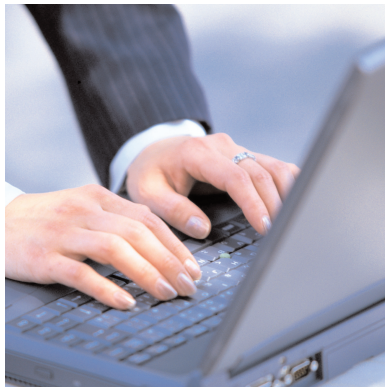




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The Economic Contributions

of the Health Care Industry to the New England Region



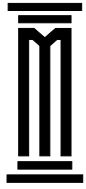
Ross DeVol and Rob Koepf

with Perry Wong and
Armen Bedroussian

February 2003



New England Healthcare Institute



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The Economic Contributions of Health Care to New England

Prepared For: **New England Healthcare Institute**

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February 2003

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Acknowledgements

About MI: The Milken Institute is an independent economic think tank whose mission is to improve the lives and economic conditions of diverse populations in the U.S. and around the world by helping business and public policy leaders identify and implement innovative ideas for creating broad-based prosperity. We put research to work with the goal of revitalizing regions and finding new ways to generate capital for people with original ideas.

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About NEHI: Founded in 2002, the New England Healthcare Institute (NEHI) is a regional, applied research health policy institute focused on enabling innovation in health care. NEHI is dedicated to identifying, analyzing and solving critical health care issues facing the people of New England. NEHI represents all sectors of the health care industry including members of the biotechnology, medical device, hospital, physician, researcher, employer and insurer communities.

Our vision is to improve the health and health care of all people in New England. Our mission is two fold: first, to find workable solutions to the most critical health care issues; and second, to drive change within the public and private sectors.

Established as a 501(c)3 non-profit organization, NEHI is funded through grants, membership dues and donations.

The Milken Institute would like to thank the entire NEHI team including Wendy Everett, President; Valerie Fleishman, Vice President; David Fleming, Special Advisor to NEHI, Genzyme Corporation; and Joe Alviani, Senior Advisor to NEHI, Alviani and Associates. The Milken Institute and NEHI would also like to thank Janice Bourque, Massachusetts Biotechnology Council; Mitch Adams, Tom Hubbard, and Bob Kispert, Massachusetts Technology Collaborative; and Tom Sommer, Massachusetts Medical Device Industry Council. We also appreciate the forum session that NEHI organized of key stakeholders in New England health care and the insightful feedback and advice that was shared. The research and production of this report was truly a collaborative effort.

The authors are grateful to Judith Gordon for her editing which greatly improved the quality of this report. Lastly, we thank Sallylynn James' outstanding design work.



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The Economic Contributions of Health Care to New England



1. Executive Summary

Introduction

For the past few decades, the health care sector has been among the fastest growing sectors of the U.S. economy. The industry ranges from health services, such as health practitioners and hospitals, drugs and pharmaceuticals, medical instruments and supplies, medical service and health insurance to research and testing services where much of the burgeoning biotechnology sector is recorded. Nurturing expansion in health care is increasingly vital to global, national and regional economic prosperity. Population growth, due in part to dramatic advances in medical science, the aging of the baby boomer generation and increased wealth are stimulating demand and opportunities in health care fields.

Pharmaceutical and biotechnology companies have, through their discoveries, improved the quality of human life and extended the lifespan of many individuals. Scientific discovery, innovation and commercialization in the medical devices industry have greatly benefited the human race. Medical devices allow less expensive and more accurate tests for a wide array of diseases. In the foreseeable future, we could see a range of innovative means of improved drug delivery, ranging from ultrasound and electricity to micromachined implants. Wristwatches may be available for diabetics to monitor blood sugar levels and constantly deliver the appropriate dosage of insulin.

Health care consumption has doubled, from 7 percent of U.S. GDP in 1970, to slightly more than 14 percent in 2001. By 2011, health care consumption expenditures in the U.S. are projected to reach 17 percent of GDP according to the Centers for Medicare & Medicaid Services.

Perhaps the anticipated high returns on investment in health care will enhance the longevity and quality of life for future generations. Senior citizens, who will account for 30 percent of the population in 10 years, represent 15 percent of the population and purchase one-third of all prescription medications dispensed in the United States. Even more dramatic demographic aging patterns will occur in Japan and Western Europe. On a global basis, the over-65 population is expected to expand from 600 million in 2000 to over one billion by 2020, according to the World Health Organization.

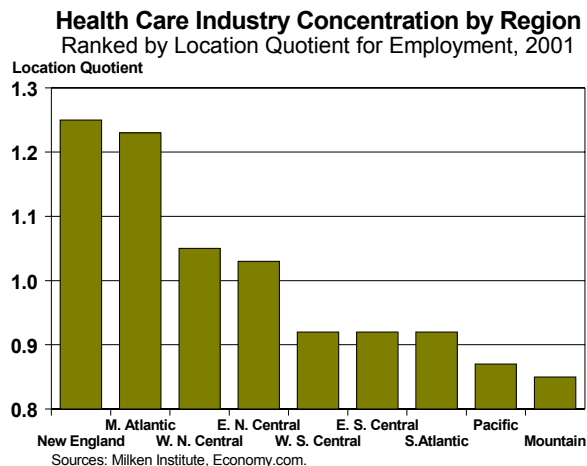
The major biotechnology, pharmaceuticals and medical device firms recognize the potential financial returns that these changing demographics imply and are making significant investments in research and development. Biotechnology and biomedicine may mean to the first half of the 21st century what electronics and computers meant to the latter half of the 20th century. We are likely to see a fusing of the information and biotechnology/biomedical industries into a powerful technological and global economic force. There is an important race underway—the one to determine which locations will be the dominant health care centers.



Health Care Concentration

New England and the Middle Atlantic states are the only regions in the U.S. to have a substantially higher than average proportion of health care industries contributing to their gross regional product. GRP is the total economic value of goods and services produced in a region. Health care directly comprises 7.5 percent of New England's GRP based on 2001 figures, leaving the region's GRP almost 10 percent more concentrated in health care than in the nation as a whole. This is even more impressive when you consider that health care services are largely consumed locally, with only specialized expertise exported as patients seek the highest quality medical care. And these figures, of course, understate the ultimate contribution to New England as its effects ripple throughout the rest of the regional economy.

New England is even more closely linked to the health care sector on the basis of employment. In 2001, more than 800,000 New England residents held jobs in the health care sector. This not only makes health care one of the leading employers in New England but it means the region has the highest concentration of health care employment in the nation. More than 11 percent of New England's workforce is directly engaged in the health care fields. As displayed in the accompanying chart, New England's health care employment is 25 percent higher than the national average. If the concentration of health care employment in a region matched the nation as a whole, its location quotient would be 1.0. A location quotient of 1.25, as is the case for health care employment in New England, means that an industry is 25 percent more concentration than for the nation.



Massachusetts is the leading health care employer in New England with over 390,000 jobs in 2001. On the basis of employment concentration, Rhode Island ties Massachusetts for second place among all states as it is 29 percent more dependent than the nation as a whole on health care activities. Only Pennsylvania has a greater concentration of health care employment at 31 percent above the national average. All six New England states have an above average concentration in health care employment and more impressively,



five are in the top 10. Connecticut is the second highest employer in the region with over 190,000 jobs in 2001.

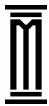
Massachusetts' top employment concentration rankings among all states are in medical instruments and supplies (4th), home health care services (5th), research and testing services, which includes biotechnology research (6th), hospitals (7th) and drugs (9th). Connecticut has impressive employment concentration rankings in many health care sectors as well. Connecticut ranks 3rd in both medical instruments and supplies and nursing and personal care facilities, 4th in both drugs and home health care services and 5th in both medical service and health insurance, and other health care practitioners.

Rhode Island ranks 2nd in health and allied services employment concentration, 4th in nursing and personal care facilities, 6th in hospitals, 7th in home health care services, and 9th in both osteopathic physicians and medical and dental labs. Maine ranks 4th in medical service and health insurance, 6th in nursing and personal care and in the top 10 in five other health care service categories. Vermont ranks 1st in health and allied services and 6th in home health care services. New Hampshire was in the top 10 in two categories.

The Milken Institute has created the Health Pole Index which depicts the local concentration of health care and a metro area's importance in the context of the nation as a whole. The Health Pole concept can be thought of as a measure of the spatial density and diversity of health care sectors in a metropolitan economy and placed in a national perspective. Using this Index, the Boston metro area is the leading health care center as displayed in the accompanying table. This report represents the first unveiling of health pole statistics in the nation.

Boston earns this 1st place distinction by ranking among the top 10 in most health care sectors. Nevertheless, Boston just edges out the New York metro area. New York was first in hospitals and in the top ten in several other categories. The Philadelphia metro places a strong 3rd in the Health Pole Index with lofty placements in drugs, medical services and health insurance, and hospitals. Chicago was 4th overall and first in medical services and health insurance and third in hospitals. Los Angeles was a distant 5th with strength in offices and clinics of medical doctors and dentists and medical laboratories.

Washington, Detroit, Nassau-Suffolk, NY, Newark and Minneapolis-St. Paul round out the top 10 Health Pole rankings. New Haven-Meriden was 16th with strength in medical instruments and drugs. A particularly striking finding was that only three metros in the Western U.S. (Los Angeles, Houston and San Diego) make the top 20. Equally noteworthy were the high rankings of the major health care centers of the Northeast corridor from Boston down to Washington, DC with not less than six among the top ten in the nation.



Top Twenty Metropolitan Areas by Health Pole

Total Health Care Employment, 2001

Rank	Metropolitan Area	Health Pole	Rank	Metropolitan Area	Health Pole
1	Boston MA-NH	100.00	11	Pittsburgh PA	36.26
2	New York NY	99.85	12	Baltimore MD	33.55
3	Philadelphia PA-NJ	97.53	13	St. Louis MO-IL	32.12
4	Chicago IL	92.20	14	Cleveland-Lorain-Elyria OH	31.23
5	Los Angeles-Long Beach CA	55.15	15	Houston TX	31.03
6	Washington DC-MD-VA-WV	48.18	16	New Haven-Meriden CT	31.00
7	Detroit MI	44.09	17	San Diego CA	24.85
8	Nassau-Suffolk NY	40.66	18	Rochester MN	23.46
9	Newark NJ	39.49	19	Tampa-St. Petersburg-Clearwater FL	23.46
10	Minneapolis-St.Paul MN-WI	36.29	20	Miami FL	22.74

Sources: Milken Institute, Economy.com.

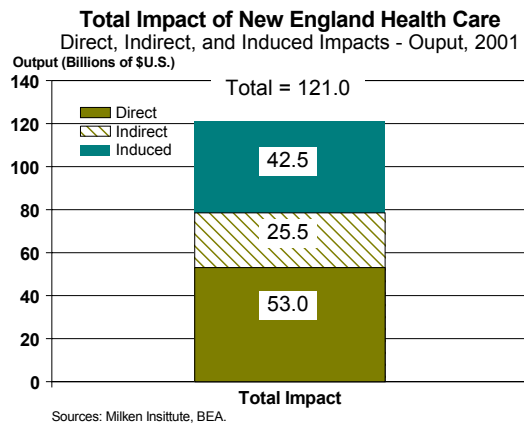
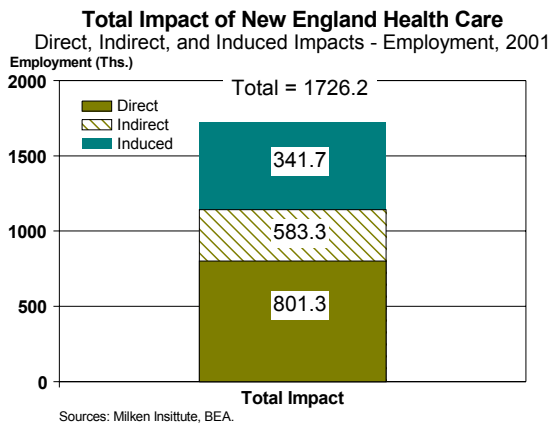
Multiplier Impact

To better understand the importance of the health care industry in New England, it is critical to analyze its impact on the overall economy. The income that the health care industry generates provides one of the major stimuli to the local economy by circulating, multiplying and generating much of the regional employment base in construction, transportation, utilities and communications, finance, insurance and real estate, wholesale and retail trade, services, and even state and local government. By using an input/output system, an estimate of the total impact or multiplier effect that health care has on New England’s economy can be provided. A multiplier, as the name implies, is a measure of the multiple effects produced by a given economic activity.

In addition to the **direct impact** of industry employment, wages and output, the health care industry impacts many supplier industries such as legal, financial and advertising services. The **indirect impact** represents the number of jobs, wages or amount of output generated from all supplier industries necessary to support employment and output in a given health care sector. The higher employment and wages in these supplier industries ripples throughout the local economy leading to higher purchases of goods and services, which, in turn, cause higher income available to be spent in the local economy, known as the **induced impact**.

In 2001, the health care industry in New England employed 801,300 workers, producing a gross regional product of \$53 billion. These figures represent the direct impact of the health care sector on the regional economy. When the full extent of multiplicative dynamics are accounted for by incorporating total impact multipliers, health care can be recognized as responsible for 1,726,200 jobs and \$121 billion worth of output throughout New England.

The additional 924,900 jobs and \$68 billion in these total impact figures stem from the indirect and induced impacts that health care brings to the rest of the economy. The indirect impact generates an additional 583,300 jobs and \$25.5 billion worth of output, while the induced effect adds another 341,700 jobs and \$42.5 billion worth of output. Together they contribute to the total impact that the health care sector brings to the region.



In the aggregate, the total health care employment multiplier in New England is 2.15. In other words, each job in New England’s health care sector produces an additional 1.15 jobs in other sectors. By the same token, since 11.4 percent of total employment in New England is health care employment, the industry ultimately accounts for nearly 25 percent of total employment in New England when including the multiplier effect (11.4 percent multiplied by 2.15).

Innovation Pipeline

New England has a rich innovation pipeline in health care sectors that is essential to sustaining long-term growth. Indeed, the research, development and innovation capacities will play an increasingly important role in determining which regions dominate the health care landscape in the future. Knowledge and discovery derived from basic medical and health research can lead to new innovations and be converted into economic value more effectively at the location of its development.

Leading states in the region are incredibly well positioned to capitalize on the promise of health care sector innovations. In areas such as funding, investment, concentration of bioscience specialists, knowledge resource pools, and rates of health-related commercialization, New England is asset rich in terms of its capacity to innovate and add value throughout the regional economy.

Averaged out on a per capita basis, no fewer than four states—Massachusetts, Connecticut, Vermont, and Rhode Island—score in the top ten of the nation for the monetary value of National Institutes of Health (NIH) awards received. First-ranked Massachusetts received almost 50 percent more in award value per capita than the next most highly ranked state, Maryland. Internationally renowned medical schools and research hospitals— among them the preeminent Harvard and Yale University medical schools and Massachusetts General Hospital—keep such funds, and human talent, flowing in and vitalizing the health science innovation capacity of New England. Combined, the region received \$2.3 billion in NIH awards in 2001.



Such dominance is exhibited in other types of funding support categories. For example, Massachusetts, the leading state in the region for most types of these investments, is also first in the nation for total funds in industrial scientific R&D and other areas more specific to the health care industry: venture capital dedicated to biotechnology and the medical device industry.

New England performs well in terms of funding to support academic-based research and development. Massachusetts, Connecticut and Vermont all rank in the top five states in terms of per capita spending on university-based R&D for the life sciences. Equally impressive, total health R&D funding for Massachusetts rose 77.4 percent between 1993 and 2000, second only to New Jersey.

Investment in the region's innovation pipeline refers to money that is funneled to organizations, typically for-profit enterprises, that supply health care products and services. Boston, one of the nation's premier centers for venture capital investment, witnessed a nearly three-fold growth in its levels of annual biopharmaceutical VC investment for the years 1995-2000. Even Rhode Island attracts more VC funding than such established biopharma states such as New Jersey and Maryland on a per capita basis. Massachusetts' VC investment in medical devices on a per capita basis is also the highest in the nation, and Rhode Island, Connecticut and New Hampshire score high as well.

These funding and investment flows into New England's health care industries, however, will be only useful if it effectively supports the work of people who create the innovations that take these industries forward. The figures for the region's position in terms of human capital for its health care industries are encouraging. As a percentage of a state's workforce, the New England states of Massachusetts, Connecticut, New Hampshire and Maine tend to rank well in various health care-related scientific fields. Massachusetts has the nation's most intense concentration of medical scientists and biomedical engineers. Maine does proportionally well in terms of its intensity of biochemists and biophysicists—it is in fact the only New England state to place in the top ten.

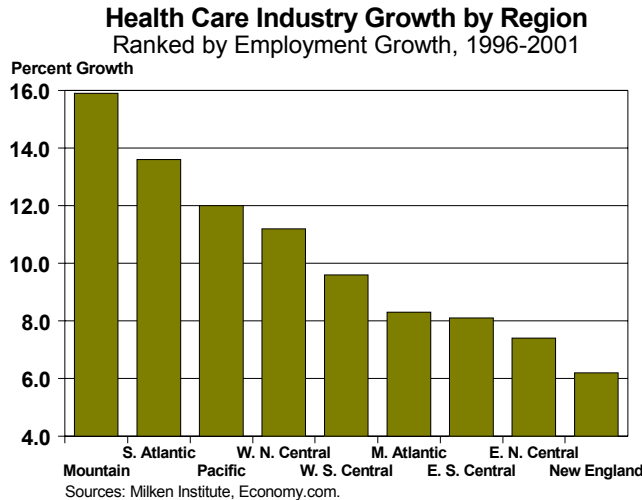
A measure of the commercialization potential of new products is the pre- and final FDA approvals. On a per capita basis, Massachusetts scores first in the nation (when ranked against other leading technology states) for the number of new biotech drugs granted FDA approval. Massachusetts and Connecticut both rank among the nation's leading technology states in regards to investigational device exemptions (IDEs) and premarket approvals (PMAs) for medical devices.

Health Care Growth

These comparisons all depict New England as a major force in the U.S. health care industry; however, there are less than stellar signals based on recent growth performance comparisons with other key regions. New England is not fully leveraging the vast innovation capacities and diversity of its health care sectors for maximum economic



benefit for the region. Warning signs on the health care industry's future should not be ignored.



Despite its health care strengths, New England is last among the Nine Census regions in health care job growth between 1996 and 2001. Much of this is tied to overall slower population growth in New England which tends to drive demand for health care services, but also reflects slipping performance in other key sectors. A significant indication of deteriorating relative performance can be found in the decline of national health care employment residing in New England. After peaking in 1984 at nearly 7.5 percent, New England's share of national health care employment fell to 6.6 percent in 2001.

Maine was the only state among the top ten states (8th) in terms of health care job growth from 1996 to 2001. Maine was among the top ten states on growth in research and testing services, clinics of medical doctors and dentists, and medical and dental laboratories. New Hampshire was 15th in growth over the period with strength in drugs, medical services and health insurance, clinics of medical doctors, and nursing/personal health care facilities. Vermont was in the upper half of performing states at 21st on job growth with strength in drugs, research and testing, and medical instruments, and health and allied services.

Connecticut ranked 45th on health care job growth between 1996 and 2001. Connecticut's only top ten growth ranking was in medical services and health insurance. Connecticut earned the dubious distinction of being last in the country in hospital job growth over the most recent five-year period. Particularly problematic for Connecticut was that the state was in the middle of the pack on growth in drugs, and research and testing services, two areas of strength for the state. Rhode Island was 46th in growth overall, without a single top ten finish in any sectors. Nevertheless, the opening of Amgen's new manufacturing site to produce Enbrel should boost its future position.



Massachusetts ranked 47th among states in health care employment growth over the most recent five years. In drugs, research and testing services, and medical instruments and supplies, sectors where Massachusetts ranks in the top ten on concentration, the state places 13th, 17th, and 22nd on job growth from 1996 to 2001, respectively. The 1990s marked a period of heavy cutbacks and consolidation for New England's hospital industry, with contraction especially felt in Massachusetts which ranked 36th on job growth. Because hospitals are such a dominant employment category in Massachusetts, it pulled down the state's overall health care job-growth performance.

Particularly troubling is the pronounced slowdown in pharmaceuticals job growth in Massachusetts and Connecticut. It is disconcerting that pharmaceutical jobs throughout the region, although more than doubling since 1980, have grown anemically compared to the expansion experienced by the 10 states logging the fastest growth (where they have averaged more than a nine-fold increase). Especially distressing for Massachusetts is that another high-cost state—California—experienced stronger job growth in the drugs category from 1996 to 2001.

Additionally, Boston has seen its high perch at the top of the Health Pole rankings slip in recent years. Among the top ten Health Pole metros, only Detroit has witnessed a greater loss in employment concentration than Boston over the past five years. Chicago, Washington, D.C., Minneapolis-St Paul and Philadelphia have all recorded health care employment concentration gains.

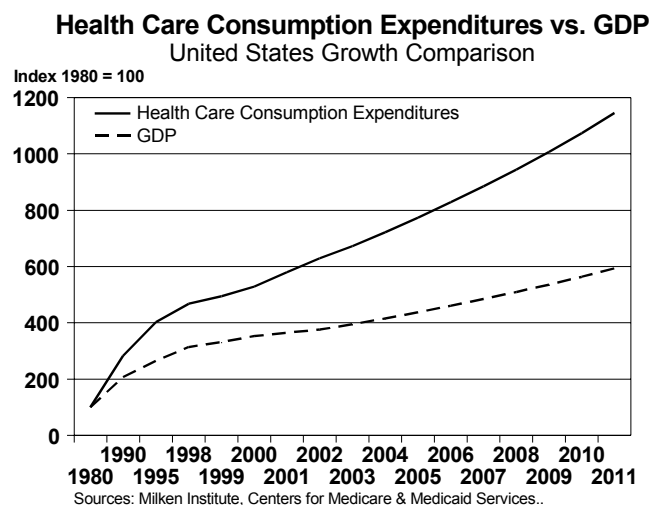
Massachusetts' higher business costs and tax structure place it at a competitive disadvantage versus other locations where pharmaceutical firms establish large-scale production operations after developing a market for their applications. Better retention efforts aimed at building manufacturing operations would more fully capture the economic value of Massachusetts' strong biopharmaceutical research capabilities.

