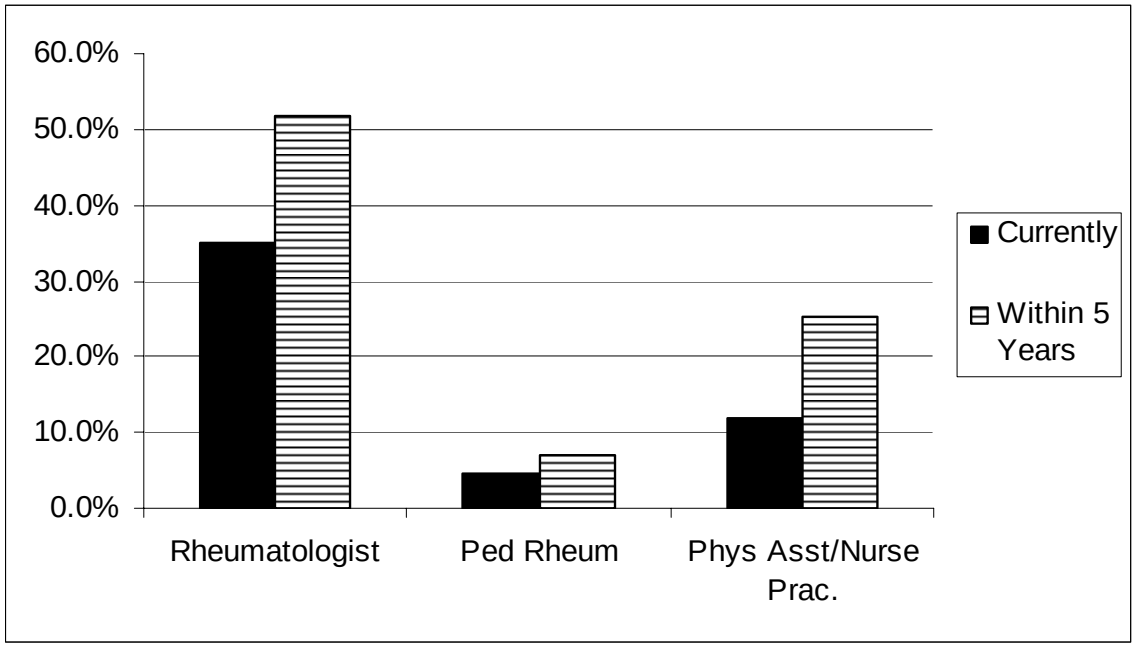
Specialty	1999	2001
Overall Internal Medicine	12.0	18.0
General Internal Medicine	12.4	18.3
Cardiovascular Disease	11.8	17.2
Gastroenterology	12.1	18.3
Other	9.1	16.0

*AMA Physician Socioeconomic Statistics, 2000-2002 and 2003.

Our final indicator of demand for rheumatology services is the percentage of surveyed physicians whose practices are currently seeking to hire or plan to hire in the next five years, a rheumatologists, a pediatric rheumatologist, or a physician's assistance or nurse practitioner. Over 30 percent of rheumatologists are in practices currently hiring and over 50 percent are in practices planning to hire in the next five years.[15]

[15] In the Appendix, we present a model predicting rheumatologist income based on visit counts, practice characteristics and personal characteristics of the rheumatologist. We include in this model an indicator for whether the rheumatologist's practice plans to hire one of the professionals listed in Figure 4.11. This indicator showed that rheumatologists in practices that are currently hiring have about $10,000 more income annually than those in practices that are not currently hiring holding the number of visits provided by the rheumatologist constant. This is an indication that excess demand in these locations may be resulting in higher rheumatologist income.

Figure 4.6
Percentage of Rheumatologists Whose Practice Plans to Hire



In summary, the substantial increases in compensation for rheumatologists that occurred between 1998 and 2002 and the high percentage of practices hiring or planning to hire indicates strong demand for rheumatology services. That almost half of rheumatologists report limiting access based on referral and almost half report wait times for non-urgent patients exceeding four weeks suggests that there is considerable excess demand for rheumatology services. That is, the current supply of rheumatologist visits is not equal to the demand for those visits such that rheumatologists are limiting access through requiring referrals or having long wait times for appointment.

In the next section, we present scenarios for supply and demand for rheumatologist services over the next 20 years. In these scenarios, we assume that supply and demand are currently equal. If demand currently exceeds supply as suggest in this section then the estimates of excess demand in the next section are conservative.

5. PROJECTIONS OF THE SUPPLY OF AND DEMAND FOR RHEUMATOLOGISTS

In this section, we use the Rheumatologist Workforce Model to project the supply of and demand for rheumatologists under several sets of assumptions, or "scenarios". The projections are designed to accomplish three things. First, they are intended to provide concrete examples of what the Workforce Model can do. Second, they are intended to provide some insight into the factors that are likely to have important effects on future demand and supply, as well as factors that may be less important. That is, they are intended to provide a "sensitivity" analysis of factors affecting the future workforce market environment. Third, we intend that the projections provide a realistic assessment of the current and future market demand and supply for rheumatologists over the next twenty years.

We recognize that (at least) two major factors affect the forecast accuracy of projections. The model must be able to reflect, accurately, the effect on demand and/or supply of anticipated changes in the health care marketplace. That is, the model must be able to reflect the effects of changes in growth in insurance coverage and household incomes; the effects of an aging population on demand; and so forth. Second, the "scenarios" considered must capture the future path of variables or factors affecting demand and supply. That is, we must correctly anticipate the changes in insurance coverage and income growth, changes in "competing" providers and disease incidence, and so forth.