Similar issues are present when evaluating medical device manufacturing. The state-by-state positions of the medical instruments and supplies industry especially, brings home the message that resources could be better leveraged to realize the New England region's potential as a dynamic and diverse center for health care industries. Among New England's leadership and key stakeholders, an increased awareness of the factors limiting health care's growth in the region among its leadership and other key stakeholders is necessary to create a vision for the future. A regional collaborative focus and perspective could greatly aid New England's potential growth prospects.



2. Industry Analysis

The industries that constitute the broadly encompassing health care economic sector are of great—and increasingly greater—importance to global, national, and regional prosperity. Population growth, due in part to dramatic advances in medical science, is stimulating demand and opportunities for health care goods and services. Health care consumption expenditures have more than doubled, from 7 percent of the U.S. GDP in 1970, to slightly more than 14 percent by 2001.¹ The Centers for Medicare & Medicaid estimate that by 2011, health care consumption expenditures will have shot up nearly 12 times over 1980 levels to 17 percent of GDP. U.S. GDP, in the meantime, will have only grown six fold.



New England is one of only two economic regions in the U.S. to have a noticeably higher-than-average proportion of health care industries contributing to its gross regional product. GRP is the total economic value of goods and services produced in a region. 7.5 percent of New England's GRP comes from health care, making its GRP almost ten percent more concentrated in health care than the national average.

The region ranks even higher in terms of employment concentration. More than 800,000 New Englanders have jobs in health care sectors. This makes the health care industry the fifth largest employer in New England and gives the region the highest concentration of health care employment in the nation. More than 11 percent of New England's workforce is directly engaged in health care fields. This concentration is a full 25 percent above the U.S. average.²

¹ Centers for Medicare & Medicaid Services, Office of the Actuary, 2002.

² The degree of concentration is derived from the regional location quotient (LQ), the calculated ratio between a regional economy and that of some reference base. In this instance, the LQ measures the proportion of people employed in New England's health care industries versus those employed by health



Top Health Care Industry Regions

Ranked by Gross Regional Product, 2001

Rank	Region	Location Quotient	% of Regional Total GRP	GRP (Bill.)
1	Middle Atlantic	1.12	7.7	118.4
2	New England	1.09	7.5	43.6
3	East North Central	1.02	7.0	101.2
4	West North Central	0.99	6.8	42.4
5	East South Central	0.97	6.7	30.4
6	South Atlantic	0.91	6.2	103.6
7	Mountain	0.79	5.4	32.9
8	Pacific	0.78	5.4	93.4
9	West South Central	0.76	5.2	53.1

Sources: Economy.com, Milken Institute.

Top Health Care Industry Regions

Ranked by Employment Concentration, 2001

Rank	Region	Location Quotient	% of Regional Total Emp.	Emp. (Ths.)
1	New England	1.25	11.4	801.0
2	Middle Atlantic	1.23	11.2	2054.2
3	West North Central	1.05	9.6	946.9
4	East North Central	1.03	9.3	2053.9
5	West South Central	0.92	8.4	1191.1
6	East South Central	0.92	8.4	636.7
7	South Atlantic	0.92	8.3	2065.8
8	Pacific	0.87	7.9	1592.9
9	Mountain	0.85	7.7	664.8

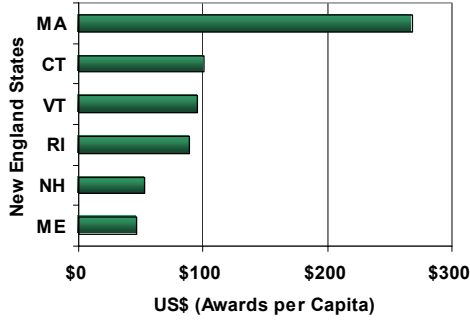
Sources: Economy.com, Milken Institute.

Leading states in the region are exceptionally well positioned to capitalize on the promise of health care innovations. Averaged out on a per capita basis, four states—Massachusetts, Connecticut, Vermont, and Rhode Island—score among the top ten in the nation in terms of monetary value of National Institutes of Health (NIH) awards received. Internationally renowned medical schools and research hospitals—such as Harvard and Yale University medical schools and Massachusetts General Hospital—keep such funds, and human talent flowing in and vitalizing the health science innovation capacity of New England. Such dominance is exhibited in other types of funding support categories. Massachusetts, the leading state in the region for most types of these investments, is also first in the nation for total funds in industrial scientific R&D and other areas more specific to the health care industry: venture capital dedicated to biotechnology and the medical device industry, for example. (For a comparative picture of the New England states’ positioning in innovation capacity, see below and the final narrative section of this report, “Innovation Pipeline Analysis.”)

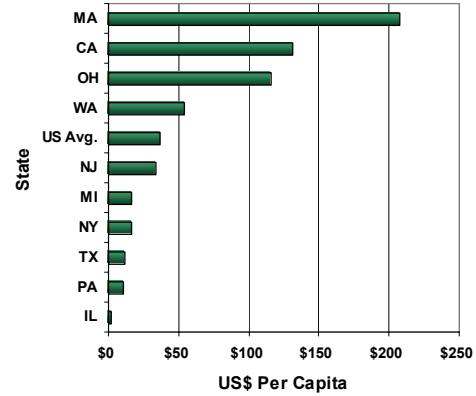
care in the nation overall. If an LQ is greater than 1.0, the industry has greater concentration in the region than in the U.S. on average.



NIH Funding



Total Funds in Industrial R&D



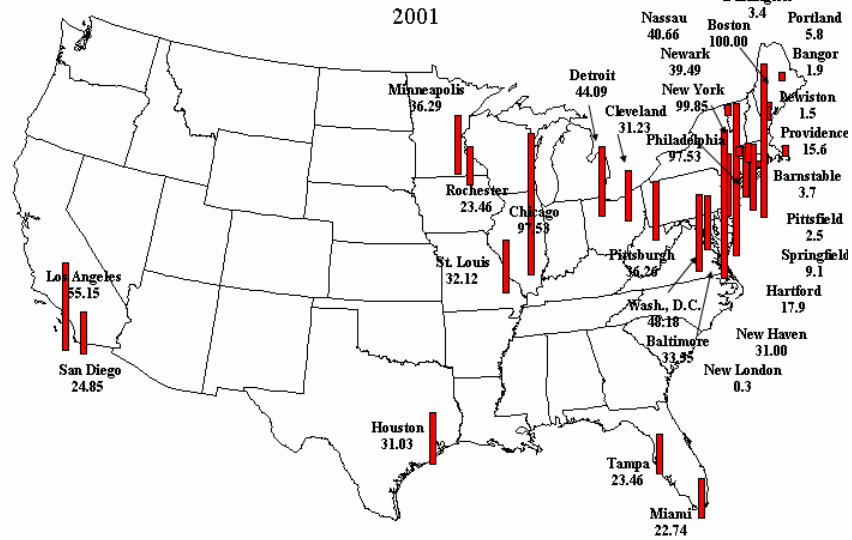
Source (Left Chart): National Institutes of Health
Source (Right Chart): National Science Foundation

Another aspect of strength for the region comes from its being home to two of the nation’s major “health poles.” A health pole is a composite measure of health care industry concentration for a metropolitan statistical area (MSA) as classified by the U.S. census. Milken Institute health pole rankings are based on combining an MSA’s health care industry location quotient with its share of national industry output. MSAs then are ranked according to their composite scoring. The metro area with the highest composite score for a given health care industry is assigned a benchmark score of 100. All subsequent ranking metropolitan areas have scores that indicate their placement relative to the benchmark. The principles behind this method for determining and comparing the “gravitational pull” of technology-driven metro areas were introduced with the Milken Institute’s nationwide mapping of “Tech-Poles” in 1999, the first of its kind. The tech-pole concept is detailed in the study *America’s High-Tech Economy: Growth, Development, and Risks for Metropolitan Areas*.³ Tech-pole scores capture the spatial intensity of a variety of technology-driven sectors. The health pole index and individual industry health pole scores referred to in this report relate specifically to areas of concentration of the health care industry. This report represents the first unveiling of national and regional health pole statistics.

³ Ross DeVol, *America’s High-Tech Economy: Growth, Development, and Risks for Metropolitan Areas* (The Milken Institute, 1999): see especially pages 4-6.



Milken Institute Health Pole Index



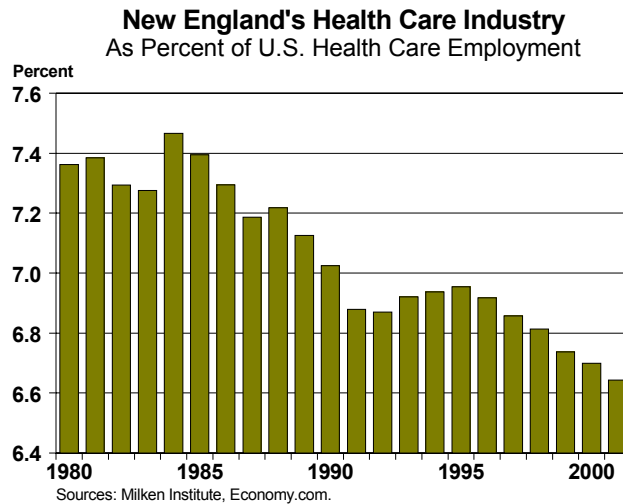
The total health pole index reflects the combined scores for all 13 health care industry components. As the table and map indicate, the New England region has the distinction of having the top ranked health pole in the United States: Boston, whose MSA classified geography includes parts of Massachusetts and New Hampshire that about the city of Boston. Another leading center for health care industries in the region is Connecticut’s New Haven-Meriden metropolitan area. At 16th place, New Haven-Meriden places in the top 20 national health poles. Its score of 31.00 shows that although among the top ranked poles, it is nearly 70 percent below first-ranked Boston.

There are aspects of the top 20 index scores that temper the region’s bragging rights. The score of second-place New York, New York, ranks only 0.15 percent behind that of Boston—a placement that makes it statistically tied with New England’s principal center for health care. New York also shares a top ten position with nearby Newark, New Jersey. Other strong showers are four metro areas in the Mid and South Atlantic regions: Philadelphia (Pennsylvania-New Jersey), Washington (District of Columbia-Maryland-Virginia-West Virginia), Pittsburgh (Pennsylvania), and Baltimore (Maryland). These four health poles ranked third, sixth, eleventh, and twelfth respectively. Their combined score of 215.52 (versus Boston and New Haven-Meriden’s score of 131.00) also shows that as a region, New England’s metro industry clustering is not as robust as that of its main regional economic competitors for health care resources and investment. Rounding out the top 10 list of health poles in the nation are Chicago, Illinois (which ranks fourth), Los Angeles-Long Beach, California (fifth), Detroit, Michigan (seventh), Nassau-Suffolk, New York (eighth), and Minneapolis-St. Paul, Minnesota-Wisconsin (tenth).

Nevertheless, overall the data on the nation’s health care sectors and their presence in New England provide evidence for two pieces of decisively good news: 1. the health care industry is growing, both in size and importance, on a massive scale; and 2. New England



enjoys significant comparative advantages in its health care sectors. Yet warning signs should not be ignored. Beyond its health pole rankings, there are other aspects of regional competitiveness that require attention. The region's percentage share of U.S. health care employment has been shrinking—albeit unevenly—in a consistently downward trend. As statistics on the nation's "Top Health Care Industry Regions" indicate, New England's number one ranking is only slightly ahead of the Middle Atlantic. As the health pole measures and other indicators reveal, locations such as Boston and New Haven are, compared to years past, less exclusive when it comes to health care industry capacity, concentrations and growth.

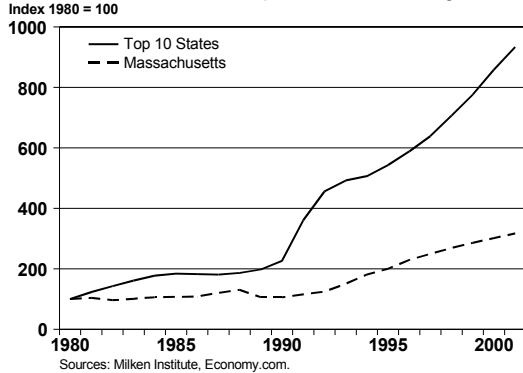


This sort of slippage is particularly noticeable in the pharmaceuticals industry. A globally scaled and rapidly expanding industry, pharmaceutical employment is strategically valuable in many ways. In its principal mission to provide curative medicine, “pharma” is a key driver of research and development in its own and other health care industries. Pharmaceutical companies also carry out various manufacturing-related functions and provide a breadth of blue- and white-collar employment opportunities. It is therefore disconcerting that pharmaceutical jobs throughout the region, although more than doubling since 1980, have grown anemically compared to the expansion experienced by the 10 states logging the fastest growth (where they have averaged more than a nine-fold increase). Even if excluding the New England region's slower growth states and comparing only Massachusetts to the top 10, the data clearly indicate that other states are outperforming the region by a substantial degree.

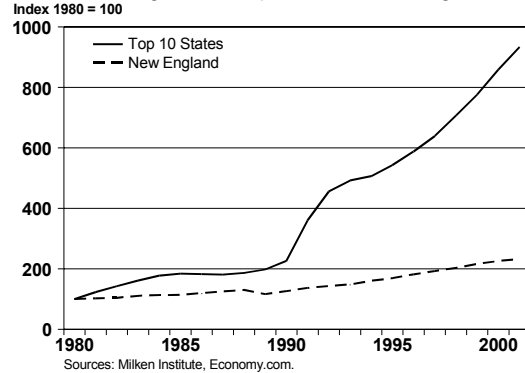


The Economic Contributions of Health Care to New England

Pharmaceutical Employment Growth Comparison
Massachusetts vs. Top 10 Fastest Growing States



Pharmaceutical Employment Growth Comparison
New England vs. Top 10 Fastest Growing States



The remainder of this section explores New England's key health care industries with an encompassing and balanced perspective of their comparative strengths and weaknesses. Specifically, six industry groupings were examined:

- a. **Pharmaceuticals**
- b. **Research and Testing Services (Includes Biotechnology Research)**
- c. **Medical Devices**
- d. **Hospitals**
- e. **Medical Services & Health Insurance**
- f. **Other Health Care Services**

The groupings encompass 13 industries (listed below) that are delineated by the U.S. government's Standard Industrial Classification system.

Health Care - Industry Components

Includes the Following SIC Categories:

SIC	Industry
283	Drugs
384	Medical Instruments & Supplies
632	Medical Service & Health Insurance
801	Offices & Clinics of Medical Doctors
802	Offices & Clinics of Dentists
803	Offices of Osteopathic Physicians
804	Offices of Other Health Care Practitioners
805	Nursing & Personal Care Facilities
806	Hospitals
807	Medical & Dental Labs
808	Home Health Care Services
809	Health & Allied Services
873	Research & Testing Services

This industry analysis begins with manufacturing and technology related sectors and moves to those that are predominantly service-oriented. The content of this section of the



report is augmented by supporting graphs and tables. Additional graphic and tabular data can be found in the Appendix.

Pharmaceuticals (Drugs)

Pharmaceutical sectors, as measured by the Standard Industrial Code (SIC) 283 for “Drugs,” directly employ slightly over 21,000 people in the New England region. When analyzing the size and characteristics of this industry, it is important to bear in mind that while an industry in its own right, it has a highly symbiotic relationship with the hybrid sector of biotechnology. Biotechnology companies innovate new drug products that both they and the drugs industry manufacturer. Pharmaceutical companies also are engaged in extensive biotechnological research and development. U.S. government statistics unfortunately do not separate out biotech activities from within the drugs sector (nor, for that matter, from the more closely approximating “biotech” industry of research and testing services). Thus, when considering the size and impact of the pharmaceutical industry, the contributions and inter-relations with biotech are not quantified but should be appreciated to exist nonetheless.

Two states, Massachusetts and Connecticut, clearly lead in providing pharmaceutical jobs in the region. New Jersey has the highest concentration of drug employment in the nation at nearly 5 times the national average. Delaware and Indiana are second and third on concentration of drug industry employment. Both have equivalently sized pharmaceutical labor pools of approximately 10,000 people each. These employment levels rank Massachusetts and Connecticut in ninth and tenth place of all states. The two states are also the only ones in the region whose location quotients are above 1—i.e., they have industry employment concentrations that are above the national average. Maine, New Hampshire, Rhode Island and Vermont score lower in terms of size and concentration but nevertheless contribute to the overall growth of pharmaceutical employment in the region, which has consistently outperformed the U.S. average (though not the more selective “top ten” states registering the highest rates of growth). Of especial significance, New England’s drug industry provides the single highest employment multiplier for any of the region’s health care industries. For each pharmaceuticals job created in any New England state, another 3.5 jobs are generated within the regional economy. (For an analysis detailing regional health care industry multipliers and their impact, see section 2: “Multiplier Analysis.”)



Drugs
States Ranked by Employment Concentration, 2001

Rank	State	Location Quotient	Emp. (Ths.)
1	New Jersey	4.96	48.3
2	Delaware	4.63	4.7
3	Indiana	2.58	18.3
4	Connecticut	2.39	9.7
5	Pennsylvania	2.03	28.0
6	North Carolina	1.61	15.3
7	Utah	1.50	3.9
8	Illinois	1.49	21.6
9	Massachusetts	1.24	10.0
10	Michigan	1.23	13.7
22	Maine	0.44	0.6
25	New Hampshire	0.41	0.6
40	Vermont	0.10	0.1
41	Rhode Island	0.10	0.1

Sources: Economy.com, Milken Institute.

Drugs
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Vermont	2650.0	0.0	2650.0	316.7	36.4
2	Kentucky	1199.3	-2.8	1236.2	157.4	18.7
3	New Hampshire	1561.8	76.5	841.7	104.2	11.0
4	Washington	926.2	166.4	285.2	78.2	8.6
5	Utah	246.2	-28.3	382.6	75.4	7.0
6	Alabama	175.8	-8.1	200.0	58.3	6.4
7	Oregon	244.1	-14.1	300.7	57.4	14.7
8	West Virginia	334.7	63.8	165.4	54.5	7.6
9	Delaware	498.9	91.2	213.2	51.6	9.4
10	California	120.0	26.8	73.4	50.9	4.5
13	Massachusetts	201.7	5.8	185.2	38.6	5.2
20	Connecticut	81.2	41.4	28.2	20.7	0.2
40	Maine	116.6	-4.1	125.8	-15.8	-6.5
47	Rhode Island	-57.5	-17.0	-48.8	-42.3	2.7
	<i>New England</i>	126.1	26.1	79.4	27.9	2.7
	<i>United States</i>	59.0	20.9	31.5	22.9	2.6

Sources: Economy.com, Milken Institute.

On a positive note, industry leaders Massachusetts and Connecticut have enjoyed relatively solid growth rates. Massachusetts' overall level of expansion has been the highest, with the state experiencing explosive, triple-digit increases in pharmaceutical employment since 1980. Growth in the 1980s started out at a modest, but still robust, 5.8 percent. It then rocketed to the level of some 185 percent for the 1990s. For the past five years (1996-2001) employment has expanded nearly 40 percent. For the most recent time period on record, 2000-2001, growth has tapered down to a rate of 5.2 percent. Such a slowdown is not surprising given recent recessionary macroeconomic conditions and heavy curtailment of investment activity in high-technology sectors. Regardless of such cyclically based fluctuations, the overall picture of employment in Massachusetts pharmaceutical sectors is unquestionably one of growth and increasing importance to the population. For every one Massachusetts resident employed by the drug industry in 1980, there are more than three employed today.

In a less positive light, however, given Massachusetts' strong research and innovation infrastructure, its relative performance should be stronger. As already mentioned, it lags the top 10 states in growth. Massachusetts' higher business cost and tax structure place it at a competitive disadvantage versus other locations where pharmaceutical firms establish large-scale production operations after developing a market for their drug applications. Better retention efforts aimed at building manufacturing operations would more fully capture the economic value of the strong research capabilities in Massachusetts. It would also enhance the job and income generated by research in the region. Especially disconcerting for Massachusetts is that another high-cost state—California—experienced stronger job growth from 1996 to 2001.

Connecticut's pharmaceutical sectors also have experienced high growth though not as explosively strong as that for Massachusetts. Connecticut's biggest growth phase was in the 1980s (41.4 percent). Its growth rate was about half that from 1996 to 2001 and registered a negligible 0.2 percent between 2000 and 2001. Unlike Massachusetts, Connecticut entered the 1980s with a higher employment base which has grown even though the industry has a relatively mature presence.

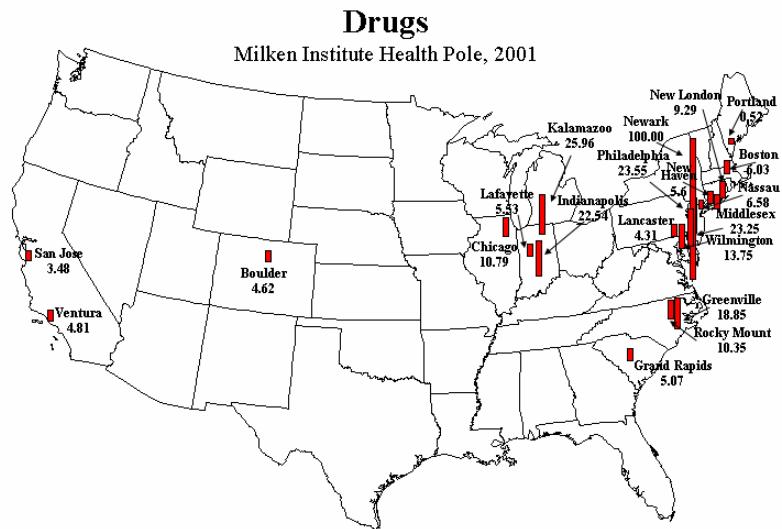


The maturing of the employment growth cycle in the state's drug industry also ought to be considered in the context of Connecticut's increasing gains in R&D investment for its overall "bioscience" cluster. Between 1995 and 2000, the state's collection of pharmaceutical and biotech-related enterprises and institutes more than doubled to a level slightly above \$3 billion.⁴ This type of forward investment bodes well for the state increasing its opportunities to capitalize on new drug developments and thus boost job growth.

The next largest pharmaceutical employers are Maine and New Hampshire, each employing some 600 workers directly. Both have been net gainers of jobs. Since the 1980s, employment figures have more than doubled in Maine and leapt by a factor of nearly 17 in New Hampshire. New Hampshire's ability to maintain high growth—with jobs still expanding by a healthy 11 percent during the generally tamer 2000-2001 time period—is also encouraging.

Vermont and Rhode Island have relatively small-sized drug industry workforces of around 100 employees. Thus Vermont's exceptional (2,650 percent) growth, though a positive sign, needs to be interpreted as coming from a less established base. Rhode Island, though enjoying slight (2.7 percent) growth 2000-2001, has a labor pool that is nearly half of what it was in 1980. Given that pharmaceutical employment in the Ocean State has consistently declined throughout the 1980s and the first and second halves of the 1990s, data supports the notion that the drug industry has endured enormous pressures in the state. Rhode Island ranks almost last in the U.S. at 47th place. A potential bright spot comes from recent developments such as Rhode Island-based investments in drug manufacturing by the biotech giant Amgen—a sign that the state's decline as a drug manufacturing force has the potential to be reversed.

⁴ Connecticut United for Research Excellence, *Bioscience: Leading the Way to a Stronger Economy* (2001): 2.



Another encouraging sign for Rhode Island comes from its shared top-ten ranking as a pharmaceuticals industry health pole. The New London, Connecticut-Norwich, Rhode Island concentration of pharmaceutical-related biotechnology firms underpins this strong showing. It should be noted that the state's ability to place so well in the rankings, however, is due in large part to its bordering on Connecticut, which shares not only the top ten health pole spot with Rhode Island but also occupies the 13th position with its New Haven-Meriden cluster. The New London-Norwich and New Haven-Meriden health

Novartis Moves Global Research Operations to Cambridge

Formed in 1996 by one of the largest corporate mergers in history, Swiss-based Novartis ranks among the world's six largest pharmaceuticals companies. Prescription drugs made by Novartis treat dermatological problems, nervous system disorders, cardiovascular diseases and cancer. The company's consumer health brands include Gerber, ExLax, Maalox, Tavist, Theraflu and CIBA Vision. For the most recent 12 months on record, the company earned more than \$20 billion in revenue from its global operations.

In September 2002, this foreign-based, globally active pharmaceutical giant chose Cambridge, Massachusetts to locate the firm's new world-wide headquarters for the Novartis Institutes for BioMedical Research (NIBR). The company plans to invest approximately \$750 million to develop and staff the center, directly providing 900 new jobs over the next two years. (If accounting for the effect of the total employment multiplier, this will amount to over 2,000 new jobs throughout the New England region.)

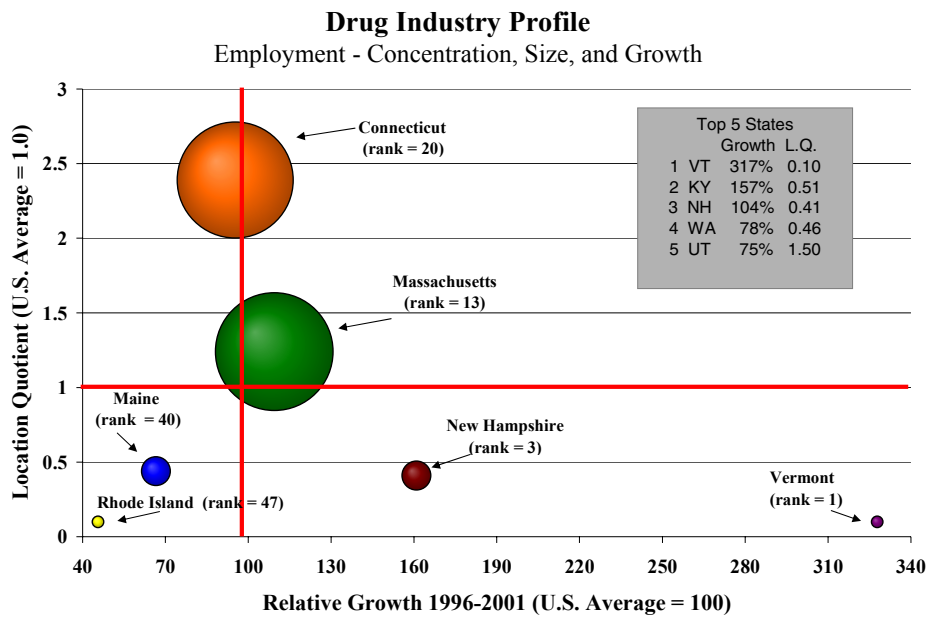
The selection of Cambridge testifies to the immense drawing power of the region (especially the Boston health pole) for the research-intensive sectors of health care. In explaining its choice of locations, the company stated: "The NIBR headquarters is located in Cambridge, where the Novartis scientific talents can be offered an invigorating setting, rich with resources that include some of America's best universities, private research institutes and hospitals." The presence of Novartis strengthens the Cambridge-Allston biotech cluster that is sustained by such companies as Genzyme and Millennium Pharmaceuticals, as well as leading research centers such as Harvard Medical School, the Massachusetts Institute of Technology and Partners HealthCare.

Sources: Novartis website, Hoover's Online, Boston *Globe*, New York *Times*.



poles are adjacent concentrations and rely heavily on the intellectual assets of Connecticut’s bioscience complex. This is yet another example of regional interdependencies and exemplifies how success in one state can provide spillover benefits into another. Boston, which ranks as the nation’s 12th largest health pole for drugs, represents New England’s other top twenty entrant in this measure. (A complete listing of top 20 U.S. health pole rankings for the drug industry can be found in the Appendix.)

With regard to other regional health poles, the Newark, New Jersey metro is the national pharmaceutical leader, with many leading firms’ headquarters based in that MSA. Kalamazoo-Battle Creek, Michigan is second as a drug center. Philadelphia is third, followed by Middlesex-Somerset-Hunterdon, New Jersey and Indianapolis, Indiana.



By way of summary, the bubble chart above captures a meaningful snapshot view of the employment situation with the drug industry in constituent New England states. The size of the bubbles reflects their employment levels. Massachusetts, with 10,000 pharmaceutical workers, and Connecticut, with a nearly identical pool of 9,700, have the two largest bubbles, followed by Maine and New Hampshire (600 employees each) and Rhode Island and Vermont (100 employees each).⁵

The vertical, y-axis positioning of each bubble corresponds to the concentration, or location quotient, of the drug industry in each state. Ideally a state’s bubble should be centered above the horizontal line at 1.0, which indicates the U.S. national average

⁵ It is interesting to note that if employment multipliers were taken into account, a bubble nearly ten times larger than that for Massachusetts would dominate the background of this graph, indicating all the jobs in New England that the state-by-state employment pools generate. Section 2 of this report explains the nature and impact of the New England health care industry’s economic multipliers.



concentration (equivalent to a location quotient of 1). The horizontal, x-axis positioning of each bubble corresponds to the relative growth of the drug industry in each state from 1996 to 2001. High-growth states are represented by bubbles centered to the right of the vertical line at 100, which indicates the average growth in the U.S. for pharmaceutical sectors.

According to the information contained in the chart, Connecticut and Massachusetts are the region's above-average performers in terms of pharmaceutical employment concentration. Massachusetts, New Hampshire and Vermont are above-average performers in terms of recent employment growth. The chart is a snapshot of employment industry dynamics. Viewed again even a short time hence, bubble sizes and positions are likely to change. For example, in spring 2003, Amgen will open a new manufacturing facility in Rhode Island. Once these data are captured, it will enlarge Rhode Island's labor pool (and thus the bubble) and promote both employment concentration and growth, moving the bubble in an upward right, northeastern direction. With European-based Novartis' planned expansion of R&D facilities in Cambridge, Massachusetts' size and positioning also will improve (see box).

Research and Testing Services (Includes Biotechnology Research)

The region's research and testing services (RTS) sectors, as measured by SIC 873, directly employ some 44,000 people in the New England region. This is more than double the total workforce directly employed by the pharmaceuticals sector. Biotechnology-related research and development activities are largely recorded in this industry category. With RTS's lower total employment multiplier of 2.3 (versus pharma's total multiplier of 4.5) the cumulative impact on region-wide employment is roughly equivalent, however.

Rank	State	Location Quotient	Emp. (Ths.)
1	Wash., D.C.	5.28	17.5
2	Idaho	3.64	10.8
3	New Mexico	2.81	10.9
4	Maryland	2.04	25.7
5	New Jersey	2.04	41.7
6	Massachusetts	1.86	31.6
7	Washington	1.60	22.3
8	New York	1.30	57.3
9	Colorado	1.28	14.6
10	California	1.27	96.0
12	Vermont	1.05	1.6
14	Maine	0.93	2.9
26	Connecticut	0.62	5.3
32	New Hampshire	0.57	1.8
38	Rhode Island	0.40	1.0

Sources: Economy.com, Milken Institute.

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Oklahoma	182.9	54.5	83.1	59.4	12.6
2	Wyoming	402.4	64.3	205.8	57.1	15.6
3	Delaware	412.9	206.0	67.6	53.9	8.0
4	Vermont	435.6	90.3	181.5	50.4	8.2
5	Arizona	450.0	147.7	122.1	44.1	7.2
6	Maine	545.8	218.9	102.5	43.3	7.2
7	Montana	110.2	21.6	72.9	36.8	9.9
8	New Jersey	51.3	44.7	4.6	32.7	4.0
9	Colorado	80.9	21.1	49.3	31.2	4.6
10	Georgia	265.9	140.5	52.2	30.5	7.9
16	Rhode Island	-41.7	-35.5	-9.7	18.9	8.2
17	Massachusetts	130.5	91.6	20.3	18.0	4.7
21	New Hampshire	437.0	315.4	29.3	11.8	0.4
28	Connecticut	18.1	18.8	-0.6	7.5	2.5
<i>New England</i>		110.7	72.3	22.3	18.7	4.6
<i>United States</i>		74.9	48.7	17.6	17.7	4.4

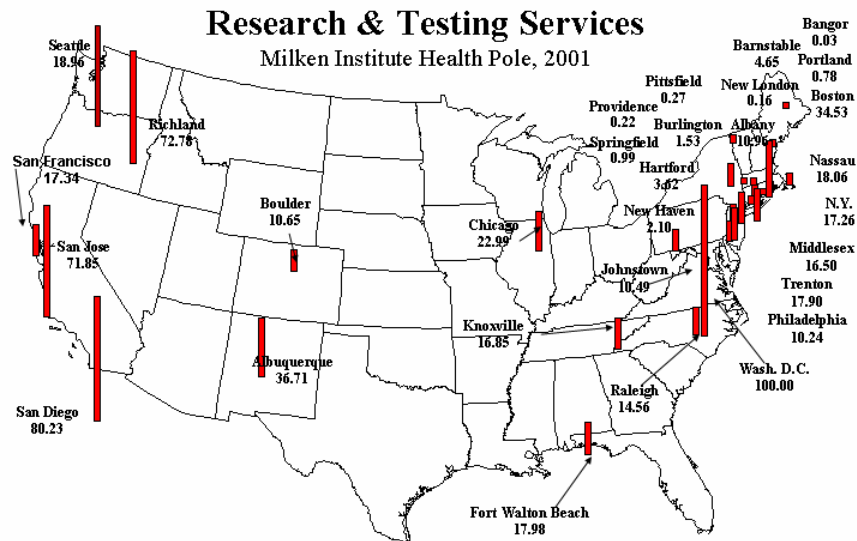
Sources: Economy.com, Milken Institute.

Massachusetts is the stand-out leader in RTS employment. With a workforce of almost 32,000, its labor pool in this highly specialized field is the fifth largest in the nation.



Although this number dwarfs that of the RTS employment levels in other New England states—from the next largest employer, Connecticut at 5,300 workers, to the smallest employer, Rhode Island at 1,000—it is significant that no state employs fewer than 1,000 RTS workers. Given the high-end, knowledge-intensive nature of the industry and, moreover, its strategic importance to other health care sectors, the inherent value of state-based RTS labor pools to regional economic vitality goes beyond what the numbers indicate on their own.

With the exception of Rhode Island, long-term growth in research and testing services employment throughout New England has generally been robust. The largest RTS state, Massachusetts, has expanded jobs by slightly more than 130 percent since 1980. Although the rate of growth slowed in the 1990s, it has nevertheless continued at a healthy pace, registering 4.7 percent in the most recent yearly interval measured (2000-2001). Even higher recent growth is evident in smaller states: the labor force in Vermont has been expanding by 8.2 percent, in Maine by 7.2 percent, and in Rhode Island, breaking its overall negative trend, by 8.2 percent. Employment region-wide has more than doubled since 1980, 35 percent higher than the national average. Recent growth rates also compare favorably to the rate of increase in pharmaceutical industry-based R&D expenditures, which for 1995-2000 are estimated at slightly over 11.3 percent.⁶



New England's one showing in the top 20 health pole listing for Research and Testing Services comes from Boston, which ranks sixth. Compared to the majority of other top 20 metropolitan areas, the Boston health pole is well positioned. Its index score of 34.5 is 50 percent higher than the next highest ranking location, Chicago. Half of the top 20

⁶ PhRMA data quoted in Standard and Poor's, *Healthcare: Pharmaceuticals* (2002): 8.



locations in fact only score about half as high as Boston. Boston's position vis-à-vis the top five, however, illustrates more will have to be done if the health pole is to improve itself amongst its leading resource competitors. The benchmark, greater Washington D.C. RTS health pole (extending through the District of Columbia, Maryland, Virginia, and West Virginia) scores almost three times higher than Boston (which encompasses territory in both Massachusetts and New Hampshire). The California health poles of San Diego and San Jose score twice as high as Boston. Finding ways to increase employment share and concentration of New England's top ranking research health pole will be critical to improving performance in this measure.

Amgen Manufactures in Rhode Island

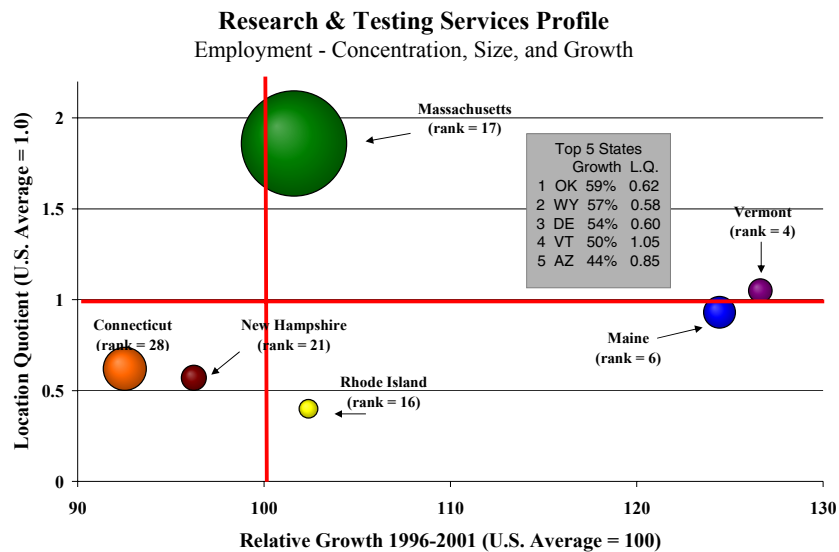
The global biotechnology leader, Amgen, is based in Thousand Oaks, near Los Angeles, but the company operates what is one of the world's most advanced cell manufacturing centers in West Greenwich, Rhode Island.

The Rhode Island manufacturing site is comprised of a state-of-the-art 250,000 square foot structure housing eight 8,000-liter bioreactors that produce Enbrel, a blockbuster drug that treats rheumatoid arthritis. In human terms, Enbrel has been used to help some 130,000 arthritis sufferers worldwide. Amgen's Enbrel facilities, which represent the company's largest manufacturing operation, also employ over 550 people. These employees were instrumental to Amgen after it took over the manufacturing site from Immunex in 2002. Worker efforts not only ensured a successful transition of management structures but also enabled the company to retrofit the facility to its present configuration and receive FDA approval in record time.

Amgen is building a second facility that is expected to employ several hundred additional workers. As one observer notes about the impact of Amgen's expanding operations: "The location of the complex on Route 95—visible to East Coast traffic—makes it a perfect calling card for Rhode Island." State economic development officials have made attracting such biopharmaceutical manufacturing operations a priority and Amgen's growing presence provides an indication of the sort of results that are possible. In a broader sense, Rhode Island's success with Amgen further testifies to how smaller, less populous states lacking jurisdiction over the tremendous resources of states like Massachusetts and Connecticut nevertheless can leverage their position as part of the greater New England region's asset base in health care industries.

Sources: Amgen website, *Drug Week*, *Providence Journal*.

The bubble chart snapshot of the region's RTS sectors reveals the state-by-state dynamics at play. The orb for Massachusetts looms large and in the positive territories of the grid: high employment concentration and above average growth. Vermont and Maine occupy roughly equal positions in terms of growth, which—at almost 30 percent above the national average—respectively ranks them as the fourth and sixth fastest growing biotech employers in the US. Both states have employment concentrations at about the national average; if their growth in biotechnology continues, their location quotients should likewise increase. Rhode Island has above-average growth but below-average (by more than 50 percent, in fact) employment concentration.



Connecticut and New Hampshire are below average according to the measures of both employment growth and concentration. In light of still positive employment growth, the states' more favorable positioning in pharmaceuticals (a key stimulus to RTS development), and a stronger RTS positioning for other states in the region, there is much potential for improvement. State-based strategies to affect such improvement will be bolstered if they are complemented by concerted, region-wide initiatives to achieve the same long-term goals.

Medical Instruments and Supplies

The region's medical instruments and supplies, as measured by SIC 384 ("Medical Instruments and Supplies"), directly provide 25,000 jobs in the New England region. These figures may differ from other estimates which are based upon a broader more inclusive definition of the medical device industry.⁷ This represents an increase of approximately 30 percent over 1980 employment levels. While reassuring as an indicator that the industry has expanded generally, this growth nevertheless fails to reach even half the rate of the U.S. on average.

⁷ For example, in the study *The Medical Device Industry in Massachusetts* conducted by the University of Massachusetts' Donahue Institute for MassMEDIC an estimate of 20,800 employees was reported for Massachusetts in 1997. These estimates come from the 1997 Economic Census from the U.S. Department of Commerce which is based upon the North American Industry Classification System (NAICS). In SIC Code 384 from the Bureau of Labor Statistics, 13,400 employees were reported in 2001. The Economic Census is generally more accurate in monitoring rapidly evolving industries such as medical devices, but only includes information for 1997. Since our research questions included time series comparisons with a focus on recent performance, we chose to utilize the BLS data because information through 2001 was available. On the basis of medical device employment on a per capita basis from the 1997 Economic Census, Massachusetts ranks 3rd in the country after Minnesota and Utah while the BLS' data set ranks Massachusetts 4th. Therefore, conclusions on medical instruments employment concentrations are virtually identical between the two data sources.



Medical Instruments & Supplies

States Ranked by Employment Concentration, 2001

Rank	State	Location Quotient	Emp. (Ths.)
1	Utah	3.74	8.8
2	Minnesota	3.65	21.3
3	Connecticut	2.30	8.4
4	Massachusetts	1.85	20.8*
5	New Jersey	1.78	15.6
6	Indiana	1.75	11.2
7	Nebraska	1.69	3.4
8	California	1.58	51.0
9	Colorado	1.41	6.9
10	Pennsylvania	1.28	15.9
13	Vermont	1.18	0.8
14	Rhode Island	1.14	1.2
25	New Hampshire	0.66	0.9
36	Maine	0.34	0.4

Sources: Economy.com, Milken Institute.

Medical Instruments & Supplies

Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Iowa	845.1	151.4	275.9	121.0	5.7
2	Vermont	335.3	148.1	75.5	59.9	13.3
3	Wyoming	850.0	50.0	533.3	46.2	0.0
4	Virginia	310.3	114.7	91.1	25.5	-3.0
5	Oregon	72.8	2.1	69.2	24.9	8.8
6	West Virginia	367.6	118.9	113.6	24.8	1.7
7	California	89.9	50.7	26.0	24.5	4.5
8	Pennsylvania	34.8	0.7	33.8	21.3	3.3
9	Arizona	232.9	62.6	104.7	18.6	3.6
10	Minnesota	180.0	64.7	70.0	17.6	2.9
19	Rhode Island	48.2	27.4	16.4	6.9	-5.7
22	Massachusetts	48.8	56.8	-5.1	4.9	3.6
33	Maine	78.5	105.4	-13.1	-9.9	-4.1
34	Connecticut	15.0	14.4	0.5	-11.4	-2.4
43	New Hampshire	-41.8	36.5	-57.4	-31.1	-3.0
	New England	30.7	38.5	-5.7	-2.1	0.9
	United States	71.0	47.5	15.9	6.7	1.0

Sources: Economy.com, Milken Institute.

*Estimate for Massachusetts comes from the 1997 Economic Census from the U.S. Dept. of Commerce which is based on the North American Industry Classification System (NAICS).