The second aspect of forecast accuracy is as much a matter of judgment and, to an extent, serendipity, as it is of science. We draw on an eclectic source of information and judgment, including our advisory Group members and our own judgment, in formulating some of the scenarios. The first aspect of forecast accuracy depends on the richness of the available data and the appropriateness of methods for applying it to capture the relationship between demand and/or supply and factors. It also rests on the assumption that relations measured in the past will be preserved in the future—that is, the measured effects are stable over time. As noted previously, the data available for estimating the effects of factors affecting demand for smaller physician specialties is often less than desired.

5.1 Baseline Case

In the Baseline Case presented in this section, we incorporate the conditions which, we believe, represent the best overall assessment of current and projected future supply and demand for rheumatologists and present these estimates of supply and demand. Then, in the next section, we discussed alternative scenarios and test the sensitivity of the Baseline estimates to changes in the model parameters.

Our Baseline Case projection makes the following assumptions:

Overall

- Supply and demand for rheumatologist services are approximately in equilibrium in 2005. This is a conservative assumption. In Section 4.2.4 and 4.2.5 above, we discussed the rapid recent increase in rheumatologist income, long wait times for rheumatologist appointments, and large share of rheumatologist practices planning to hire which all suggest excess demand.

Supply-Side

- Fellowship Positions - The number of fellowship positions will remain at the 2004-2005 level throughout the projection period, both for adult (378) and pediatric (56) rheumatologists. The fill-rate for pediatric rheumatology fellowships was fairly constant from 2000-2001 through 2004-2005. We assume the fill-rate for the projection period will be the average of the fill-rates observed in this 5-year period (51%). The fill-rate for adult rheumatology fellowships increased from an average of 78% between 2000-2001 through 2002-2003 to an average of 90% between 2003-2004 and 2004-2005. We assume the higher average fill-rate of the 2003-2004 and 2004-2005 periods will continue in the projection period.
- International Medical School Graduates - International medical school graduates will account for 35% and 29% of adult and pediatric rheumatology fellows and 80% of international medical school graduates (IMGs) will practice in the United States after completing their fellowship.
- Share of Females in the Workforce – The share of female fellows will remain at the 2004-2005 level with 49% and 69% of new adult and pediatric rheumatologists, respectively, being female.
- Hours Worked – Male and female rheumatologists will continue to provide the same average number of visits per month as they do currently (based on the rheumatologists survey). That is, male and female rheumatologists will on average produce 3,758 and 2,800 visits per year, respectively.

Demand-Side

- US population will grow by age group at rates projected by the U.S. Census Bureau.
- Per capita personal real income will grow 1% annually. This estimate is in-line with the real per capita income growth that has been observed over the last 5 years and over the last 20 years. The average annual increase over the 20 years from 1985 to 2005 was 1.4%. Growth over the last five years has been somewhat slower at 0.8%.
- Rate of uninsured will remain constant. This is also a conservative assumption, because the aging of the population will bring a greater share of the population into the Medicare program.

5.1.1 Adult Rheumatologists

Figure 5.1 shows the Baseline case for adult rheumatologists. On the graph, the projected supply, indicated by squares is compared to projected demand, indicated by diamonds, under the particular assumptions listed above. Female rheumatologists and older rheumatologists conduct fewer visits annually than their middle age male counterparts. To adjust for the increasing share of women and older rheumatologists in the workforce we normalize the supply of rheumatologists relative to the mean number of visits produced by the average rheumatologists in 2005. The dotted line indicated with triangles is the actual number of rheumatologists estimated to be in the workforce. The line with squares is the adjusted effective supply, after accounting for a change in visits per rheumatologist due to changes in the demographic composition of the workforce.