The New England-based industry's gap with the U.S. average has been increasing with time. In the 1980s, growth was approximately 10 percent less robust than that for the nation. Of greater concern, throughout the 1990s, the industry actually contracted by nearly 6 percent in New England while conversely it grew some 16 percent nationwide. Such trends reinforce other data that point to the high cost of doing business in the region and the flight of manufacturers in particular.

The Medical Device Industry in Massachusetts

Although not as visible in the public's eye as industries like pharmaceuticals and hospitals, medical devices play a major role in the health care industry. Research on the medical device industry in Massachusetts, the leading sectoral employer for the region, indicates:

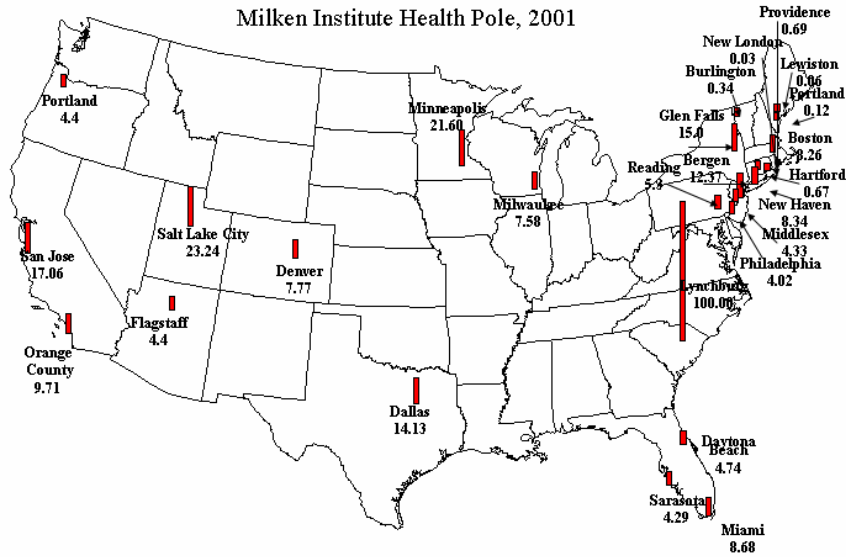
- There are over 260 medical device manufacturing establishments.
- Production is concentrated in surgical and medical instruments, and electromedical and electrotherapeutic instruments.
- The combined employee payroll for the industry in Massachusetts totals almost \$1 billion.
- Productivity in the industry, measured by value added per hour worked, surpasses that of overall manufacturing in the state by 52 percent.
- Capital expenditures per worker exceed those of overall manufacturing by 26 percent.

Source: Alan Clayton-Matthews, *The Medical Device Industry in Massachusetts* (University of Massachusetts Donahue Institute, 2001).



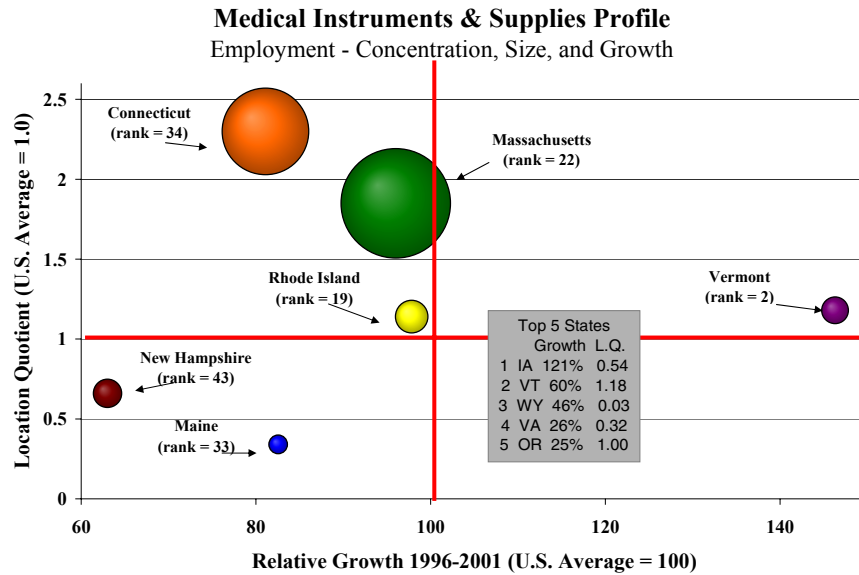
Medical Instruments & Supplies

Milken Institute Health Pole, 2001



New England's medical instruments sectors are anchored on the nearly equal ranking health poles of New Haven-Meriden and Boston, which score 8.34 and 8.26 respectively. Their index points effectively qualify them as tied for 10th place. Lynchburg, Virginia, is the leading center for medical instruments and supplies, followed by Salt Lake City-Ogden, Utah and Minneapolis-Saint Paul, Minnesota-Wisconsin. Dallas and Miami also placed in the top ten.

As mentioned above, creating a more manufacturing friendly environment is the type of fundamental step necessary to bolster employment concentration and growth in the medical instruments and supplies industry. Yet judging by the higher ranking of other MIS health poles that operate in high-cost environments (California's fourth ranked San Jose and seventh ranked Orange County, for example), significantly advancing New England's MIS health poles will likely require more than just lowering costs, but improving support infrastructure (such as creating a more supportive regulatory or policy environment or improving product commercialization strategies) as well.



A strong point in the industry’s regional standing is the preponderance of states with medical device concentration larger than the U.S. average. Connecticut, Massachusetts, Rhode Island and Vermont all share this positive distinction. Vermont is doubly blessed with an above-average LQ and exceptionally high growth. It is, in fact, the only state in New England with growth that outperforms the U.S. baseline. Its medical devices workforce, numbering around 800, is small enough however, to indicate that this growth rate is likely the result of a limited number of firms. The dominant regional employers, Massachusetts and Connecticut benefit from heavy industry concentration but are saddled by anemic growth. The state-by-state positions of the medical instruments and supplies industry especially brings home the message that resources could be better leveraged to realize the New England region’s potential as a dynamic and diverse center for health care industries.

Hospitals

In terms of employment, hospitals are by far the largest component of New England’s health care complex. With more than 257,000 direct employees in aggregate, sizable hospital labor pools register in every state of the region. If viewed as a topographical map, a mountainous pinnacle of 136,300 hospital workers covers the state of Massachusetts, which ranks in the top ten of American states. A smaller but still comparatively large protrusion with an altitude of 46,900 workers rises out of Connecticut, which ranks 24th. Although the remaining states fall at or near the bottom tier of the national hospital employment ranking, their workforces still represent sizable, hill-like masses: Maine with 24,100 hospital employees, Rhode Island with 20,500, New Hampshire with 20,300, and Vermont with 9,400. The mountain metaphor is also justified based on employment



The Economic Contributions of Health Care to New England

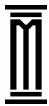
concentrations, which for nearly every state is at or above the national average. The most stand-out states are Rhode Island, which is 38 percent above the national average, Massachusetts, 32 percent above, and Maine, 28 percent. Only Connecticut's LQ, at 0.9 falls below 1, and then just slightly.

Hospital Industry		
States Ranked by Employment Concentration, 2001		
Rank	State	Location Quotient
		Emp. (Ths.)
1	North Dakota	1.64
2	West Virginia	1.57
3	Montana	1.47
4	Pennsylvania	1.46
5	South Dakota	1.45
6	Rhode Island	1.38
7	Massachusetts	1.32
8	Maine	1.28
9	Michigan	1.25
10	New Jersey	1.24
22	New Hampshire	1.05
27	Vermont	1.01
31	Connecticut	0.90

Sources: Economy.com, Milken Institute.

Hospitals					
Employment Growth, Ranked by 1996-2001 Growth					
Rank	State	Percent (%) Growth by Time Period			
		'80-'00	'80-'90	'90-'00	'96-'01
1	Minnesota	47.4	7.8	36.7	38.0
2	North Carolina	111.3	54.1	37.1	30.7
3	Nevada	178.8	80.3	54.7	26.8
4	South Carolina	123.0	58.4	40.8	26.7
5	Georgia	309.1	126.5	80.6	26.0
6	Idaho	87.3	27.6	46.8	21.9
7	Alaska	124.1	83.2	22.4	19.5
8	Indiana	57.4	28.3	22.7	16.1
9	Nebraska	33.8	13.5	17.9	15.7
10	South Dakota	76.7	34.7	31.2	15.3
17	Maine	36.4	18.8	14.8	11.8
29	New Hampshire	81.3	65.9	9.3	6.3
36	Massachusetts	16.8	12.2	4.1	3.5
44	Vermont	31.8	28.8	2.3	0.5
45	Rhode Island	30.7	27.3	2.7	-0.8
51	Connecticut	7.3	31.1	-18.2	-12.7
	<i>New England</i>	21.3	21.2	0.0	0.5
	<i>United States</i>	45.1	29.0	12.4	7.5

Sources: Economy.com, Milken Institute.



Massachusetts Hospitals

Among the various health care clusters that dot the New England landscape, one of the most outstanding concentrations of resources and expertise comes from hospitals and affiliated institutions in Massachusetts. Boston boasts three top-rated medical schools: those at Boston University, Tufts, and Harvard. Worcester's UMass Medical School and an additional 18 teaching hospitals reinforce the agglomeration of inter-related hospital and academic institutions. Highlights of some of Boston's major hospitals:

- Founded in Boston in 1811, Massachusetts General is the oldest and largest hospital in New England (and third oldest in the U.S.). It conducts the largest hospital-based research program in the nation, with an annual research budget of more than \$300 million.
- With over 16,000 employees, Massachusetts General is also the largest nongovernment employer in Boston. Almost all of the hospital's staff physicians have appointments at Harvard Medical School.
- Founded in 1832, Boston's Brigham and Women's Hospital is New England's first obstetrical hospital and one of the oldest in the nation. Like Mass General, the hospital is affiliated with the Harvard Medical School.
- Brigham and Women's Hospital houses one of the best regarded biomedical research institutes in the world. More than 500 scientists and \$240 million in research grants sustain the hospital's research activities.
- With roots stretching back to 1896, Beth Israel Deaconess Medical Center (another Harvard affiliate) is located in the heart of Boston's medical community. Serving more than half a million patients annually, the center is also the third-largest recipient of NIH biomedical research funding among independent teaching hospitals.
- Beth Israel Deaconess performs important clinical and research programs with such partner institutions as the Harvard-Thorndike Laboratory, Dana-Farber Cancer Institute, and the Joslin Diabetes Center.

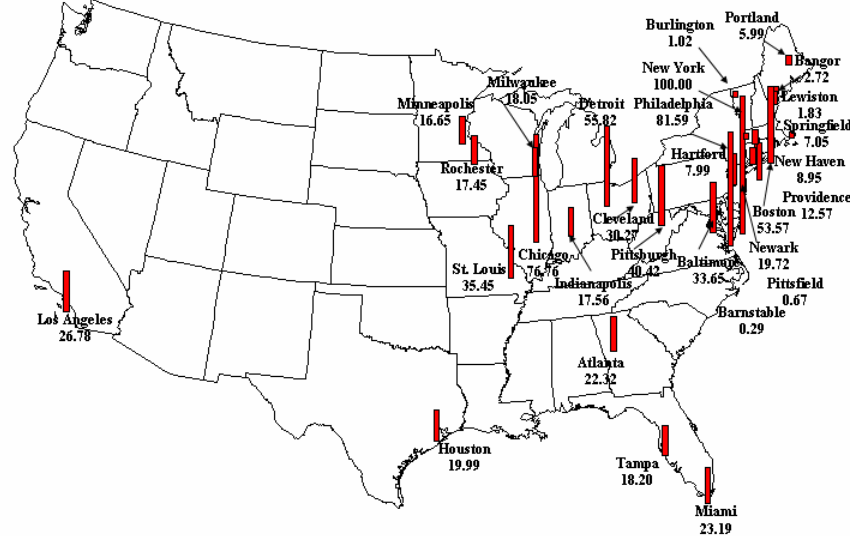
Source: The Howell Group of Boston, MA, *Why Care?*

For the most part, hospital employment throughout the region has been growing, though with the exception of Maine and New Hampshire, no state (nor the region overall) has exceeded national average rates of growth. With this category in particular, more moderate growth is not necessarily a bad sign when coupled with such factors as demographic trends and improved efficiencies in health care delivery (be that in the form of increased hospital-based productivity or innovative forms of nonhospital-based health care provision). A unique feature of the hospital industry is that it is more service and less technology oriented, per se. The industries examined so far—drugs, research and testing services and medical devices—primarily focus on technology as both an input and output of operations. Hospitals, on the other hand, may be technologically intensive, but human beings constitute their chief input and better human health constitutes their chief output. Hospitals succeed based on how well they “treat” people (in the full meaning of the word), not on how well they process technology.



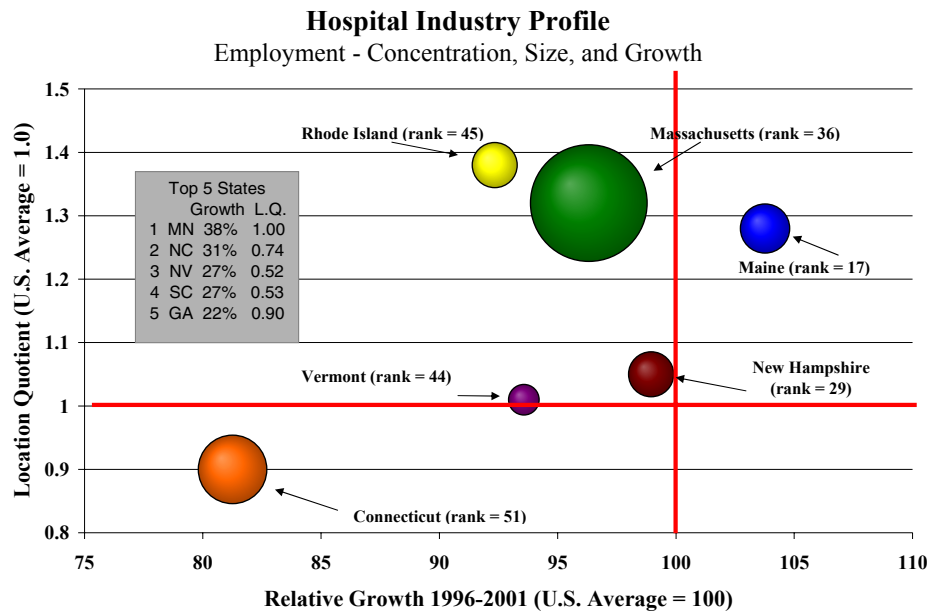
Hospitals

Milken Institute Health Pole, 2001



The region's leading center for hospital care is the greater Boston area, which ranks as the fifth largest hospital health pole in the U.S. The nation's largest hospital health pole is New York City, which scores nearly twice as high as Boston. The nation's other higher ranking health poles are Philadelphia, Pennsylvania-New Jersey; Chicago and Detroit.

The Boston area's strengths come from the size and service quality of its hospital facilities (see box) as well as peripheral but tightly related organizations. Harvard's famed medical school and Boston's dense concentration of research and testing service companies are vital components of the overall infrastructure that supports the prominence of the hospital cluster. In a similar vein, having a leading hospital health pole in the region supports all the industries studied in this report: from pharmaceutical manufacturing to insurance services to clinics. Hospitals function as magnets for key end-users (patients) and conduits (doctors) of the products and services supplied by the region's varied health care industries; the sector represents a common underlying thread and provides an important stimulus for both demand and innovation across New England's health care economy.



As already discussed, the New England region underperforms the U.S. average in terms of hospital industry growth. The bubble chart's dynamic portrayal vividly illustrates this, with every state except Maine falling below the vertical line at 100 that marks U.S. average growth. The 1990s marked a period of heavy cutbacks and consolidation for New England's hospital industry, with contraction especially felt in the region's anchor state of Massachusetts. Cutbacks in Medicare combined with distressed financial models mean that between 55 and 60 percent of Massachusetts hospitals have been losing money. As the Massachusetts Hospital Association (MHA) reports: "in Massachusetts we have the dubious distinction of being the only state in the nation where all three payers—private insurance/HMOs, Medicare and Medicaid—pay less than what it costs to provide care."⁸

At the same time, the bubble chart also shows that every state in New England bar one has above average concentrations of hospital employment, an indication that local populations have relatively good geographic access to hospital care and that the broader regional health care economy has a large hospital base with which to interact. The other bright spot in the hospital industry is that the exceptional quality of its care and research attracts both patients and talent from all over the world. A study initiated by the MHA and Massachusetts Medical Society found that in the state "[a]nnual non-resident patient discharges are estimated to total 39,000, a source of \$887 million in purchased services."⁹ This indicates that these hospitals are, in effect, a significant source of export revenue. Better ways to support the region's hospital system need to be pursued in order to maintain this critical asset for human and economic well being.

⁸ Massachusetts Hospital Association Testimony on Hospital Closures, Joint Committee on Health Care, February 2, 2002.

⁹ The Howell Group, *Why Care?* (Boston, 2002): 3.



Medical Services & Health Insurance

New England's Medical Service & Health Insurance (MSHI) industry directly employs almost 29,000 people. Massachusetts and Connecticut, which employ roughly equal numbers of 9,700 and 9,600 respectively, are the leading states in this category. Connecticut's growth has been unusually strong. MSHI in the Constitution State expanded by over 440 percent between 1980 and 2000; this momentum has been holding, with growth between 1996 and 2001 at 50.7 percent and for the year 2000 to 2001 at 8.5 percent. Despite their smaller labor pools, for the period 1996-2001, the states of Vermont, New Hampshire, and Maine have achieved the next highest levels of growth—all in the 40 percent range.

Rank	State	Location Quotient	Emp. (Ths.)
1	Nebraska	3.38	9.2
2	North Dakota	2.95	2.9
3	Minnesota	2.63	21.0
4	Maine	2.01	3.7
5	Connecticut	1.91	9.6
6	Delaware	1.88	2.3
7	South Carolina	1.81	9.9
8	Pennsylvania	1.76	29.9
9	New Hampshire	1.72	3.2
10	Wisconsin	1.65	14.0
14	Rhode Island	1.22	1.7
21	Massachusetts	0.98	9.7
41	Vermont	0.70	0.6

Sources: Economy.com, Milken Institute.

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Georgia	461.8	51.3	271.4	60.8	9.0
2	North Dakota	347.6	53.2	192.3	58.8	5.6
3	Minnesota	673.1	127.8	239.3	51.4	9.6
4	Connecticut	441.7	112.1	155.4	50.7	8.5
5	Nevada	846.5	136.4	300.3	48.2	8.0
6	North Carolina	273.3	20.9	208.7	45.7	5.8
7	Arizona	877.5	275.7	160.2	45.2	5.9
8	Florida	620.9	178.4	159.0	44.5	3.0
9	Vermont	693.3	334.7	82.5	43.0	4.5
10	New Hampshire	229.6	27.3	159.0	42.7	7.8
11	Maine	428.8	101.9	162.0	41.6	7.8
27	Massachusetts	54.1	-0.3	54.6	16.4	6.3
42	Rhode Island	52.6	54.7	-1.4	-1.9	0.9
	<i>New England</i>	158.6	34.7	92.0	31.2	7.0
	<i>United States</i>	170.0	70.2	58.6	21.5	2.9

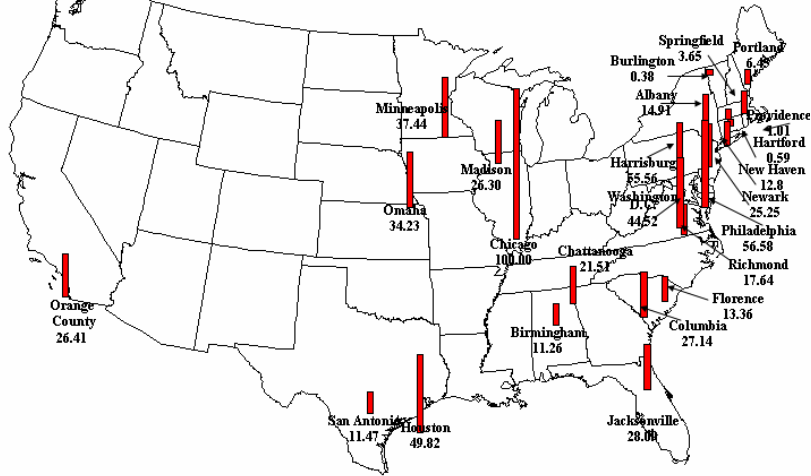
Sources: Economy.com, Milken Institute.

The region's industry growth spots have subsequently acquired strong employment concentrations. Maine, Connecticut and New Hampshire all score among the top ten states based on MSHI location quotients; Maine with twice the national average, and Connecticut and New Hampshire 91 percent and 72 percent more heavily concentrated than the national average, respectively. Massachusetts, which has the largest employment pool in the region, has an LQ of 0.98, which means its employment concentration is essentially at par with the nation as a whole.