Figure 5.1
Base Case: Adult Rheumatologists, 2005-2025

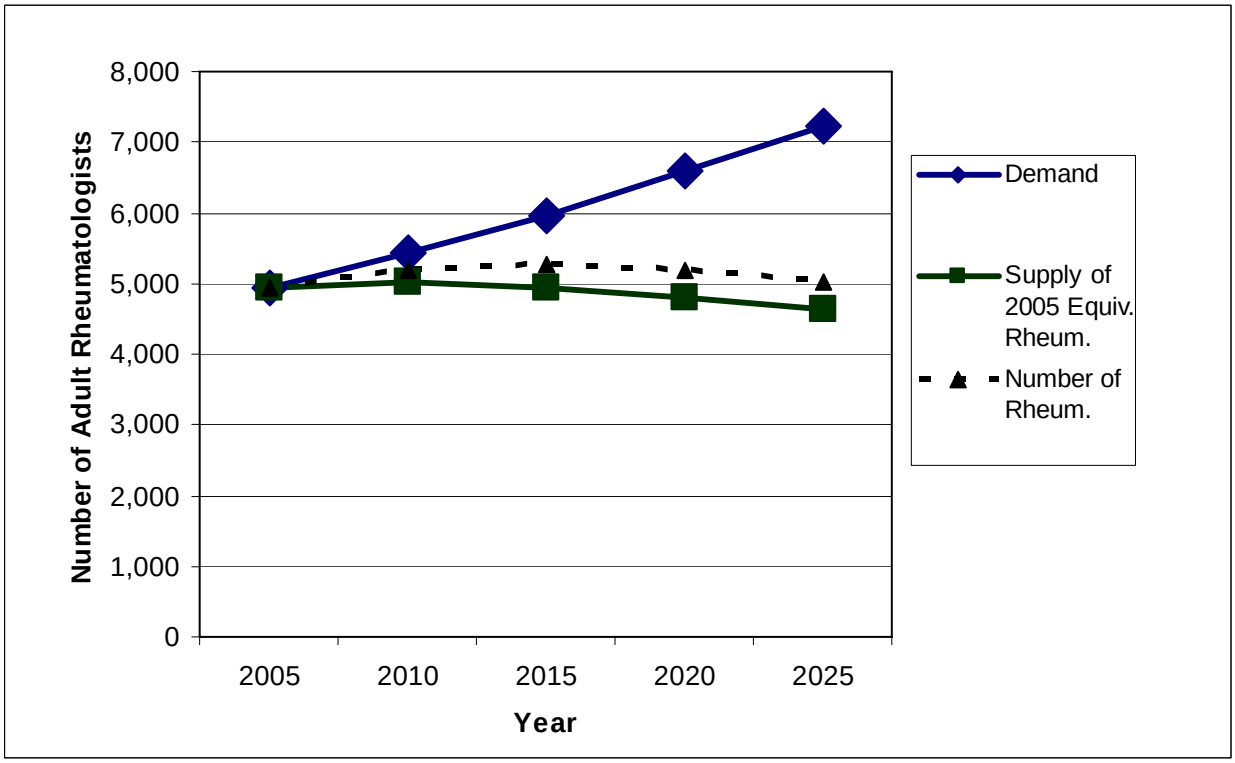


Table 5.1
Excess Demand for Adult Rheumatologists, 2005-2025

	2005	2010	2015	2020	2025
Demand	4,946	5,422	5,968	6,584	7,219
Supply of 2005 Equiv. Rheum.	4,946	5,019	4,940	4,806	4,643
Difference	0	403	1,029	1,778	2,576
Number of Rheum.	4,946	5,198	5,258	5,178	5,008

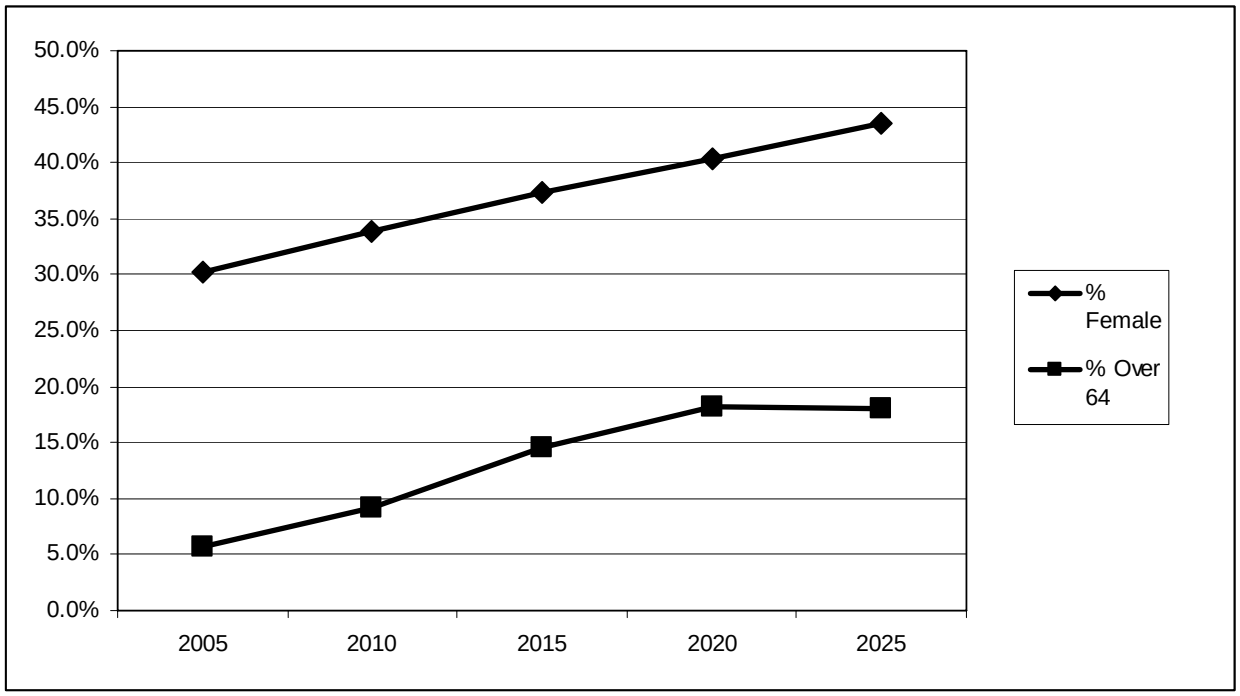
The figure indicates excess demand of about 1,000 rheumatologists by 2015 and about 2,600 rheumatologists by 2025. We will discuss the trends underlying the supply and demand sides of these estimates in turn.

Supply is affected by three main factors. First, the assumptions surrounding fellowships and international medical school graduates imply that about 150 new adult rheumatologists will enter the US workforce each year for the next 20 years. The new entrants are offset by the second

factor, the number of retirements.[16] The number of retirements is less than the number of new entrants until 2016 when the supply of rheumatologists begins to decline. The decline in the supply of rheumatologists is related to retirement of the large cohort of rheumatologists who were between 45 and 59 years of age in 2005. In 2005 there were 50 practicing rheumatologists who reached the age of 65. In the year 2012, we estimate their will be approximately 112. A large share of these individuals will remain active in the labor force through age 74. Data from the Census Bureau indicates that about 67 percent of men and 44 percent of women professionals will remain active in the labor force between the ages of 65 and 69. This share drops only slightly to 58 and 41 percent of men and women, respectively between the ages of 70 and 74. Our model assumes all rheumatologists retire completely from the labor force by the age of 75.

The final supply factor as discussed above is the anticipated decline in the number of visits conducted annually by the average rheumatologists. This results from a higher share of female rheumatologists and rheumatologists over the age of 64. Figure 5.2 displays the increase in the share of female and rheumatologists over the age of 64 between 2005 and 2025. In 2005, 30 percent of the workforce is female and about 6 percent are over age 64. These shares climb to 44 and 18 percent by 2025.

Figure 5.2
Share of Female Rheumatologists and Rheumatologists Over Age 64



[16] Also affecting supply is mortality. However, mortality effects on supply are a second order effect.