Medical Services & Health Insurance

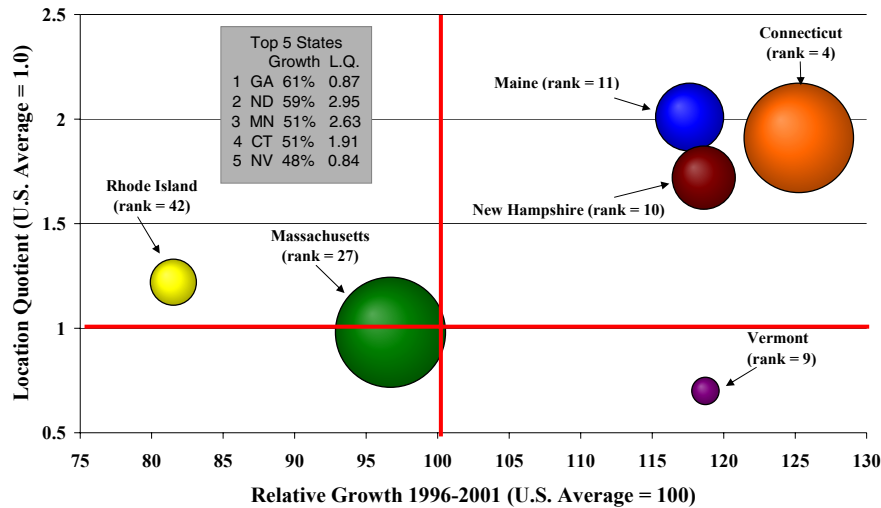
Milken Institute Health Pole, 2001



The metro areas of New Haven-Meriden and Boston provide the region with two medical services and health insurance health poles that score in the national top 20 (though just barely, at 17th and 18th place respectively). The nation's five leading health pole metropolitan areas are top-ranked Chicago, Illinois; second place Philadelphia, Pennsylvania-New Jersey; third place Harrisburg-Lebanon-Carlisle, Pennsylvania; fourth place Houston, Texas; and fifth place Washington, District of Columbia-Maryland-Virginia-West Virginia. The top 20 showing for New Haven-Meriden and Boston corresponds with Massachusetts and Connecticut being the region's largest employers in MSHI.

Medical Services & Health Insurance Profile

Employment - Concentration, Size, and Growth





The dynamics revealed by the MSHI bubble chart show just how far the states of Connecticut, Maine, and New Hampshire lead the region in this industry. With high growth and strong state-wide industry concentrations, the orbs representing these three states are clustered high in the upper right-hand quadrant of the chart—exactly the type of location that would be desired in a strategically targeted industry. Massachusetts repeats a pattern that shows up in other bubble charts by demonstrating a large employment pool but one that falls below the national average for growth. The combination of having a more mature health care economy and being saddled by very high business costs is likely the chief factor behind this persistent characteristic in the state’s economic dynamism.

Other Health Care Services

Other health care services in the New England region employ nearly 425,000 workers. This category encompasses a variety of service delivery specialists and vehicles: medical doctor offices and clinics, dentist offices and clinics, osteopathic physician offices, other health care practitioner offices, home health care services, nursing and personal care facilities, medical and dental laboratories, and health and allied services.

Other Health Care Services

Summary Table

Industry	SIC Code	Employment (Ths.) 2001	Employment Growth (%) 1996-2001	Location Quotient 2001
Doctors	801	107.5	9.7	1.01
Dentists	802	36.4	1.2	0.97
Osteopathic Physicians	803	1.2	12.1	0.39
Other Health Care Practitioners	804	27.3	21.2	1.13
Nursing & Personal Care Facilities	805	140.2	-2.6	1.43
Medical & Dental Labs	807	10.9	3.8	0.93
Home Health Care Services	808	75.3	25	2.23
Health & Allied Services	809	25.8	3.1	1.13
Total for Other Health Care Services		424.6	6.9	1.27

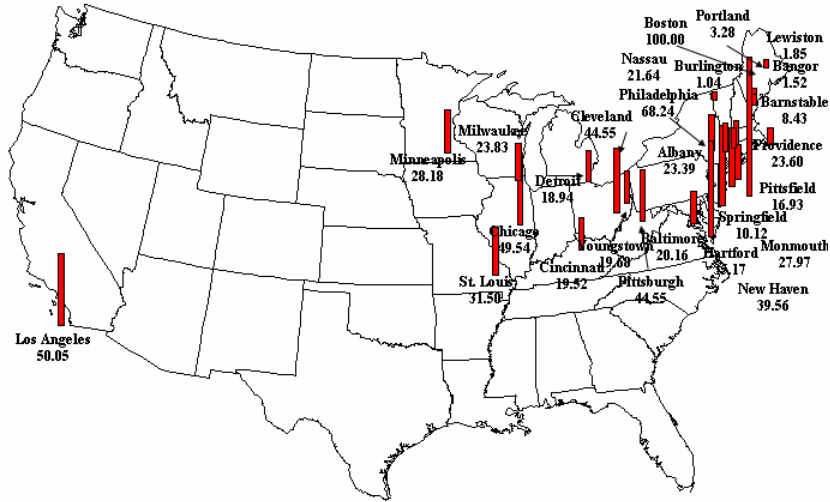
Sources: Milken Institute, BLS.

Detailed statistics on all the eight industries can be found in the Appendix to this report. The table above captures relevant headline figures. As data for 2001 employment levels indicate, doctor and dentist offices, and clinics along with nursing homes are the major employers in this category, accounting for 284,000 jobs (67 percent of total employment).

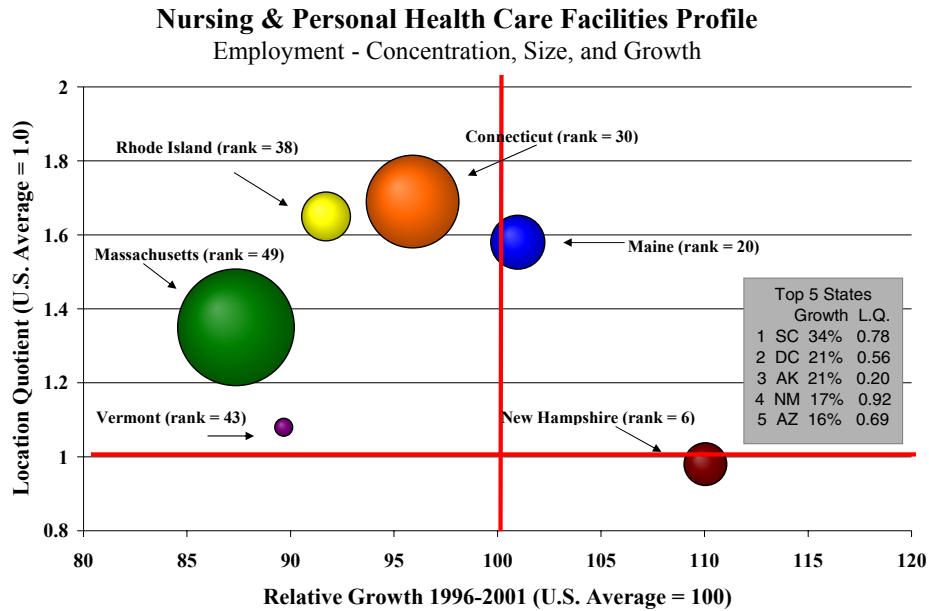


Nursing & Personal Care Facilities

Milken Institute Health Pole, 2001



With 140,000 workers, nursing and personal care facilities constitute the single largest industry in this category for the region. In terms of health pole rankings, nursing and personal care facilities also provide the region with its strongest showing among any industry. New England boasts no fewer than four health poles in nursing and personal care facilities that place in the national top 20 rankings. Boston's nursing and personal care facilities rank first in the nation. Two other New England health poles, New Haven-Meriden and Hartford, also rank in the top 10 (seventh and eighth place, respectively). The health pole for Providence-Fall River-Warwick, Rhode Island-Massachusetts, places 14th. Other high-ranking health poles for nursing and personal care facilities include Philadelphia, Pennsylvania-New Jersey (ranked second); New York, New York (third); Los Angeles-Long Beach, California (fourth); and Chicago, Illinois (fifth).



The bubble chart profile for nursing and personal care facilities reveals the region's solid yet relatively sedate positioning. The industry presence in all but one state is concentrated at levels above the national average; the single state that falls below the average, New Hampshire, does so only slightly. New Hampshire's prospects for traveling above the bar of average concentration, moreover, is good given its exceptionally high growth rate, which is, in fact, the highest in New England. At the same time, New Hampshire is the exception to the rule in terms of growth—no other state in the region is so noticeably above the U.S. average rate of expansion for this industry. The region's outstanding metro health pole positioning and state-based location quotient rankings may slip if growth is not somehow stimulated outside of New Hampshire.



3. Multiplier Analysis

Methodology

To better understand the importance of the health care industry in New England we must analyze its impact on the overall economy. Multiplicative values known as “multipliers” allow us to do this by quantifying how employment and output in the health care industry ripple through other regional economic sectors. In addition to providing numerical data on an industry’s regional impact, economic multipliers also bring to light region-wide interdependencies and inter-industry relationships. It is important to appreciate these relationships because they directly influence how regional economies respond to business cycles and changes in long-term industry structure.

To conduct its systematic economic multiplier impact analysis, the Milken Institute has utilized the Regional Input-Output Modeling System (RIMS II) developed by the Bureau of Economic Analysis. This methodology makes use of the input-output structure of U.S. industries to estimate the total impact one industry has on the wider economy. When speaking of “total impact,” three types of economic multipliers are implied: those responsible for direct, indirect and induced effects. It is through the aggregation of these impacts that a given industry contributes to its local economy. In terms of health care sectors, the roles of the three types of impact can be described as follows:

Direct Impact - The number of jobs, wages or amount of output directly generated by a given health care sector.

Indirect Impact - The number of jobs, wages or amount of output generated from all supplier industries necessary to support employment/output in a given health care sector.

Induced Impact - The number of jobs, wages or amount of output generated by employees’ incomes in all direct and indirect industries.

The data used to capture these types of impact come from the Bureau of Labor Statistics. It consists of 3-digit industry employment and output data as defined by the Standard Industrial Classification System (SIC).

Of course, economic effects go beyond the industry where the activity originates. For example, there are related supplier and end-user industries that benefit as well. Spillover economic activity associated within related industries is captured by the indirect impacts. Supplier industries that cater to the health care sector, for instance, generate a vast number of jobs within the wholesale and retail trade industries. Even these suppliers must themselves in turn utilize a network of their own suppliers to obtain goods and services, thereby producing a further chain reaction of indirect impacts to the economy.

The induced impact measure captures the economic activity generated to meet household demand for all good and services that have been created by the increased activity in all the direct and indirect industries. In the area of employment, for example, new jobs are

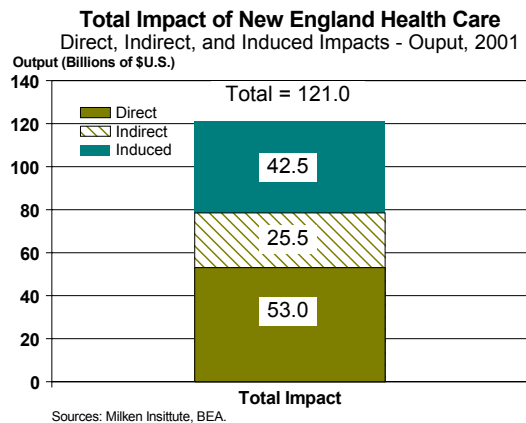
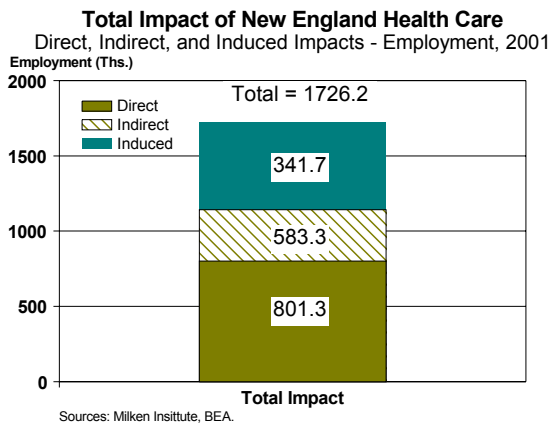


induced by the consumer spending of all the workers whose jobs are directly and indirectly dependent on health care industries. Thus, in addition to the consumer spending made by medical doctors, health insurance agents, biotech researchers, and hospital orderlies, the spending made by the restaurant workers, retail clerks, real estate agents, contractors, and many others indirectly dependent on the industry is also accounted for in this measure.

Multiplier Impact

In 2001, the health care industry in New England employed over 801,300 workers, producing a gross regional product of \$53 billion. These figures represent the direct impact of the health care sector on the regional economy. When the full extent of multiplicative dynamics are accounted for by applying total impact measures, health care can be recognized as responsible for 1,726,200 jobs and \$121 billion worth of output throughout New England.

The additional 924,900 jobs and \$68 billion in these total impact figures stem from the indirect and induced impacts that health care brings to the rest of the economy. The indirect impact generates an additional 583,300 jobs and \$25.5 billion worth of output, while the induced effect adds another 341,700 jobs and \$42.5 billion worth of output. Together they contribute to the total impact that the health care sector brings to the region. (See charts below.)



Consequently, the total health care employment multiplier in New England is 2.15 (1,726,200/801,300). In other words, each job in New England's health care sector produces an additional 1.15 jobs in other sectors. By the same token, since 11.4 percent of total employment in New England is in health care, the industry ultimately accounts for nearly 25 percent of total employment in New England when including the multiplier effect (11.4 percent multiplied by 2.15).



The Economic Contributions of Health Care to New England

The following table provides a breakdown of the direct, indirect and induced impacts on employment per New England's health care industry:

New England Multiplier Analysis
Regional Health Care Employment, 2001

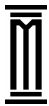
<i>SIC</i>	HC Industry	Direct Impact (Ths.)	Indirect Impact (Ths.)	Induced Impact (Ths.)	Total Impact (Ths.)	Total EMP Multiplier
283	Drugs	21.1	32.8	41.5	95.4	4.52
873	Testing & Research Labs	44.2	15.4	41.9	101.5	2.30
804,7,9	Other Med. & Health Services	63.9	14.3	33.7	111.9	1.75
384	Med. Instruments & Supplies	25.1	16.2	23.4	64.6	2.58
806	Hospitals	257.5	165.7	202.5	625.7	2.43
801-3	Doctors & Dentists	145.6	33.1	116.7	295.4	2.03
805	Nursing & Personal Care	140.1	15.7	51.7	207.5	1.48
632	Med. Service & Health Insurance	28.5	40.8	48.5	117.8	4.13
808	Home Health Care Services	75.3	7.7	23.3	106.4	1.41
Total Health Care		801.3	341.7	583.3	1726.2	2.15

Similarly, a total output multiplier of 2.28 indicates that for each dollar of output produced in the health care sector, an additional \$1.28 worth of output is generated outside of it.

New England Multiplier Analysis
Regional Health Care Output, 2001

<i>SIC</i>	HC Industry	Direct Impact (Bill.)	Indirect Impact (Bill.)	Induced Impact (Bill.)	Total Impact (Bill.)	Total Output Multiplier
283	Drugs	3.8	1.8	1.8	7.4	1.94
873	Testing & Research Labs	4.6	1.7	4.1	10.5	2.26
804,7,9	Other Med. & Health Services	3.0	1.0	2.1	6.1	2.02
384	Med. Instruments & Supplies	2.1	0.9	1.1	4.1	1.98
806	Hospitals	15.1	9.9	10.3	35.3	2.34
801-3	Doctors & Dentists	12.4	3.7	11.9	28.0	2.26
805	Nursing & Personal Care	5.3	1.8	5.2	12.2	2.31
632	Med. Service & Health Insurance	4.1	3.8	3.7	11.5	2.81
808	Home Health Care Services	2.5	0.9	2.4	5.8	2.29
Total Health Care		53.0	25.5	42.5	121.0	2.28

Among New England's health care sectors, the drug (pharmaceuticals) industry contains the highest employment multiplier of 4.52; however, it also has the lowest output multiplier of 1.94. The reason for this phenomenon is two-fold. First, the drug industry relies heavily on research and development. Hence, a majority of its financial resources are funneled directly into the planning and development of drugs. As a result, the output it initially generates outside of the drug industry is generally low. Secondly, since it takes years for drugs to appear on the market, the full effect on output is not realized until the drug becomes approved by the Federal Drug Administration (FDA).



For each job in New England's drug industry an additional 3.5 jobs are created in other sectors. The drug industry plays an important role in creating jobs in other industries. For instance, industries such as medical devices and medical labs within the health care sector rely heavily upon the performance of the drug industry.

Another industry that contributes to New England's overall economy is medical service and health insurance. Connecticut, Maine and New Hampshire are all part of the top ten states in employment concentration in this industry, while Connecticut and Massachusetts are ranked in the top ten in actual employment size. Each job in medical service and health insurance creates an additional 3.13 jobs in other sectors, while each dollar of output generates an additional \$1.81. Much of this success depends on the rate of return most companies make on their investments. In the case of health insurance, most publicly traded companies in the industry profit from their premiums and therefore, are able to make such high investments.

Companies in this industry are obligated to hire the necessary services and equipment from other industries needed to run their businesses. Aside from underwriters, actuaries and insurance brokers, companies would utilize the need for transportation and utility services, building maintenance, high-tech supplies such as computers, electronic gadgets and other office equipment. Thus, although Connecticut employs 9,600 workers in this field, its overall impact on the economy after applying the employment multiplier is significantly higher, producing over 39,700 jobs. Similarly, although New England employs 28,500 workers in the medical service and health insurance sectors, their total impact accrues to about 117,800 jobs after the multiplier effect ripples through the economy.

Of the 1,726,200 jobs created through the total employment impact (direct + indirect + induced) of New England's health care sector, 74 percent or 1,270,500 jobs reside in Massachusetts and Connecticut. Similarly, 77 percent or \$93.4 billion of output generated from health care's total output impact come from industries based in Massachusetts and Connecticut.

The following chart portrays how the total impact of New England's health care employment and output are distributed among its six states:



The Economic Contributions of Health Care to New England

New England Multiplier Analysis Regional Health Care Employment and Output, 2001

State	Employment				Output			
	Direct Impact (Ths.)	Indirect Impact (Ths.)	Induced Impact (Ths.)	Total Impact (Ths.)	Direct Impact (Bill.)	Indirect Impact (Bill.)	Induced Impact (Bill.)	Total Impact (Bill.)
Massachusetts	393.1	168.6	287.8	849.5	26.6	12.7	21.2	60.5
Connecticut	193.2	84.4	143.4	421.0	14.5	6.9	11.5	32.9
New Hampshire	59.6	25.8	44.3	129.7	3.5	1.7	2.9	8.1
Rhode Island	56.9	22.4	38.5	117.8	3.1	1.6	2.5	7.3
Vermont	31.7	11.6	21.2	64.6	1.6	0.7	1.3	3.7
Maine	66.8	28.8	48.1	143.6	3.7	1.9	3.0	8.6
New England	801.3	341.7	583.3	1726.2	53.0	25.5	42.5	121.0



4. Innovation Pipeline Analysis

As stated in the introduction to the Industry Analysis section of this report, leading states in New England are exceptionally well positioned to capitalize on the promise of health care innovations. In areas such as funding, investment, concentrations of bioscience specialists, knowledge resource pools and rates of technology commercialization, the region is asset rich in terms of its capacity to innovate and is a high performer in terms of its ability to prepare health care science innovations for the commercial marketplace.

This final narrative section of the report analyzes the comparative strengths and weaknesses of the region's "innovation pipeline"—the support infrastructure and outcome measures that reflect the ability of the region to capitalize on its strengths in life science knowledge and inventiveness.

Funding

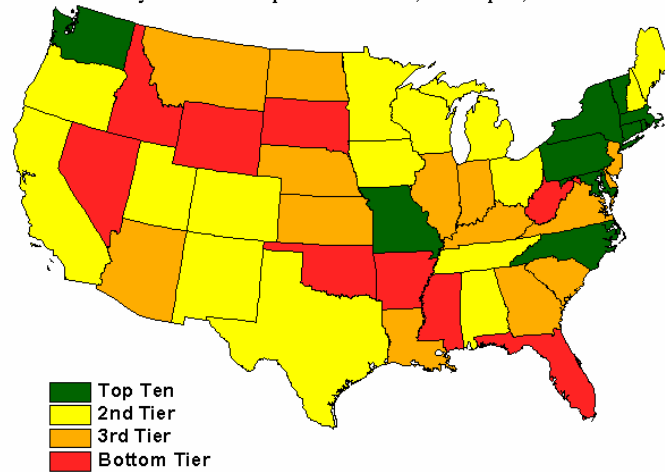
Funding in the context of our analysis relates to money spent on health care industry activities that are not necessarily tied to a specific commercial outcome (though these activities may be of tremendous commercial and economic importance). For example, the Bethesda, Maryland-based National Institutes of Health (NIH) disperses monetary awards to support "basic, applied and clinical and health services research" in line with the organization's mission "to understand the processes underlying human health and to acquire new knowledge to help prevent, diagnose and treat human diseases and disabilities."¹⁰ The spending goals are thus to cure disease, not necessarily produce marketable innovations. In the process of searching for disease cures, however, commercially viable innovations often emerge.

¹⁰ US Department of Health and Human Services, National Institutes of Health: <http://www.nih.gov/> (accessed February 2003).



National Institutes of Health Awards

By State of Recipient Institution, Per Capita, 2001



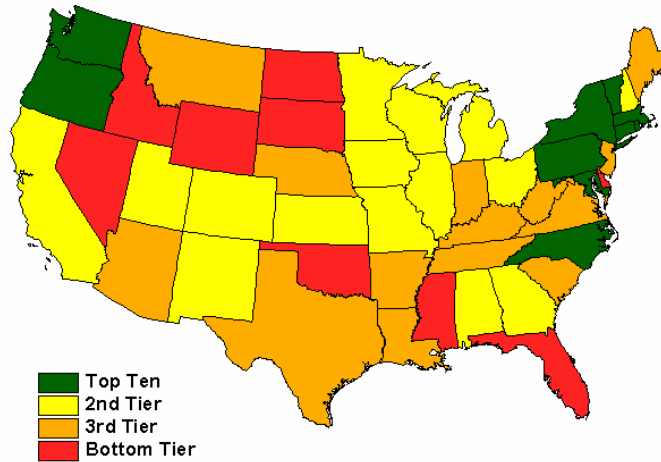
With regard to NIH award funding, the New England region does outstandingly well. Averaged out on a per capita basis, no fewer than four states—Massachusetts, Connecticut, Vermont, and Rhode Island—score among the nation’s top ten for monetary value of NIH awards received. First-ranked Massachusetts received almost 50 percent more in award value per capita than the next most highly ranked state, Maryland. Even the lower ranked New England states of New Hampshire (18th) and Maine (21st) fall within the top half of all scores, testifying to the general robustness of the region’s positioning in this category. All told, the region is in receipt of \$2.3 billion in awards. Leading regionally based award recipients include Harvard University (\$270 million), Yale University (\$256 million), and Massachusetts General Hospital (\$209 million).¹¹ Other top ten states for NIH awards include Pennsylvania, Washington, Missouri and North Carolina.