Table 5.2
Share of Female Rheumatologists and Rheumatologists Over Age 64

	2005	2010	2015	2020	2025
% Female	30.2%	33.8%	37.3%	40.4%	43.6%
% Over 64	5.6%	9.2%	14.6%	18.2%	18.0%

Our model indicates a slight decline in the supply of rheumatologists. However, it indicates dramatic increases in demand for rheumatologists. These increases stem from two factors.

- Increases in the overall population size and in the share of the population over age 65; and
- Increases in personal income per capita which enable consumers to purchase a greater level of health care services.

Forty percent of the observed increase in demand is related to growth in the US population holding constant the age distribution of the population. Eleven percent of the increase is related to increases in the share of the population over age 64 and the remaining forty-nine percent is related to per capita income growth.

5.1.2 Pediatric Rheumatologists

Figure 5.3 shows the Base Case for pediatric rheumatologists. On the graph, the projected supply, indicated by squares is compared to projected demand, indicated by diamonds, under the particular assumptions listed above. Female rheumatologists and older rheumatologists conduct fewer visits annually than their middle age male counterparts. To adjust for the increasing share of women and older rheumatologists in the workforce we normalize the supply of rheumatologists relative to the mean number of visits produced by the average pediatric rheumatologists in 2005. The dotted line is the actual number of rheumatologists estimated to be in the workforce. The line indicated by the squares is the effective number of pediatric rheumatologists, after adjusting for the effect that changes in the demographic composition of supply will have on visits.

Figure 5.3
Base Case: Pediatric Rheumatologists

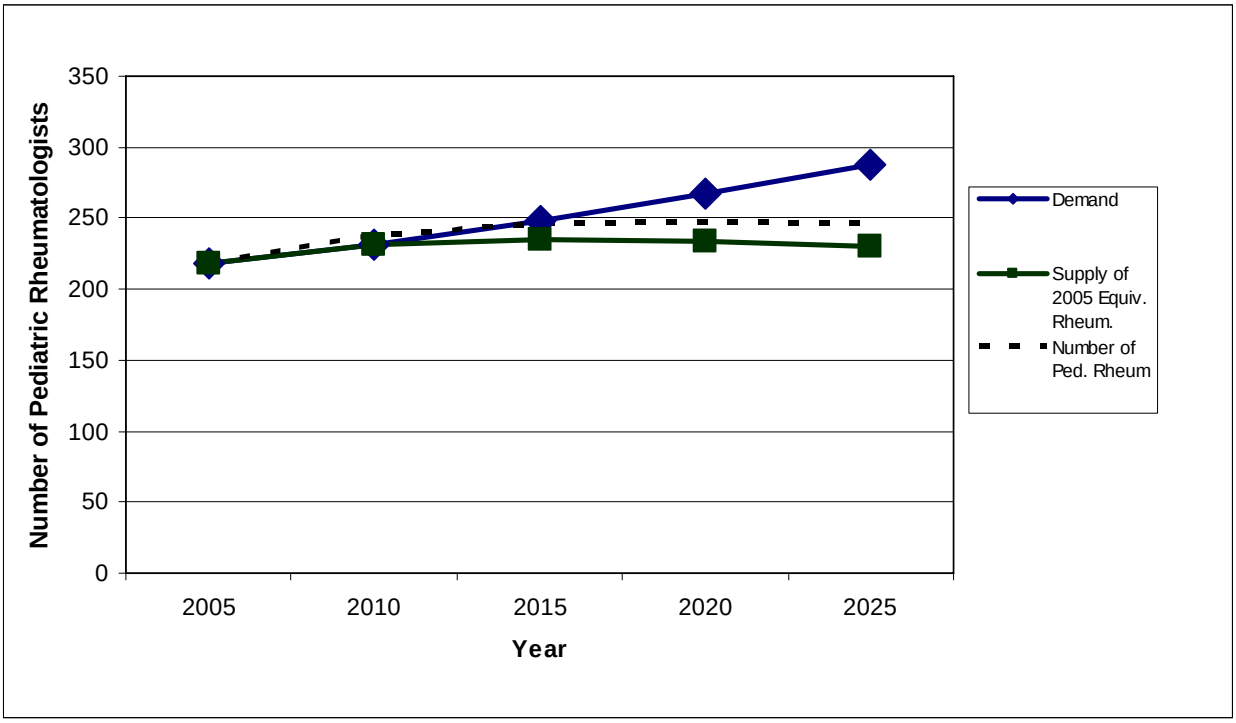


Table 5.3
Excess Demand for Pediatric Rheumatologists, 2005-2025

	2005	2010	2015	2020	2025
Demand	218	231	248	267	287
Supply of 2005 Equiv. Rheum.	218	238	247	252	254
Difference	0	-7	1	15	33
Number of Rheum.	218	244	258	266	271

The figure indicates excess demand of about 33 pediatric rheumatologists by 2025. We will discuss the trends underlying the supply and demand sides of these estimates in turn.

Supply is affected by three main factors. First, the assumptions surrounding fellowships and international medical school graduates imply that about 9 new pediatric rheumatologists will enter the US workforce each year for the next 20 years. The new entrants are offset by the second factor, the number of retirements. The number of retirements is projected to be less than the number of new entrants throughout the projection period. The final supply factor as discussed above is the anticipated decline in the number of visits conducted annually by the average rheumatologists. This results from a higher share of female rheumatologists and rheumatologists over the age of 64. Figure 5.4 displays the increase in the share of female and rheumatologists

over the age of 64 between 2005 and 2025. In 2005, 52 percent of the workforce is female and about 4 percent are over age 64. These shares climb to 62 and 16 percent by 2025.