¹¹ Amounts are according to the most current NIH data at the time of going to press, that for fiscal year 2001.



R&D Expenditures on Human Services

By U.S. Department of Health, \$US per Capita, 2000

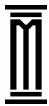


The region does similarly well in terms of federal funding that is dedicated to support research and development (R&D). Massachusetts, Connecticut and Vermont all rank among the top five states in terms of per capita spending on university-based R&D for the life sciences (see above and relevant maps in the Appendix section). As the Milken Institute's *State Science and Technology Index* recently reported on federally funded R&D in the U.S.:

Nearly \$15.5 billion of all R&D at doctorate-granting universities was spent on research relating to the life sciences, or an average per capita figure of \$55.85. In excess of 57 percent of all institutional R&D at doctorate-granting universities was spent on life sciences projects. Life science programs throughout the country are by far the largest recipients of R&D funds.¹²

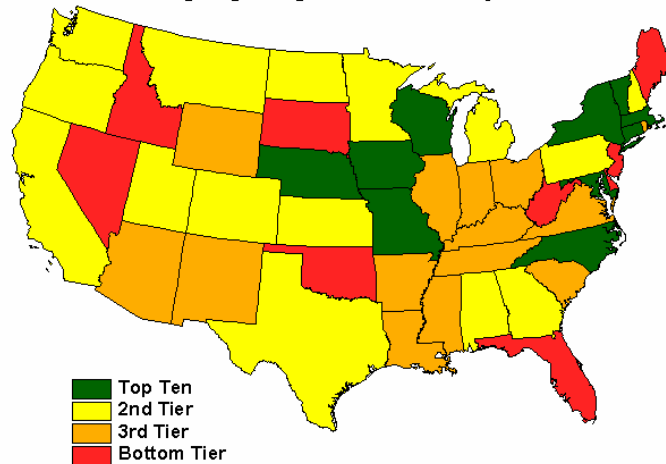
New England is exceptionally well positioned to capture the disproportionate funding flow for R&D in the life sciences. Its block of second, third and fourth ranked state recipients for R&D expenditures in life science (Massachusetts, Connecticut, Vermont) all individually earn more than \$90 per capita in funding. Rounding out the top five of R&D states are first-ranked Maryland and fifth-ranked North Carolina.

¹² Ross DeVol, *State Science and Technology Index* (Milken Institute, 2002): 63.



R&D Expenditures on Life Sciences

At Degree-granting Institutions, Per Capita, 2000



With regard to the growth underpinning such standings, the Massachusetts Technology Collaborative reports:

Since 1993, total health R&D funding for Massachusetts has increased a total of 77.4 percent, second only to New Jersey (93.3 percent). From 1997 to 2000, HHS funding per capita for Massachusetts increased 38.4 percent, second only to New Jersey at 57.1 percent. Total federal health care R&D expenditures in Massachusetts were approximately \$1.5 billion in 2000, placing the state second among the LTS in total federal health care R&D funding (California ranked first with just over \$2.0 billion).¹³

Maintaining adequate growth in R&D funding is crucial for the region to hold onto or expand its strong showing in this dimension of its innovation pipeline.

Investment

Investment in the region's innovation capacity refers to money that is funneled to organizations, typically for-profit enterprises, that supply health care products and services. Whereas the "funding" levels addressed above indicate the degree to which innovation in the region's health care sectors is supported by the federal government, "investment" levels provide indications of how highly the marketplace values the region's innovation efforts.

Boston, one of the nation's premier centers for venture capital (VC) investment, experienced a nearly three-fold growth in its levels of annual biopharmaceutical VC

¹³ Massachusetts Technology Collaborative, *Index of the Massachusetts Innovation Economy, 2002*: 50.



investment for the years 1995-2000.¹⁴ On a per capita basis, Massachusetts attracts the highest level of venture capital investment for the biotech industry in the nation. Another New England stronghold for VC funding, Rhode Island, brings in more per capita funding than such established biopharma states as New Jersey and Maryland.

VC Investment in Biotech Industry
By New England and Leading Tech. States, 2002 YTD

\$'s	
State	Per Capita
Massachusetts	60.59
California	26.43
Rhode Island	21.15
New Jersey	17.30
Maryland	15.20
Pennsylvania	11.90
Colorado	6.13
New Hampshire	5.56
New York	5.54
Maine	2.33
Indiana	1.34
Utah	1.15
Connecticut	1.02
Vermont	0.00

Source: PricewaterhouseCoopers

Although our industry analysis of the medical devices industry indicates that increasing pressures are hindering growth, it is reassuring to observe that venture capital continues to flow at unusually high levels. As with VC biotech investment, VC investment in the medical devices industry is highest in Massachusetts. Rhode Island likewise again outperforms the Mid Atlantic biotech heavyweights of New Jersey and Maryland in this category, as do the states of Connecticut and New Hampshire. Given the cost sensitivities of the medical device sector, it is important that the region continue these levels of risk capital investment. Ways should also be found to adequately support not just the new enterprise formation and R&D in the region's medical device industry (where VC money tends to be directed), but the components involved in finished product manufacturing and commercialization as well. Indeed, indicators show that although the region does outstandingly well in terms of VC investment for medical devices, it does less well in terms of the necessary approvals for product commercialization.

¹⁴ Brookings Institution, "Profile of Biomedical Research and Biotechnology Commercialization," 2002; cited in Massachusetts Biotechnology Council, *Mass Biotech 2010* (Massachusetts Biotechnology Council, 2002): 10.



VC Investment in Med. Devices Industry

By New England and Leading Tech. States, 2002 YTD

\$'s	
State	Per capita
Massachusetts	27.57
California	18.62
Rhode Island	13.60
Connecticut	8.20
Colorado	6.61
New Hampshire	0.08
New Jersey	0.06
Maryland	0.02
Maine	0.00
Vermont	0.00

Source: PricewaterhouseCoopers

Although it is impossible to say definitively how much funding and investment aid in the innovation process, the high level of money channeled to the region coincides with an extremely strong showing in patents for the region's anchor states of Massachusetts and Connecticut. As research by the Massachusetts Technology Collaborative reveals, the number of patents issued to residents in Massachusetts and Connecticut puts the states in first and second place respectively. Not only does this indicate a robustly innovative technology environment in general, but in the case of Massachusetts, the largest share of patents goes to health care industries, an indication that the state is especially innovative in this field.¹⁵

Specialist Intensity

Ultimately, whatever money (funding or investment) flows into New England's health care industries, such financing will only be useful if it effectively supports the work of people who create the innovations that take these industries forward. Innovators are hardly limited to fields of scientific endeavor, but in a technology-driven industry like health care, scientific specialists are at the heart of the knowledge fermentation and technical inventiveness that is crucial to the industry's innovative capacity.

As noted in the Milken Institute's *State Science and Technology Index*:

Knowledge and the innovation capacities of human capital are at the core of the new intangible-based economics of place. In the old tangible-based economy, human capital was not seen as a reservoir of talent exploitable

¹⁵ Massachusetts Technology Collaborative, *Index of the Massachusetts Innovation Economy*, 2002: 31.

Regional Medical Schools Stand Strong

According to the Association of American Medical Colleges, the New England region has more than 11,000 medical school faculty, of whom nearly 90 percent focus on clinical instruction.* Massachusetts has the largest concentration of faculty (71 percent) followed by Connecticut (15 percent).

The sizable presence of medical experts is impressive in its own right, but even more so when considering the quality of the institutions with which they are affiliated. *US News and World Report* ranks seven out of the region's nine medical schools among the top 50 in the nation for research. Within this group, Harvard Medical School (which is the affiliation of about half of all faculty in the region) ranks number one and Yale (the third largest employer) ranks ninth.

Medical School Faculty Employment
New England, 2001

Med. School	BASIC	CLINICAL	OTHER	TOTAL
Harvard	508	5000	1	5509
Tufts	142	805	1	948
Boston Univ.	165	775	4	944
Yale	140	699	1	840
Univ. of Conn.	126	678	1	805
Dartmouth	82	554	3	639
Univ. of Mass.	125	472	3	600
Brown	80	489	2	571
Univ. of Vermont	107	263	1	371
Total	1475	9735	17	11227

Sources: AAMC, New England Healthcare Institute.

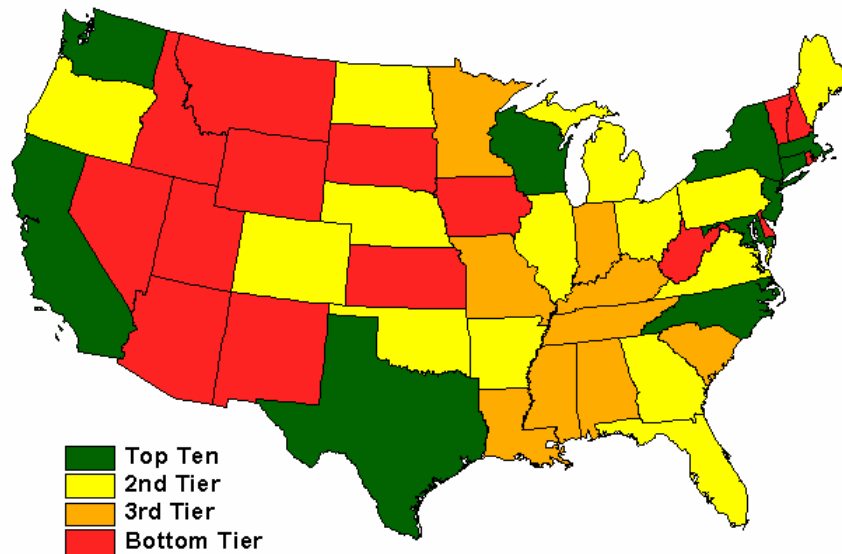
*The total figure is somewhat conservative considering that it excludes practitioners and researchers whose primary appointments are outside their schools of affiliation.
Sources: Association of American Medical Colleges, *US News and World Report*.



for economic development. In contrast, today a state or region's most important source of competitive advantage is the knowledge embedded in its people (intellectual capital). In contrast to the past, where firms and industry agglomerations attracted people, the intangible-based economy's dynamic is that concentrations of talent are attracting firms.¹⁶

The figures for the region's position in terms of human capital for its health care industries are encouraging. As a percentage of a state's workforce, the New England states of Massachusetts, Connecticut, New Hampshire and Maine tend to rank well in various health care-related scientific fields. Massachusetts has the nation's most intense concentration of medical scientists and biomedical engineers with 106 medical scientists and 21 biomedical engineers per 100,000 working population. Connecticut is another top-ten ranking state in both categories and New Hampshire has the third largest concentration of biomedical engineers.

Intensity of Medical Scientists per 100,000 Workforce, 2000

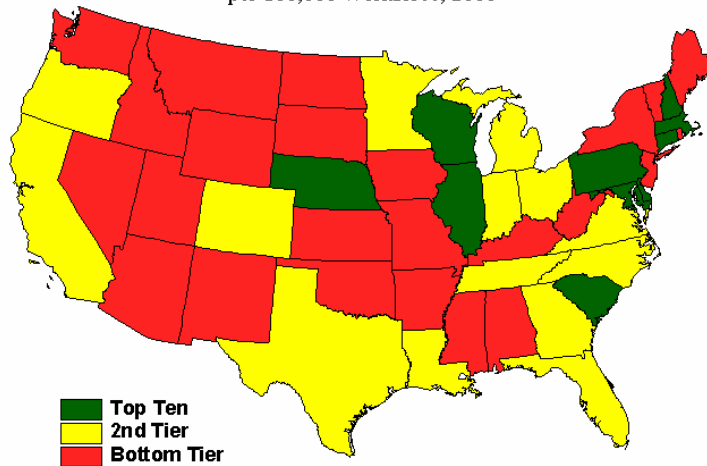


¹⁶ DeVol, *State Science and Technology Index*: 22.



Intensity of Biomedical Engineers

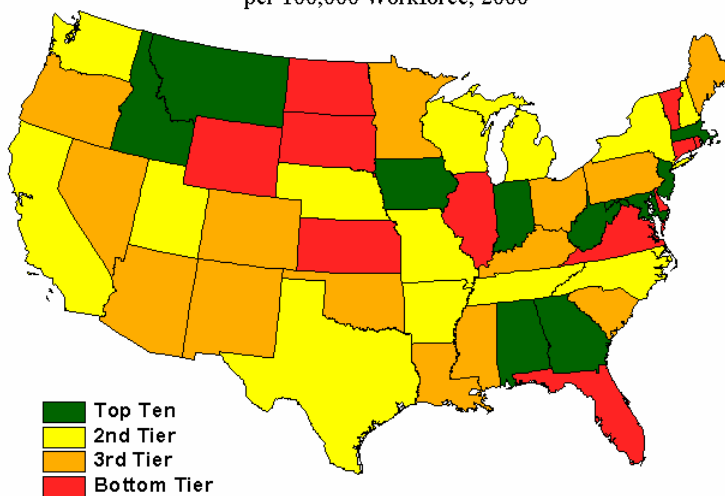
per 100,000 Workforce, 2000



Maine does proportionally well in terms of its intensity of biochemists and biophysicists—it is in fact the only New England state to place in the top ten. It also manages to place in the top half of the nation in terms of its proportion of microbiologists and medical scientists. Massachusetts and New Hampshire also rank high in their intensity of microbiologists. Maine’s strong showing in these specialized fields shows how a state need not be an existing biotech powerhouse to attract the most important form of capital for innovation: human capital.

Intensity of Microbiologists

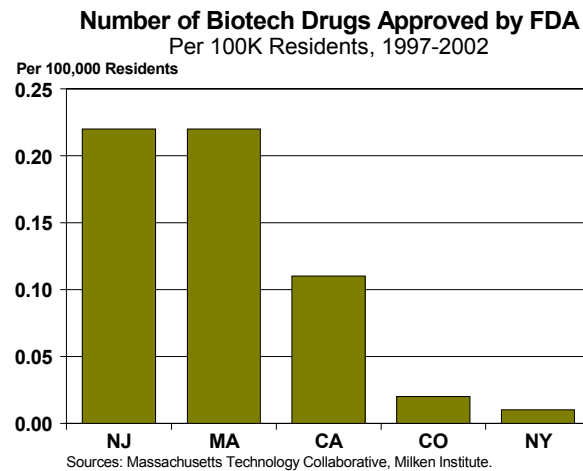
per 100,000 Workforce, 2000





Commercialization Potential

For health care product innovations to be commercialized requires progression through a complex approvals process governed by the federal Food and Drug Administration (FDA). The thrust of innovation activity in the pharmaceutical and health care research and testing services industries is to produce new drugs, which require approval from the FDA's Center for Drug Evaluation and Research. Given the societal ramifications of new medicines, the center's "NDA" (New Drug Approval) process is extensive and thorough, combining experimental clinical trials and rigorous review procedures. To gain approval requires high quality innovation output and extensive coordination between relevant entities—not only among innovators and government bureaucracies, but also between the drugs, RTS and hospital sectors. Regions with effective government rapport and strong intra-industry connections stand the best chance for moving their biotechnology innovations to market sooner.

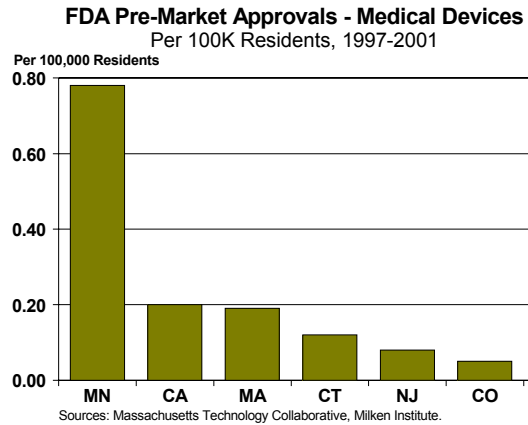
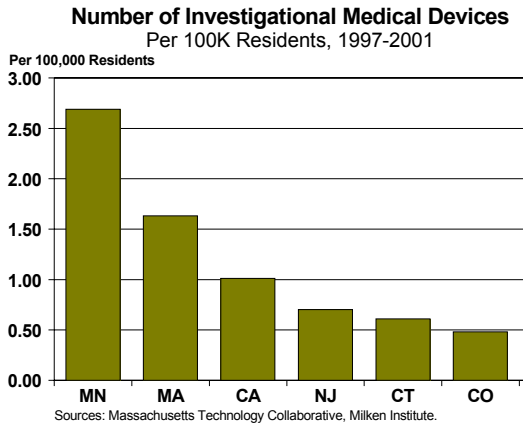


On a per capita basis, Massachusetts ties for first in the nation (when ranked against other leading technology states) for the number of new biotech drugs granted FDA approval. Its approval statistics are twice as high as the next ranking state, California. Other leading states for approval include New Jersey, Colorado, and New York. (Connecticut received no drug approvals for the time frame measured: 1997-2002.) Nevertheless, this positioning is far from unchallenged. Massachusetts' score in fact ties with that for New Jersey. Moreover, if the per capita adjustment is removed, then in absolute numbers of drugs approved, California (with 39 drugs approved) moves to first place and in fact dwarfs the Bay State (with 14 drugs approved) by a greater than 2:1 margin. Solidifying and where possible expanding upon Massachusetts' strengths in developing new drugs and navigating the approval process will be necessary to protect the New England region's competitive edge in the hotly contested field of drug development.

In the area of new medical devices, two categories of FDA approval are especially important: that for investigational device exemptions (IDEs) and that for premarket approvals (PMAs). As with drug approvals, approval rates for medical devices reflect the



strength of a region's ability to maneuver through the complex approval process as well as the synergism of its intra-industry links. For medical device innovations, interaction between device manufacturers and teaching hospitals, the typical location for clinical trials, is particularly valuable.



Massachusetts and Connecticut both rank among the nation's leading technology states in regards to investigational device exemptions (IDEs) and premarket approvals (PMAs) for medical devices. Massachusetts demonstrates noticeable strength, consistently placing among the top three of states in both categories. Such favorable positioning is once again not unqualified, however. The leading state in both categories, Minnesota, is ahead by a large degree (Minnesota's per capita rate of premarket approvals is more than four times that of Massachusetts and 2.5 times that of Massachusetts and Connecticut combined). California also scores slightly higher than Massachusetts for per capita PMAs. The less than superlative showing for premarket approvals is ironic in light of Massachusetts' top score for per capita venture capital investment in the medical device industry, indicating an area of relative imbalance in the region's innovation pipeline. California's lower per capita investment coupled with higher PMA attainment indicates that the state is effectively able to "do more with less." Among various steps that could be taken to address the situation are to explore the nature of California's and Minnesota's medical device industries, their approval application techniques, and their linkages to their regional health care industries. These deserve to be explored in an effort to understand how the New England region might improve its competitive positioning.



5. Conclusion

The health care industry is clearly of major importance to New England's economy and society. As the number one health care center in the nation—and in many respects, the world—New England faces tremendous opportunities and challenges in preserving its leadership in health care goods, services, and innovation. Ensuring that the health care industry continues to contribute to the New England region should be a top priority for citizens and business and community leaders.

In moving forward, key points to bear in mind about the industry's value and competitiveness include the following:

- Health care is a growing industry that disproportionately benefits the region.
- The region enjoys superlative positioning. New England ranks first among nine U.S. regions for the percentage of people directly employed by health care sectors. The region's principal city for the industry, Boston, is the nation's top-ranked health pole.
- Although industrial activity in the region often gravitates around the two major health pole clusters of Boston and New Haven-Meriden, the industry's impact spreads throughout the region.
- More than 800,000 jobs throughout the region are in health care fields, representing over 11 percent of all regional employment. No less than five New England states—Rhode Island, Massachusetts, Connecticut, Maine, and Vermont—place in the top 10 states in the nation for percentage of workers directly employed by health care sectors. Even New Hampshire's 18th place showing puts it firmly in the top half of the nation regarding health care employment.
- When accounting for the cumulative effects of health care employment, the impact on the region is even greater. 1.7 million people, 25 percent of the overall workforce, have jobs that are dependent upon the health care industry. The cumulative effects that apply to output value also means that the industry's annual \$53 billion in revenues is responsible for more than \$121 billion in gross regional product.
- The health care industry in the region is highly interdependent—both across sectors and across the states where these sectors reside. How a given health care sector performs in one state, will have a profound impact on other sectors and other state economies.
- The region not only leads in the health care industry overall, it has especial strengths as a center for innovation. For example, three New England states—Massachusetts, Connecticut and Vermont—all rank among the top five states in



terms of per capita spending on university-based R&D for the life sciences. The region also does exceedingly well in directing venture capital investments to key sectors for innovation such as biotechnology. The intensity of highly trained professionals and workers adds to New England's unique innovation capacity in the biosciences.

- There are significant threats to the industry that need addressing. Although New England ranks first among nine U.S. regions in the percentage of people directly employed in the health care industry, the region ranks last in employment growth. Since the early 1980s, New England's share of national health care employment has been declining. The region's leadership should seek out means to reverse the decline in New England's health care employment growth rate; otherwise, the region's favorable competitive positioning will decline as well.
- High rates of investment for health care science innovation have yet to translate into correspondingly high rates of growth in jobs or, in some categories, new technology commercialization. Ways to improve the functioning of the region's innovation pipeline need to be pursued.
- High costs and regulatory issues also are squeezing firms out of the region, particularly those involved in mass manufacturing. Labor-intensive health care work is subsequently declining, going to other states and parts of the world eager to attract these jobs. Leaders need to determine how to make the region attractive to the full-breadth of health care industrial activity.

This study validates the importance of the health care industry to the vitality of New England's economy. It also identifies some of the threats to the industry's future growth. Policy makers, industry leaders and other stakeholders must marshal their talents and resources to address such pressing questions as:

- What should New England do to maintain its national leadership in health care employment?
- What can be done to reverse the decline in New England's health care employment growth rate?
- How can the region be made more attractive to health care employers?

Innovative and collaborative cross-regional approaches for preserving and fostering industry growth must also be sought. By working together to retain and attract health care jobs, the New England region can be more powerful than the sum of its parts.



6. Appendix



Appendix - Drugs Profile

Drugs

Top States Ranked by Employment Concentration, 2001

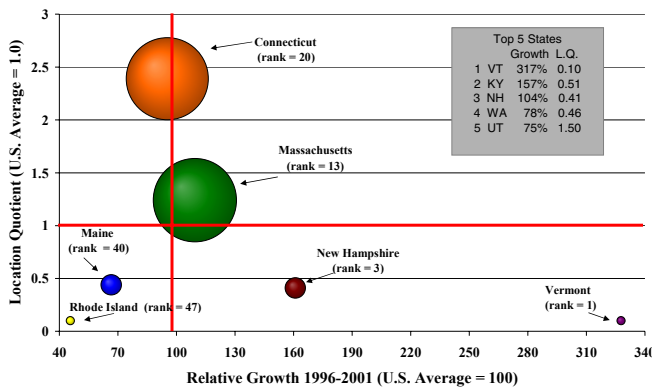
Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	New Jersey	4.96	1.2	48.3
2	Delaware	4.63	1.1	4.7
3	Indiana	2.58	0.6	18.3
4	Connecticut	2.39	0.6	9.7
5	Pennsylvania	2.03	0.5	28.0
6	North Carolina	1.61	0.4	15.3
7	Utah	1.50	0.4	3.9
8	Illinois	1.49	0.4	21.6
9	Massachusetts	1.24	0.3	10.0
10	Michigan	1.23	0.3	13.7
22	Maine	0.44	0.1	0.6
25	New Hampshire	0.41	0.1	0.6
40	Vermont	0.10	0.03	0.1
41	Rhode Island	0.10	0.02	0.1

Sources: Economy.com, Milken Institute.

- Massachusetts and Connecticut are among the nation's leading pharmaceutical states. The two states together employ 19,700 in the pharma industry.
- Vermont and New Hampshire are among the top five in the nation in pharmaceutical employment growth from 1996-2001.
- Boston, New London and New Haven have successfully contributed to their state's performance. They are ranked among the top twenty metropolitan areas in the health pole index for drugs.

Drug Industry Profile

Employment - Concentration, Size, and Growth



Drugs

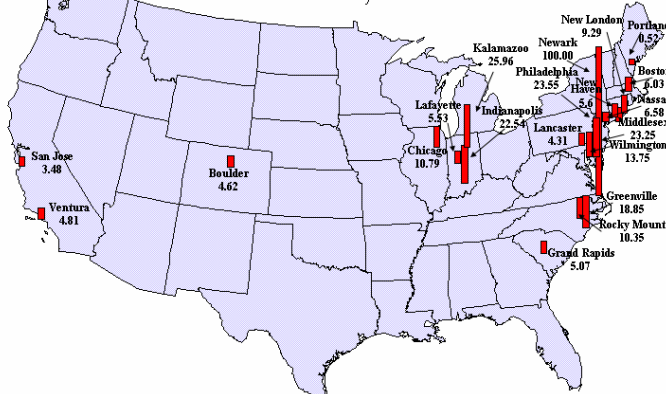
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Vermont	2650.0	0.0	2650.0	316.7	36.4
2	Kentucky	1199.3	-2.8	1236.2	157.4	18.7
3	New Hampshire	1561.8	76.5	841.7	104.2	11.0
4	Washington	926.2	166.4	285.2	78.2	8.6
5	Utah	246.2	-28.3	382.6	75.4	7.0
6	Alabama	175.8	-8.1	200.0	58.3	6.4
7	Oregon	244.1	-14.1	300.7	57.4	14.7
8	West Virginia	334.7	63.8	165.4	54.5	7.6
9	Delaware	498.9	91.2	213.2	51.6	9.4
10	California	120.0	26.8	73.4	50.9	4.5
13	Massachusetts	201.7	5.8	185.2	38.6	5.2
20	Connecticut	81.2	41.4	28.2	20.7	0.2
40	Maine	116.6	-4.1	125.8	-15.8	-6.5
47	Rhode Island	-57.5	-17.0	-48.8	-42.3	2.7
<i>New England</i>		126.1	26.1	79.4	27.9	2.7
<i>United States</i>		59.0	20.9	31.5	22.9	2.6

Sources: Economy.com, Milken Institute.

Drugs

Health Pole, 2001



Drugs

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Newark NJ	100.00
2	Kalamazoo-Battle Creek MI	25.96
3	Philadelphia PA-NJ	23.55
4	Middlesex-Somerset-Hunterdon NJ	23.25
5	Indianapolis IN	22.54
6	Greenville NC	18.85
7	Wilmington-Newark DE-MD	13.75
8	Chicago IL	10.79
9	Rocky Mount NC	10.32
10	New London-Norwich CT-RI	9.29
11	Nassau-Suffolk NY	6.58
12	Boston MA-NH	6.03
13	New Haven-Meriden CT	5.60
14	Lafayette IN	5.53
15	Grand Rapids-Spartanburg-Anderson SC	5.07
16	Ventura CA	4.81
17	Boulder-Longmon CO	4.62
18	Lancaster PA	4.31
19	San Jose CA	3.48
20	New York NY	3.02

Sources: Milken Institute, Economy.com.

Appendix - Research & Testing Services Profile

Research & Testing Services

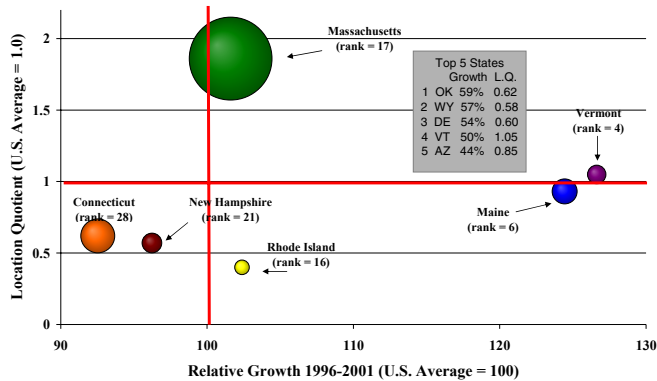
Top States Ranked by Employment Concentration, 2001

Rank	State	Location		Emp. (Ths.)
		Quotient	% of State Total Emp.	
1	Wash., D.C.	5.28	2.7	17.5
2	Idaho	3.64	1.9	10.8
3	New Mexico	2.81	1.4	10.9
4	Maryland	2.04	1.0	25.7
5	New Jersey	2.04	1.0	41.7
6	Massachusetts	1.86	0.9	31.6
7	Washington	1.60	0.8	22.3
8	New York	1.30	0.7	57.3
9	Colorado	1.28	0.7	14.6
10	California	1.27	0.6	96.0
12	Vermont	1.05	0.5	1.6
14	Maine	0.93	0.5	2.9
26	Connecticut	0.62	0.3	5.3
32	New Hampshire	0.57	0.3	1.8
38	Rhode Island	0.40	0.2	1.0

Sources: Economy.com, Milken Institute.

- Massachusetts has the 6th largest employment concentration in research and testing services (R&D).
- Vermont and Maine were among the fastest growing states in R&D employment growth from 1996-2001.
- Boston ranks as the 6th largest metro in the research and testing health pole index. It is nearly 35 percent the size of Washington D.C., which ranks 1st on the health pole index.

Research & Testing Services Profile
Employment - Concentration, Size, and Growth



Research & Testing Services

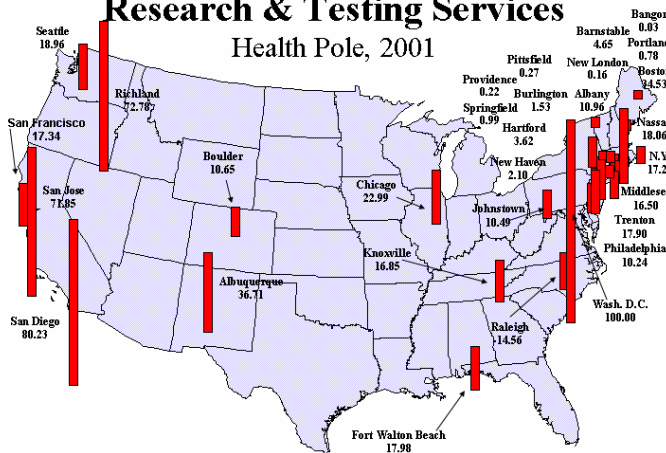
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Oklahoma	182.9	54.5	83.1	59.4	12.6
2	Wyoming	402.4	64.3	205.8	57.1	15.6
3	Delaware	412.9	206.0	67.6	53.9	8.0
4	Vermont	435.6	90.3	181.5	50.4	8.2
5	Arizona	450.0	147.7	122.1	44.1	7.2
6	Maine	545.8	218.9	102.5	43.3	7.2
7	Montana	110.2	21.6	72.9	36.8	9.9
8	New Jersey	51.3	44.7	4.6	32.7	4.0
9	Colorado	80.9	21.1	49.3	31.2	4.6
10	Georgia	265.9	140.5	52.2	30.5	7.9
16	Rhode Island	-41.7	-35.5	-9.7	18.9	8.2
17	Massachusetts	130.5	91.6	20.3	18.0	4.7
21	New Hampshire	437.0	315.4	29.3	11.8	0.4
28	Connecticut	18.1	18.8	-0.6	7.5	2.5
New England		110.7	72.3	22.3	18.7	4.6
United States		74.9	48.7	17.6	17.7	4.4

Sources: Economy.com, Milken Institute.

Research & Testing Services

Health Pole, 2001



Research & Testing Services

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metroplian Area	Health Pole
1	Washington DC-MD-VA-WV	100.00
2	San Diego CA	80.23
3	Richland-Kennewick-Pasco WA	72.78
4	San Jose CA	71.85
5	Albuquerque NM	36.71
6	Boston MA-NH	34.53
7	Chicago IL	22.99
8	Seattle-Bellevue-Everett WA	18.96
9	Nassau-Suffolk NY	18.06
10	Fort Walton Beach FL	17.98
11	Trenton NJ	17.90
12	San Francisco CA	17.34
13	New York NY	17.26
14	Knoxville TN	16.85
15	Middlesex-Somerset-Hunterdon NJ	16.50
16	Raleigh-Durham-Chapel Hill NC	14.56
17	Albany-Schenectady-Troy NY	10.96
18	Boulder-Longmont CO	10.65
19	Johnstown PA	10.49
20	Philadelphia PA-NJ	10.24

Sources: Milken Institute, Economy.com.

Appendix - Medical Instruments & Supplies Profile

Medical Instruments & Supplies

Top States Ranked by Employment Concentration, 2001

Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Utah	3.74	0.8	8.8
2	Minnesota	3.65	0.8	21.3
3	Connecticut	2.30	0.5	8.4
4	Massachusetts	1.85	0.4	20.8*
5	New Jersey	1.78	0.4	15.6
6	Indiana	1.75	0.4	11.2
7	Nebraska	1.69	0.4	3.4
8	California	1.58	0.3	51.0
9	Colorado	1.41	0.3	6.9
10	Pennsylvania	1.28	0.3	15.9
13	Vermont	1.18	0.3	0.8
14	Rhode Island	1.14	0.2	1.2
25	New Hampshire	0.66	0.1	0.9
36	Maine	0.34	0.1	0.4

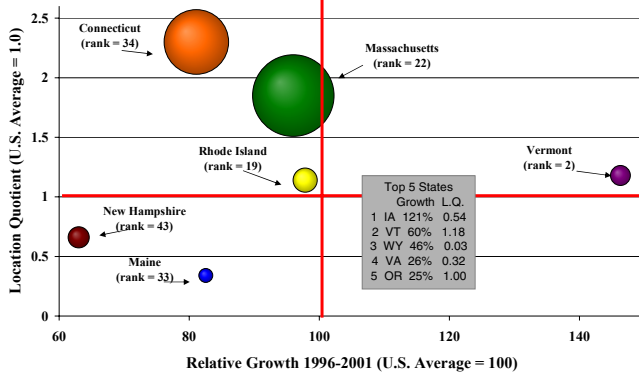
Sources: Economy.com, Milken Institute.

- Connecticut and Massachusetts are among the top five states with the highest employment concentration in the medical supplies industry.
- Vermont is the second fastest growing state in terms of medical instruments and supplies employment. Connecticut, on the other hand, has lagged in growth relative to the U.S.
- New Haven and Boston are among the top 20 metros in the industry's health pole index.

*Estimate for Massachusetts comes from the 1997 Economic Census from the U.S. Dept. of Commerce which is based on the North American Industry Classification System (NAICS).

Medical Instruments & Supplies Profile

Employment - Concentration, Size, and Growth



Medical Instruments & Supplies

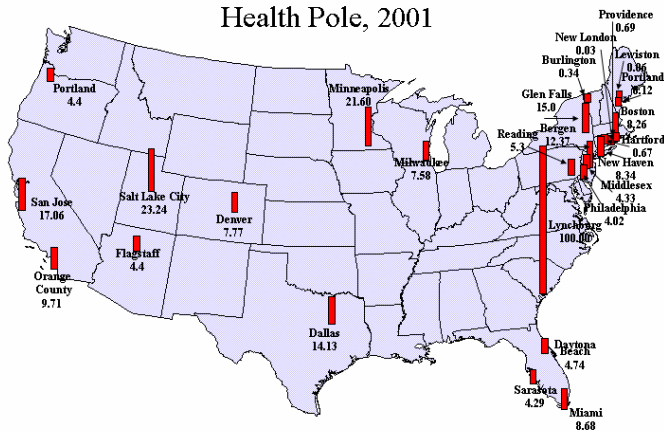
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Iowa	845.1	151.4	275.9	121.0	5.7
2	Vermont	335.3	148.1	75.5	59.9	13.3
3	Wyoming	850.0	50.0	533.3	46.2	0.0
4	Virginia	310.3	114.7	91.1	25.5	-3.0
5	Oregon	72.8	2.1	69.2	24.9	8.8
6	West Virginia	367.6	118.9	113.6	24.8	1.7
7	California	89.9	50.7	26.0	24.5	4.5
8	Pennsylvania	34.8	0.7	33.8	21.3	3.3
9	Arizona	232.9	62.6	104.7	18.6	3.6
10	Minnesota	180.0	64.7	70.0	17.6	2.9
19	Rhode Island	48.2	27.4	16.4	6.9	-5.7
22	Massachusetts	48.8	56.8	-5.1	4.9	3.6
33	Maine	78.5	105.4	-13.1	-9.9	-4.1
34	Connecticut	15.0	14.4	0.5	-11.4	-2.4
43	New Hampshire	-41.8	36.5	-57.4	-31.1	-3.0
	New England	30.7	38.5	-5.7	-2.1	0.9
	United States	71.0	47.5	15.9	6.7	1.0

Sources: Economy.com, Milken Institute.

Medical Instruments & Supplies

Health Pole, 2001



Medical Instruments & Supplies

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Lynchburg VA	100.00
2	Salt Lake City-Ogden UT	24.34
3	Minneapolis-St. Paul MN-WI	21.60
4	San Jose CA	17.06
5	Glen Falls NY	15.00
6	Dallas TX	14.13
7	Bergen-Passaic NJ	12.37
8	Orange County CA	9.71
9	Miami FL	8.68
10	New Haven-Meriden CT	8.34
11	Boston MA-NH	8.26
12	Denver CO	7.77
13	Milwaukee-Waukesha WI	7.58
14	Reading PA	5.30
15	Daytona Beach FL	4.74
16	Portland-Vancouver OR-WA	4.40
17	Flagstaff AZ-UT	4.40
18	Middlesex-Somerset-Hunterdon NJ	4.33
19	Sarasota-Bradenton FL	4.29
20	Philadelphia PA-NJ	4.02

Sources: Milken Institute, Economy.com.

Appendix – Medical Service & Health Insurance Profile

Medical Service & Health Insurance

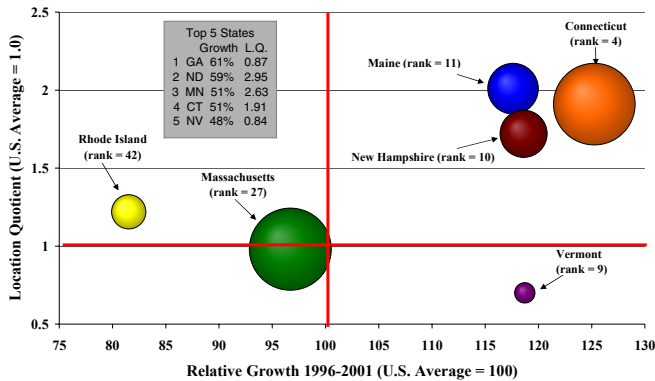
Top States Ranked by Employment Concentration, 2001

Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Nebraska	3.38	1.0	9.2
2	North Dakota	2.95	0.9	2.9
3	Minnesota	2.63	0.8	21.0
4	Maine	2.01	0.6	3.7
5	Connecticut	1.91	0.6	9.6
6	Delaware	1.88	0.6	2.3
7	South Carolina	1.81	0.5	9.9
8	Pennsylvania	1.76	0.5	29.9
9	New Hampshire	1.72	0.5	3.2
10	Wisconsin	1.65	0.5	14.0
14	Rhode Island	1.22	0.4	1.7
21	Massachusetts	0.98	0.3	9.7
41	Vermont	0.70	0.2	0.6

Sources: Economy.com, Milken Institute.

- Maine, Connecticut and New Hampshire all rank in the top ten in employment concentration.
- Connecticut's medical service and health insurance sector grew by more than 50 percent from 1996-2001, making it the fourth fastest growing state in the industry.
- New Haven and Boston are among the nations leading metros in the health pole index, ranking 17th and 18th, respectively.

Medical Services & Health Insurance Profile
Employment - Concentration, Size, and Growth



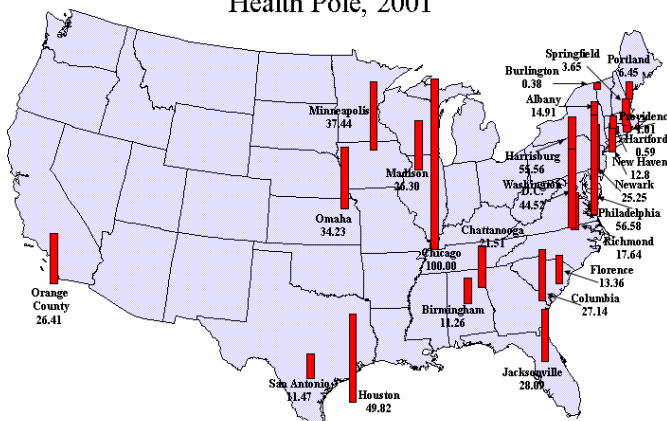
Medical Services & Health Insurance

Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Georgia	461.8	51.3	271.4	60.8	9.0
2	North Dakota	347.6	53.2	192.3	58.8	5.6
3	Minnesota	673.1	127.8	239.3	51.4	9.6
4	Connecticut	441.7	112.1	155.4	50.7	8.5
5	Nevada	846.5	136.4	300.3	48.2	8.0
6	North Carolina	273.3	20.9	208.7	45.7	5.8
7	Arizona	877.5	275.7	160.2	45.2	5.9
8	Florida	620.9	178.4	159.0	44.5	3.0
9	Vermont	693.3	334.7	82.5	43.0	4.5
10	New Hampshire	229.6	27.3	159.0	42.7	7.8
11	Maine	428.8	101.9	162.0	41.6	7.8
27	Massachusetts	54.1	-0.3	54.6	16.4	6.3
42	Rhode Island	52.6	54.7	-1.4	-1.9	0.9
<i>New England</i>		158.6	34.7	92.0	31.2	7.0
<i>United States</i>		170.0	70.2	58.6	21.5	2.9

Sources: Economy.com, Milken Institute.

Medical Services & Health Ins. Health Pole, 2001



Medical Services & Health Insurance

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Chicago IL	100.00
2	Philadelphia PA-NJ	56.58
3	Harrisburg-Lebanon-Carlisle PA	55.56
4	Houston TX	49.82
5	Washington DC-MD-VA-WV	44.52
6	Minneapolis-St. Paul MN-WI	37.44
7	Omaha NE-IA	34.23
8	Jacksonville FL	28.09
9	Columbia SC	27.14
10	Orange County CA	26.41
11	Madison WI	26.30
12	Newark NJ	25.52
13	Chattanooga TN-GA	21.51
14	Richmond-Petersburg VA	17.64
15	Albany-Schenectady-Troy NY	14.91
16	Florence SC	13.36
17	New Haven-Meriden CT	12.80
18	Boston MA-NH	11.87
19	San Antonio TX	11.47
20	Birmingham AL	11.26

Sources: Milken Institute, Economy.com.