Figure 5.4
Share of Female Rheumatologists and Rheumatologists Over Age 64

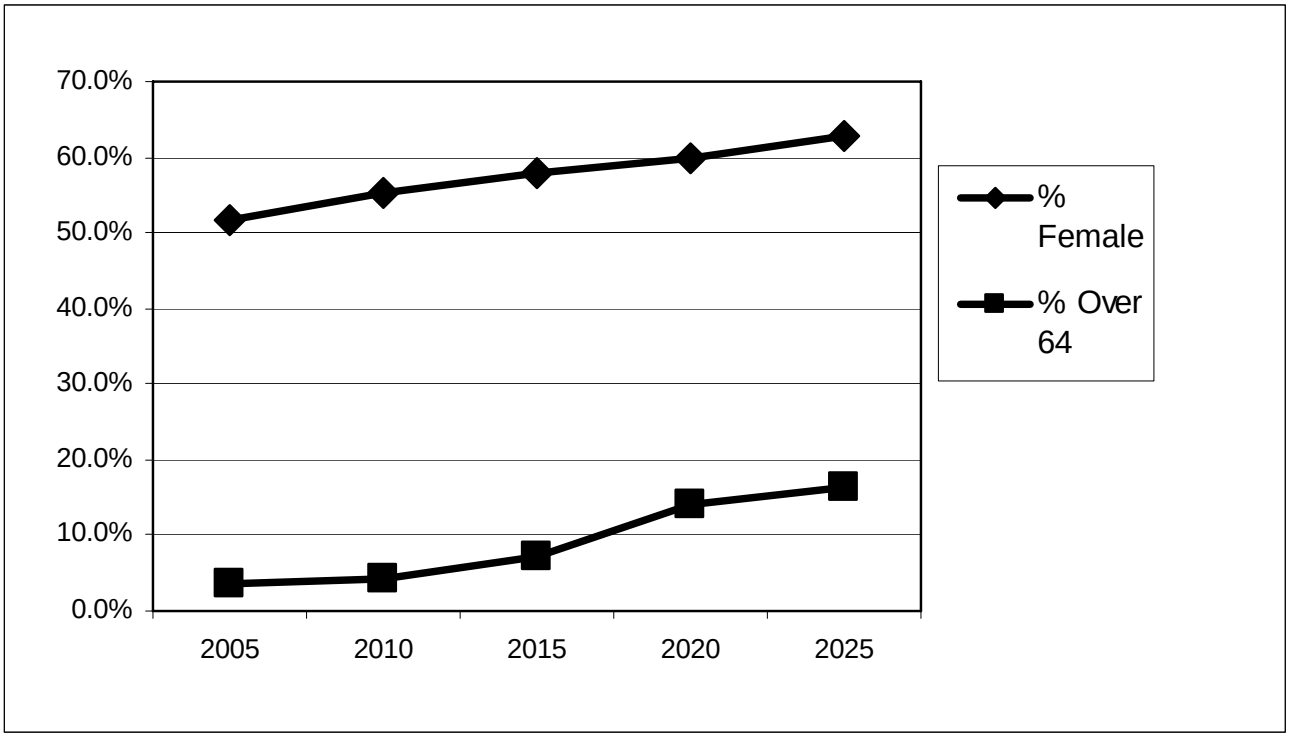


Table 5.4
Share of Female Rheumatologists and Rheumatologists Over Age 64

	2005	2010	2015	2020	2025
% Female	51.6%	55.2%	57.9%	59.7%	62.7%
% Over 64	3.7%	4.4%	7.2%	14.1%	16.3%

Our model indicates supply and demand for pediatric rheumatologist will run in parallel over the next 20 years. The projected increases in demand stem from two factors.

- Increases in the overall population size; and
- Increases in real personal income per capita which enable consumer to purchase a greater level of health care services.

Thirty-nine percent of the observed increase in demand is related to growth in the US population under age 18. The remaining sixty-one percent is related to per capita income growth.

5.2 Alternative Scenarios

In the baseline scenarios in Section 5.1, we assumed there would be no change in the percentage of the population that is uninsured over the next 20 years. We also assumed the level of per capita personal income growth that would be observed over the next twenty years would be 1% annually. In this section, we discuss how declines in the number of uninsured individuals and higher rates of per capita real personal income growth would affect demand.

5.2.1 Declines in the Uninsured Population

The result for the impact of the uninsured population on demand for pediatric rheumatologist was counterintuitive and may result from concentrations of pediatric rheumatologists in large urban areas and at academic medical centers. Therefore, we will only discuss the impact of a change in the share of the population that is uninsured for adult rheumatologists. Specifically, we assess the impact of a 3 percent annual reduction in the percentage of the population that is uninsured. This implies a decline from 15.3 percent uninsured in 2005 to 8.3 percent uninsured in 2025. Figure 5.5 displays the results of this scenario in contrast to the baseline case.

Figure 5.5
Change in Demand
Resulting from 3% Annual Reduction in Percent Uninsured

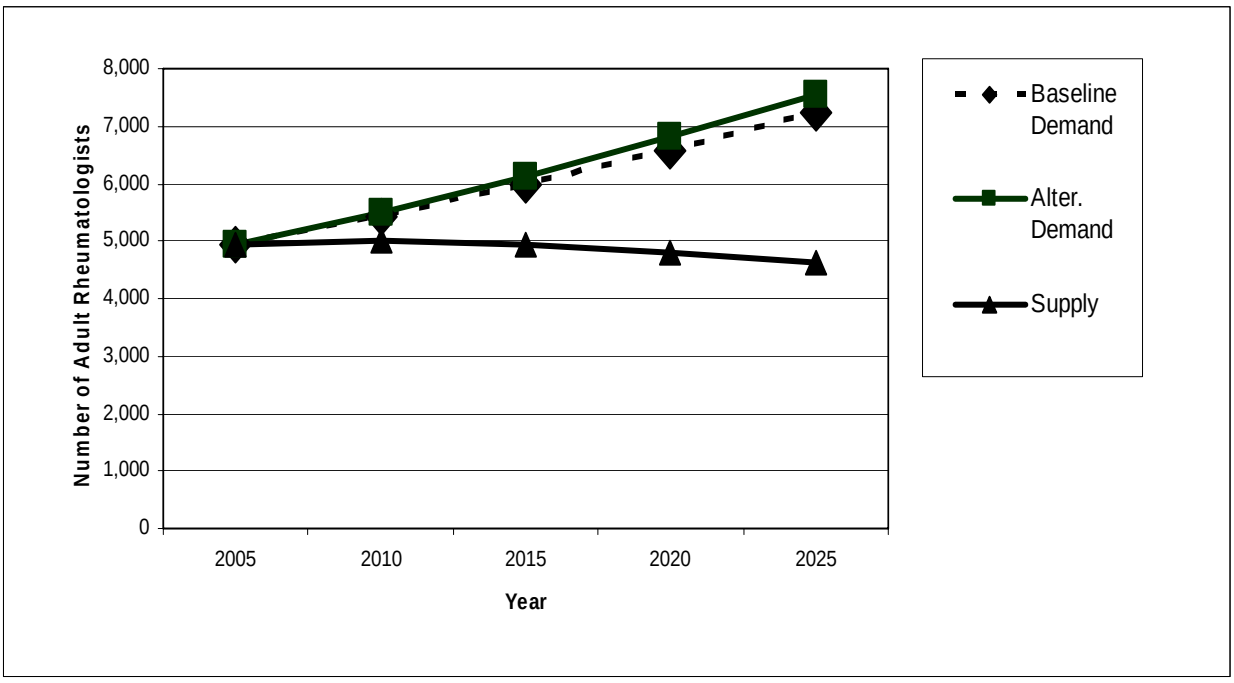


Table 5.5
Change in Demand
Resulting from 3% Annual Reduction in Percent Uninsured

	2005	2010	2015	2020	2025
Baseline Demand	4,946	5,422	5,968	6,584	7,219
Alter. Demand	4,946	5,487	6,112	6,819	7,563
Supply	4,946	5,019	4,940	4,806	4,643

This very substantial reduction in the uninsured population results in only a modest increase of 344 or 4.8 percent more rheumatologists demanded.

5.2.2 Increased Per Capita Personal Income Growth

Our baseline scenario assumes per capita real personal income will grow 1% annually. This estimate is in-line with the average over the last five year and the last 20 years. However, between 1995 and 2000, real per capita income growth annually was almost three percent. In this section, we assess how increasing the assumed income growth rate from 1 to 3 percent would affect estimated demand. We look at demand for adult and pediatric rheumatologists in turn.

Figure 5.6 displays the change in estimated demand from increasing per capita personal income growth to 3 percent annually in the adult rheumatologist model.

Figure 5.6
Change in Demand
Related to Increased Per Capita Income Growth
Adult Rheumatologists

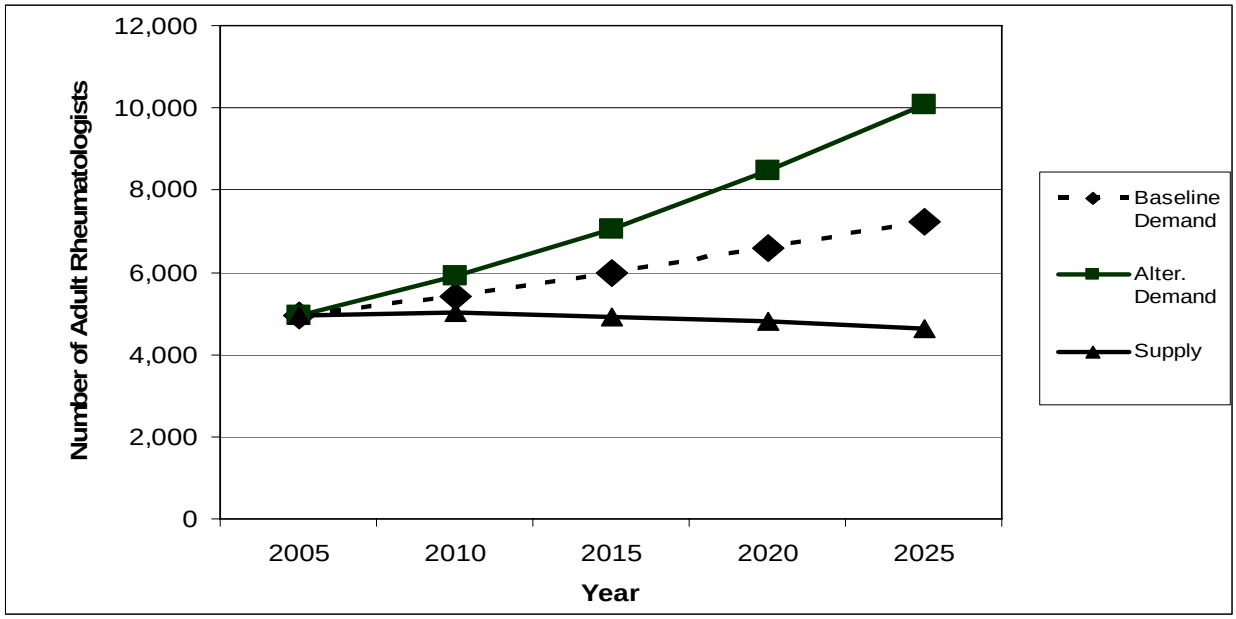


Table 5.6
Change in Demand
Related to Increased Per Capita Income Growth
Adult Rheumatologists

	2005	2010	2015	2020	2025
Baseline Demand	4,946	5,422	5,968	6,584	7,219
Alter. Demand	4,946	5,899	7,058	8,460	10,081
Supply	4,946	5,019	4,940	4,806	4,643

Increasing the projected income growth rate to 3 percent results in a very substantial increase in the demand of an additional 2,862 or 40 percent more rheumatologists demanded.

Figure 5.7 displays the change in estimated demand from increasing per capita personal income growth to 3 percent annually in the pediatric rheumatologist model.

Figure 5.7
Change in Demand
Related to Increased Per Capita Income Growth
Pediatric Rheumatologists

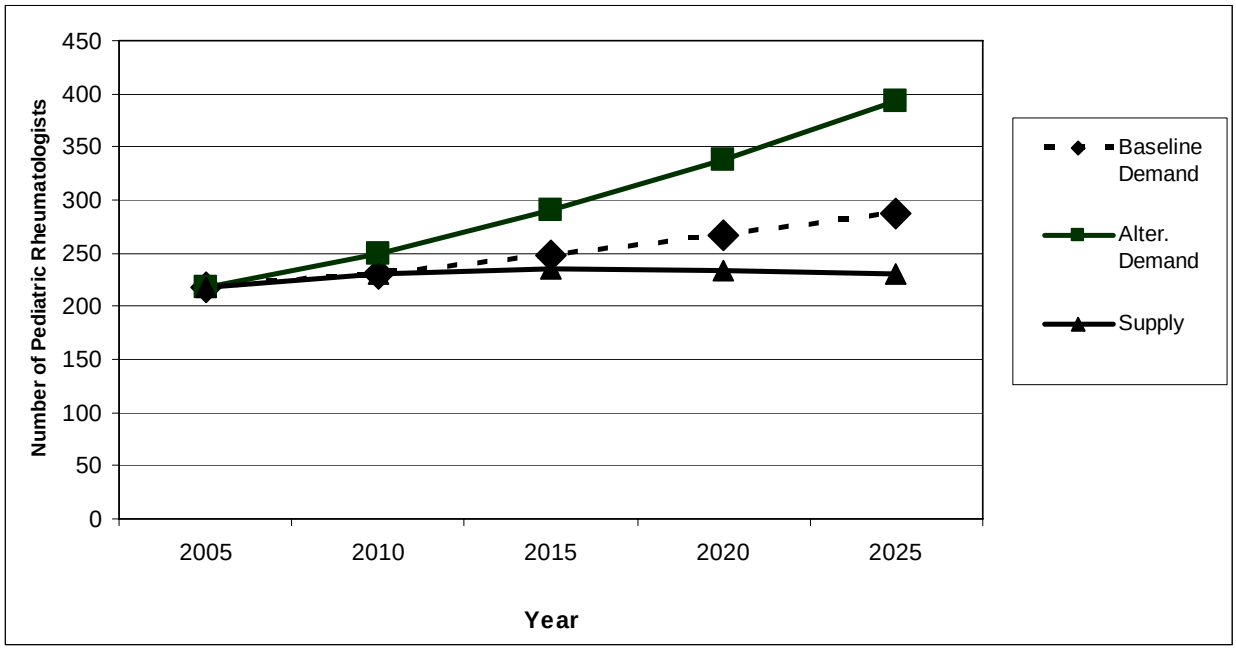


Table 5.7
Change in Demand
Related to Increased Per Capita Income Growth
Pediatric Rheumatologists

	2005	2010	2015	2020	2025
Baseline Demand	218	231	248	267	287
Alter. Demand	218	250	291	338	394
Supply	218	238	247	252	254

Increasing the projected income growth rate to 3 percent results in a very substantial increase in the demand of an additional 107 or 37 percent more pediatric rheumatologists demanded.

5.3 Methods for Addressing Excess Demand

In this section, we discuss four potential approaches the rheumatology community might take to address the projected excess demand for rheumatologist services. These are:

- Increase fellowship positions and fill rates;
- Use allied health professionals to substitute for rheumatologists where possible;
- Improve practice efficiency through methods such as patient screening and improved scheduling; and
- Advocate for reimbursement methods and reimbursement rates that encourage efficient practice.

We discuss the potential of each of these methods for increasing the effective supply of rheumatologists in this section.

Addressing excess demand for rheumatology services through increased production of rheumatologist alone would require substantial increases to the number of rheumatology fellows. It may be difficult to increase fellowship positions this dramatically. Therefore, it is likely that some combination of this approach and the other approaches which target practice efficiency will be required.

In Section 2.5, we discuss research related to improving practice efficiency in the rheumatology community. Data from the rheumatologist survey suggests that some rheumatologists have made their practices more efficient by screening patients and using allied health personal, however the survey suggests that substantial room for improvement exists.

Several authors have suggested that using advance practice nurses or physicians assistants for patients with chronic conditions and those requiring more education, coping skills, and monitoring can provide better patient outcomes and more efficiently target rheumatologists' time (Newman et al., 2004 and Bodenheimer, 2002). Data from the survey indicates that only about one-quarter of rheumatologists are in a practice with a nurse practitioner or physician's assistant.

Thus, there appears to be substantial room for increasing the roll of these professionals in rheumatology.

Rheumatologists have implemented strategies to improve health care delivery in their practices. Above in Section 2.5, we noted that in the article "Pre-Appointment Management of New Patient Referrals in Rheumatology: A Key Strategy for Improving Health Care Delivery," doctors Harrington and Walsh discuss implementation of a screening process for newly referred patients. Rather than giving each referred patient the next time slot available, each case was reviewed by a rheumatologist before an appointment was provided. This reduced the number of new patients needing to be seen by 40%. This type of screening could dramatically reduce demand for rheumatologists. Since 52% of rheumatologists do not currently require any type of patient referral, there appears to be substantial room for reducing excess demand through this mechanism.

Insurer payment policies are an important factor in determining what services will be provided by medical professionals. While rheumatologists are concerned about providing efficacious treatment for their patients and running efficient practices, they must run profitable practices to stay in business. All of the strategies discussed above for targeting excess demand for rheumatology services require conducive reimbursement policies. The rheumatology community will need to advocate for reimbursement methods and rates that will provide sufficient incentives for these strategies to succeed.

6. DISCUSSION

The analysis presented here indicates a growing excess demand for the services of adult rheumatologists. There are several factors at work producing this excess. First, the population is both growing and aging. Because the prevalence rate of musculoskeletal conditions tends to be higher for older members of the population, the demand for rheumatologists grows by more than simply the growth in the aggregate population. Second, demand increases with per capita income growth. A modest assumption of a 1% rate of growth in income has a dramatic effect on demand. Third, a large number of rheumatologists are baby boomers themselves. Those physicians, currently 50-59 years of age, will have left the workforce or will have greatly reduced hours of work, over the next fifteen years. At the same time, there is evidence that those who replace them may work fewer hours, on average.

For pediatric rheumatologists, the same factors are generally at work. However, the effects of the aging population have less of an effect on excess demand. This is so for the obvious reason that their patients are children, not the elderly. But, also, the pediatric workforce is on average younger than the adult rheumatology workforce. Hence, the decline in supply due to retirements occurs somewhat less rapidly.

These baseline estimates assume a real per capita income growth of 1% per year. This is in-line with real per capita growth over the most recent 20 years. However, we demonstrated that increases in income growth above this level have a substantial impact on demand. If growth were 3 percent per year, the level of excess demand for adult and pediatric rheumatologists increases by almost 40 percent. .

There will be adjustments related to the excess demand on the supply side. Higher earnings in the profession will increase the demand for fellowship positions. If fellowship positions are expanded, they are likely to be filled. In addition, higher earnings may encourage some physicians to delay retirement and others to expand clinical hours. Both of these factors will work to reduce excess demand by expanding supply.

In addition, excess demand is likely to encourage introduction of practice efficiencies. Because a physician's time will become more valuable, methods for screening patients are likely to be adopted by rheumatology practices. In addition, advanced practice nurses and physicians assistants are likely to become more common in rheumatology practices. Both of these measures will expand the effective supply of rheumatology services, reducing excess demand.

While these market factors are likely to mitigate the level of excess demand observed over the next 20 years, the level of excess predicted in these models suggests that proactive interventions on the part of the rheumatology community are warranted. These interventions might include:

- expanding the number of fellowship positions and providing information to medical school graduates about the future of rheumatology;
- disseminating information about practice efficiency methods and providing support to rheumatologists undertaking practice efficiency improvement;
- disseminating information on best practices including information on optimal lengths of follow-ups, use of information technology to encourage appropriate follow-up and optimal use of nurse practitioners and physicians assistants to assist with chronic care patients;
- expanding training programs for nurse practitioners and physicians assistants who are interested in rheumatology; and
- advocating for reimbursement policies that encourage practice efficiency and the use of allied health personnel as appropriate.

While excess demand for rheumatologist may result in higher incomes for rheumatologists over the next 20 years, proactively taking steps to practice more efficiently, improve quality of care, and to adequately staff practices for the number of patients to be seen is likely to be essential to maintaining high levels of job satisfaction in the rheumatology community and to providing the best quality of care for patients.

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Appendix: Income Regression Model

APPENDIX: INCOME REGRESSION MODEL

This section describes the results of the income model developed by the Lewin Group as part of this workforce study. The data for the income model come from a survey of rheumatologists conducted by The Lewin Group for ACR in late 2005 and early 2006. The survey included a random sample of rheumatologists supplemented by oversamples of pediatric, rural, academic, and young (under age 40) rheumatologists. There were over 600 respondents to the survey. The survey response rate was 37 percent. The results of this survey provided information on:

- Annual income from the practice of rheumatology;
- Number of initial and follow-up visits provided per month;
- Current efforts to hire adult or pediatric rheumatologists or nurse practitioners or physicians' assistants;
- Primary employment setting;
- Marital status/children/gender;
- Availability of office technologies; and
- Region of country

Ordinary least squares regression was used to predict annual income based on the other variables listed above. The purpose of this model was to determine the importance of these factors as predictors of rheumatologist income. Table A.1 displays the regression results.

Table A.1: Income Regression Results (Adjusted R-Square = .364)

Independent Variable	Change in Annual Income ($1000s)
Visits per Year (1000s)	
Initial	$23.6*
Follow-up	$18.8*
Primary Employment Setting (Relative to Group Practice)	Employ effects are relative to this group.
Solo Practice	$2.1
Partnership Practice	-$3.3
Government	-$25.4
Medical School	-26.4*
Industry	$18.2
Hospital	$33.4*
Age Category (Relative to 40-49)	Age effects are relative to this group.
< 40 Years Old	-$1.1
50-59 Years Old	$39.8*
Over 60 Years Old	$9.6
Family Characteristics (Relative to Single Female)	Family effects are relative to this group.
Male	$35.3
Married Male	$34.1*
Male with Children Less Than 6	-$27.3*
Male with Children 6-18	$30.0*
Married Female	$22.6
Female with Children Less Than 6	-$4.0
Female with Children 6-18	$5.3
Practice Has Control of:	
Infusion Technology	$6.6
Ultrasound	-$17.9*
Densitometry	$17.0*
MRI-Hand/Foot	$10.6
X-Ray	$21.7*
Lab	$6.1
Non-US Medical School Graduate	-$6.1
Board Cert. or Fellow Trained Pediatric Rheumatology	-$5.1
Hiring Rheumatologist or NP/PA	$9.6

* Significantly different from zero at 85% confidence level.