Appendix - Offices & Clinics of Medical Doctors Profile

Offices & Clinics of Doctors

Top States Ranked by Employment Concentration, 2001

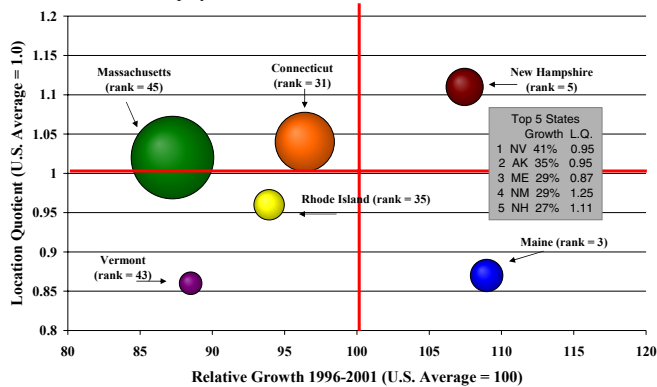
Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Minnesota	1.42	2.1	57.7
2	Hawaii	1.41	2.1	11.9
3	New Mexico	1.25	1.9	14.4
4	Florida	1.22	1.8	133.2
5	Oregon	1.21	1.8	29.6
6	Wisconsin	1.15	1.7	49.6
7	Washington	1.15	1.7	47.7
8	South Dakota	1.14	1.7	6.6
9	New Hampshire	1.11	1.7	10.5
10	California	1.06	1.6	234.4
11	Connecticut	1.04	1.6	26.6
13	Massachusetts	1.02	1.5	51.5
19	Rhode Island	0.96	1.5	7.0
33	Maine	0.87	1.3	8.0
36	Vermont	0.86	1.3	3.9

Sources: Economy.com, Milken Institute.

- New Hampshire ranks 9th in the nation in the employment concentration of medical doctors.
- Maine and New Hampshire are among the fastest growing states in the industry, while Vermont and Massachusetts have exhibited the weakest employment growth in the nation.
- Although growth in Massachusetts has been relatively slow, Boston ranks 3rd in this industry's health pole index among all metros.

Offices & Clinics of Medical Doctors Profile

Employment - Concentration, Size, and Growth



Offices & Clinics of Medical Doctors

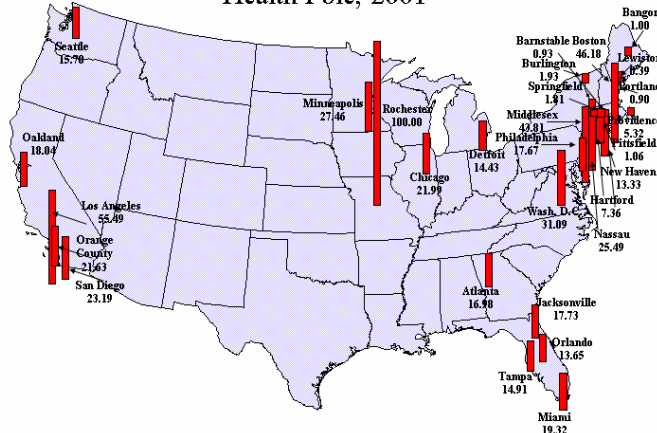
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Nevada	413.2	150.3	105.1	41.1	6.3
2	Alaska	225.1	72.7	88.2	34.8	6.5
3	Maine	229.2	111.9	55.4	28.9	2.9
4	New Mexico	199.4	57.6	89.9	28.7	5.9
5	New Hampshire	250.2	133.2	50.2	26.7	5.2
6	Wyoming	64.6	13.1	45.5	25.6	4.6
7	South Dakota	178.7	64.0	70.0	25.5	3.3
8	Idaho	160.7	54.9	68.3	24.9	5.5
9	Wisconsin	145.1	62.4	50.9	24.3	5.0
10	Nebraska	114.8	47.6	45.5	24.2	3.4
31	Connecticut	164.5	99.7	32.5	13.7	2.6
35	Rhode Island	126.8	67.7	35.3	10.8	1.8
43	Vermont	126.2	86.6	21.2	4.4	-0.1
45	Massachusetts	131.1	80.0	28.4	2.9	1.6
<i>New England</i>		152.2	89.5	33.1	9.7	2.2
<i>United States</i>		140.8	66.8	44.3	19.3	3.7

Sources: Economy.com, Milken Institute.

Offices & Clinics of Medical Doctors

Health Pole, 2001



Offices & Clinics of Medical Doctors

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Rochester MN	100.00
2	Los Angeles-Long Beach CA	55.49
3	Boston MA-NH	46.18
4	Middlesex-Somerset-Hunterdon NJ	43.81
5	New York NY	41.08
6	Washington DC-MD-VA-WV	31.09
7	Minneapolis-St. Paul MN-WI	27.46
8	Nassau-Suffolk NY	25.49
9	San Diego CA	23.19
10	Chicago IL	21.99
11	Orange County CA	21.63
12	Miami FL	19.32
13	Oakland CA	18.04
14	Jacksonville FL	17.73
15	Philadelphia PA-NJ	17.67
16	Atlanta GA	16.98
17	Seattle-Bellevue-Everett WA	15.70
18	Tampa-St. Petersburg-Clearwater FL	14.91
19	Detroit MI	14.43
20	Orlando FL	13.65

Sources: Milken Institute, Economy.com.

Appendix - Offices & Clinics of Dentists Profile

Offices & Clinics of Dentists

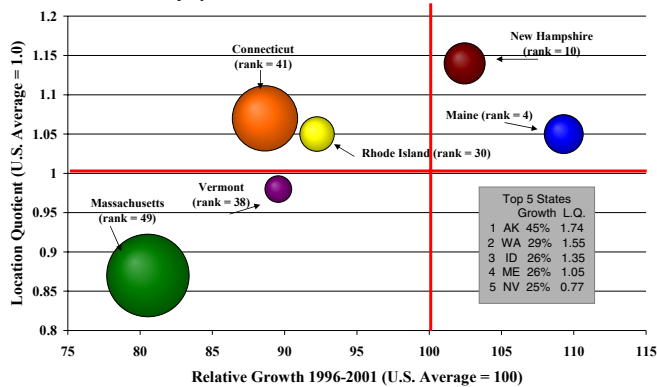
Top States Ranked by Employment Concentration, 2001

Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Alaska	1.74	0.9	2.7
2	Washington	1.55	0.8	22.5
3	Oregon	1.49	0.8	12.9
4	Idaho	1.35	0.3	4.2
5	California	1.34	0.7	105.2
6	Hawaii	1.28	0.7	3.8
7	Michigan	1.23	0.7	30.0
8	Utah	1.21	0.6	6.9
9	New Hampshire	1.14	0.6	3.8
10	New Jersey	1.09	0.6	23.3
11	Connecticut	1.07	0.6	9.6
12	Maine	1.05	0.6	3.4
13	Rhode Island	1.05	0.6	2.7
15	Vermont	0.98	0.5	1.6
30	Massachusetts	0.87	0.5	15.4

Sources: Economy.com, Milken Institute.

- New Hampshire ranks 9th in the nation in the employment concentration of dentists.
- Maine and New Hampshire are among the fastest growing states in the industry, while Connecticut and Massachusetts are among the slowest.
- Boston ranks 5th in the health pole index for dentists. Los Angeles ranks 1st.

Offices & Clinics of Dentists Profile
Employment - Concentration, Size, and Growth



Offices & Clinics of Dentists

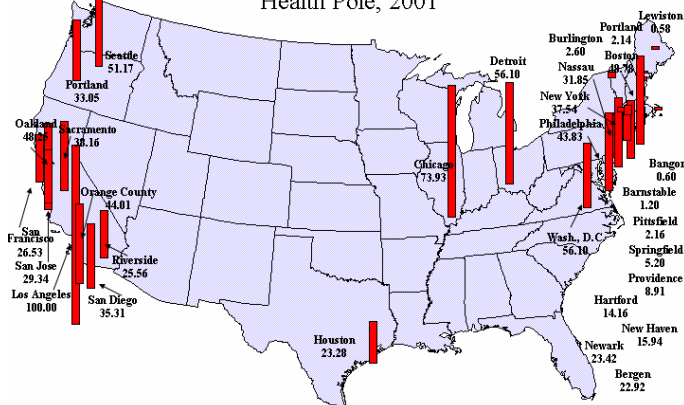
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'90	'80-'90	'90-'00	'96-'01	'00-'01
1	Alaska	380.6	140.1	100.2	44.5	7.5
2	Washington	127.3	57.8	44.0	28.5	4.3
3	Idaho	155.9	43.7	78.2	26.4	6.5
4	Maine	174.9	81.9	51.1	25.7	3.0
5	Nevada	188.5	80.1	60.2	25.3	4.1
6	Oregon	122.2	49.7	48.4	22.2	5.5
7	Arizona	177.1	71.7	61.4	21.8	4.4
8	Nebraska	89.1	39.7	35.3	18.3	3.0
9	Utah	195.3	86.1	58.7	18.1	4.4
10	New Hampshire	168.7	95.5	37.4	17.8	4.6
30	Rhode Island	113.7	75.0	22.1	6.1	1.1
38	Vermont	110.1	78.5	17.7	3.0	0.0
41	Connecticut	52.3	43.2	6.4	2.0	0.7
49	Massachusetts	56.5	47.7	6.0	-7.4	-0.6
<i>New England</i>		74.8	54.2	13.4	1.2	0.8
<i>United States</i>		119.0	63.6	33.9	15.0	2.3

Sources: Economy.com, Milken Institute.

Offices & Clinics of Dentists

Health Pole, 2001



Offices & Clinics of Dentists

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Los Angeles-Long Beach CA	100.00
2	Chicago IL	73.93
3	Detroit MI	56.10
4	Seattle-Bellevue-Everett WA	51.17
5	Boston MA-NH	48.78
6	Oakland CA	48.25
7	Orange County CA	44.01
8	Philadelphia PA-NJ	43.83
9	Sacramento CA	38.16
10	New York NY	37.54
11	Washington DC-MD-VA-WV	35.79
12	San Diego CA	35.31
13	Portland-Vancouver OR-WA	33.05
14	Nassau-Suffolk NY	31.85
15	San Jose CA	29.34
16	San Francisco CA	26.53
17	Riverside-San Bernardino CA	25.56
18	Newark NJ	23.42
19	Houston TX	23.28
20	Bergen-Passaic NJ	22.92

Sources: Milken Institute, Economy.com.

Appendix - Offices of Osteopathic Physicians Profile

Offices of Osteopathic Physicians

Top States Ranked by Employment Concentration, 2001

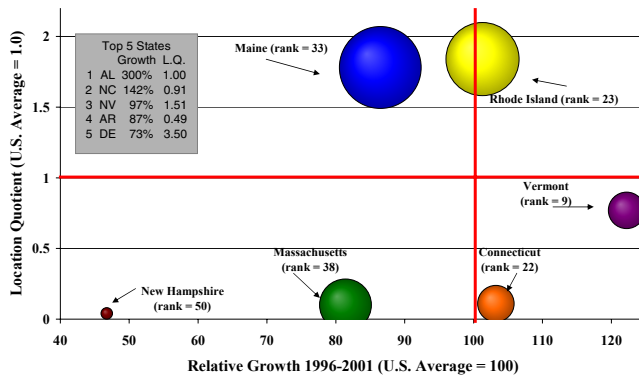
Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Delaware	3.50	0.2	0.6
2	Pennsylvania	3.41	0.1	8.5
3	Michigan	3.00	0.1	6.0
4	Montana	2.20	0.1	0.0
5	West Virginia	2.12	0.1	0.7
6	Ohio	1.97	0.1	4.8
7	New Jersey	1.93	0.1	3.4
8	Arizona	1.87	0.1	1.9
9	Rhode Island	1.84	0.1	0.4
10	Maine	1.78	0.1	0.5
21	Vermont	0.77	0.0	0.1
40	Connecticut	0.11	0.01	0.1
41	Massachusetts	0.10	0.01	0.2
47	New Hampshire	0.04	0.002	0.01

Sources: Economy.com, Milken Institute.

- Although Rhode Island and Maine rank among the top ten states in employment concentration of osteopathic physicians, the two states employ a combined 900 people in this industry.
- Rhode Island is has both a higher concentration than the U.S. average and has grown relatively faster than the U.S. average in the osteopathic physician industry.

Offices & Clinics of Osteopathic Physicians Profile

Employment - Concentration, Size, Growth



Offices of Osteopathic Physicians

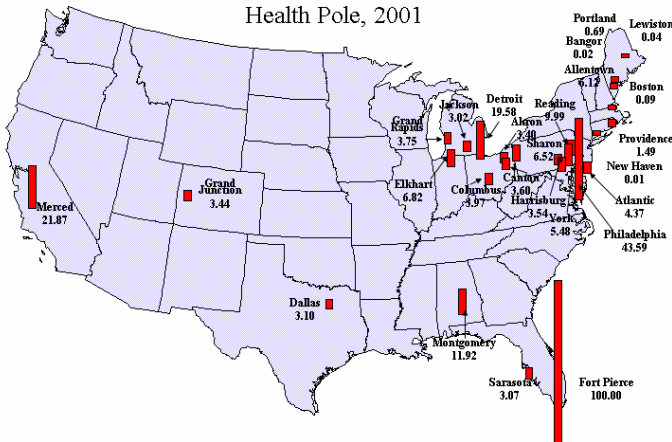
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Alabama	9271.4	485.7	1500.0	299.5	29.1
2	North Carolina	3125.0	300.0	706.3	141.5	21.7
3	Nevada	631.7	39.0	426.3	97.2	16.0
4	Arkansas	3566.7	816.7	300.0	87.2	13.2
5	Delaware	753.7	138.8	257.5	72.8	12.4
6	Illinois	687.5	51.5	419.9	71.6	15.0
7	Virginia	391.5	59.3	208.5	58.9	10.7
8	New York	426.3	49.4	252.3	50.2	11.5
9	Vermont	352.4	71.4	163.9	46.4	6.3
10	South Dakota	NA	NA	154.5	42.9	7.1
22	Connecticut	NA	NA	127.3	25.4	5.3
23	Rhode Island	442.6	132.4	133.5	22.5	4.6
33	Maine	157.0	126.9	13.3	4.4	-0.4
38	Massachusetts	150.0	95.0	28.2	-1.9	0.7
50	New Hampshire	-57.7	50.0	-71.8	-41.2	-9.1
<i>New England</i>		226.0	123.3	46.0	12.1	2.2
<i>United States</i>		215.5	84.7	70.9	20.8	4.5

Sources: Economy.com, Milken Institute.

Offices of Osteopathic Physicians

Health Pole, 2001



Offices of Osteopathic Physicians

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Fort Pierce-Port St. Lucie FL	100.00
2	Philadelphia PA-NJ	43.59
3	Merced CA	21.87
4	Detroit MI	19.58
5	Montgomery AL	11.62
6	Reading PA	9.99
7	Elkhart-Goshen IN	6.82
8	Sharon PA	6.52
9	Allentown-Bethlehem-Easton PA	6.12
10	York PA	5.48
11	Atlantic-Cape May NJ	4.37
12	Columbus OH	3.97
13	Grand Rapids-Muskegon-Holland MI	3.75
14	Canton-Massillon OH	3.60
15	Harrisburg-Lebanon-Carlisle PA	3.54
16	Grand Junction CO	3.44
17	Akron OH	3.40
18	Dallas TX	3.10
19	Sarasota-Bradenton	3.07
20	Jackson MI	3.02

Sources: Milken Institute, Economy.com.

Appendix - Offices of Other Health Care Practitioners Profile

Offices of Other Health Care Practitioners

Top States Ranked by Employment Concentration, 2001

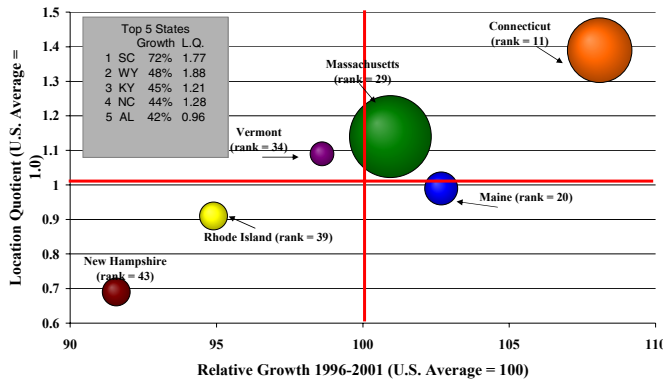
Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Wyoming	1.88	0.6	1.6
2	South Carolina	1.77	0.6	11.2
3	Maryland	1.48	0.5	12.6
4	Florida	1.46	0.5	36.4
5	Connecticut	1.39	0.5	8.1
6	New Mexico	1.39	0.5	3.6
7	Tennessee	1.34	0.5	12.5
8	Pennsylvania	1.30	0.4	25.5
9	Iowa	1.30	0.4	6.6
10	Nebraska	1.28	0.4	4.0
24	Massachusetts	1.14	0.4	13.0
28	Vermont	1.09	0.4	1.1
37	Maine	0.99	0.3	2.1
40	Rhode Island	0.91	0.3	1.5
49	New Hampshire	0.69	0.2	1.5

Sources: Economy.com, Milken Institute.

- Connecticut ranks 5th in the nation in this industry's employment concentration. Roughly, it has a 39 percent higher concentration than the U.S. average.
- Both Connecticut and Massachusetts have higher employment concentrations in this industry than the U.S. average and have been growing relatively faster than the nation.
- Boston ranks 7th in this industry's health pole index. Nashville ranks 1st.

Offices of Other Health Care Practitioners Profile

Employment - Concentration, Size, Growth



Offices of Other Health Care Practitioners

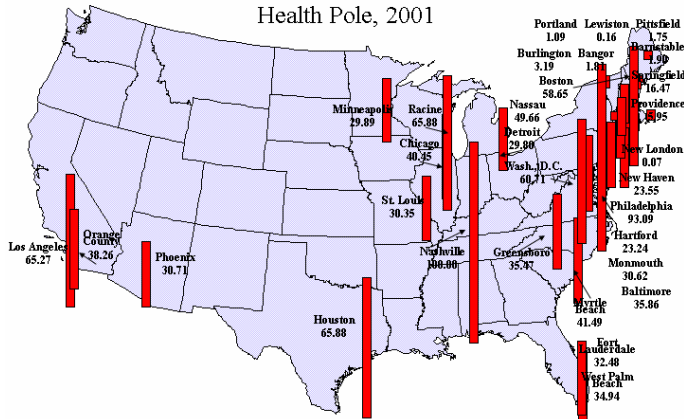
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	South Carolina	1111.3	221.0	277.3	72.3	13.6
2	Wyoming	550.7	85.8	250.1	48.1	12.4
3	Kentucky	677.4	200.5	158.8	45.0	10.3
4	North Carolina	827.1	224.4	185.8	43.6	8.3
5	Alabama	603.0	188.0	144.1	42.3	6.4
6	Maryland	1070.6	405.5	131.6	37.8	7.0
7	Virginia	593.2	208.2	124.9	35.2	6.7
8	Iowa	308.7	95.1	109.5	34.8	5.5
9	New Mexico	475.7	173.8	110.2	29.4	5.6
10	Mississippi	388.3	113.6	128.5	28.6	6.4
11	Connecticut	458.7	177.2	101.5	28.4	5.6
20	Maine	483.6	272.1	56.8	22.0	2.4
29	Massachusetts	510.1	220.1	90.6	19.9	3.9
34	Vermont	568.7	269.3	81.1	17.2	2.8
39	Rhode Island	320.6	158.7	62.6	12.8	2.4
43	New Hampshire	398.6	259.1	38.9	8.8	3.1
	New England	473.2	210.8	84.4	21.2	4.1
	United States	356.0	186.7	59.0	9.1	3.5

Sources: Economy.com, Milken Institute.

Offices of Other Health Care Practitioners

Health Pole, 2001



Offices of Other Health Care Practitioners

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Nashville TX	100.00
2	Philadelphia PA-NJ	93.09
3	Houston TX	68.43
4	Racine WI	65.88
5	Los Angeles-Long Beach CA	65.27
6	Washington DC-MD-VA-WV	60.71
7	Boston MA-NH	58.65
8	Nassau-Suffolk NY	49.66
9	Myrtle Beach SC	41.49
10	Chicago IL	40.45
11	Orange County CA	38.26
12	Baltimore MD	35.86
13	Greensboro-Winston-Salem-High Point NC	35.47
14	West Palm Beach-Boca Raton FL	34.94
15	Fort Lauderdale FL	32.48
16	Phoenix-Mesa AZ	30.71
17	Monmouth-Ocean NJ	30.62
18	St. Louis MO-IL	30.35
19	Minneapolis-St. Paul MN-WI	29.89
20	Detroit MI	29.80

Sources: Milken Institute, Economy.com.

Appendix - Nursing & Personal Care Facilities Profile

Nursing & Personal Care Facilities

Top States Ranked by Employment Concentration, 2001

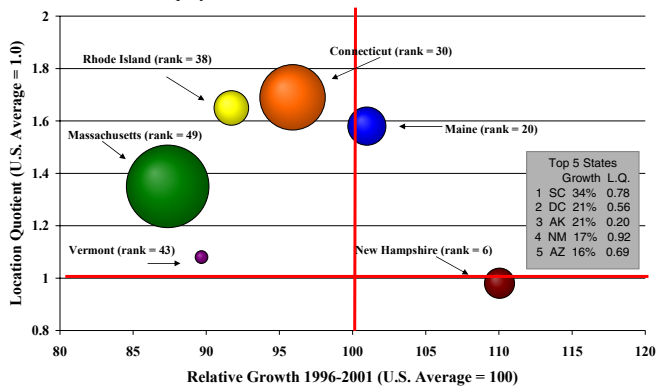
Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	North Dakota	2.07	2.9	9.6
2	Iowa	1.80	2.5	37.2
3	Connecticut	1.69	2.4	39.6
4	Rhode Island	1.65	2.3	11.0
5	South Dakota	1.64	2.3	8.7
6	Maine	1.58	2.2	13.5
7	Nebraska	1.54	2.1	19.7
8	Pennsylvania	1.48	2.1	117.8
9	Ohio	1.47	2.1	114.4
10	Massachusetts	1.35	1.9	63.0
20	Vermont	1.08	1.5	4.5
22	New Hampshire	0.98	1.4	8.5

Sources: Economy.com, Milken Institute.

- Connecticut, Rhode Island, Maine and Massachusetts all rank in the top ten in nursing and personal care facility employment.
- Maine is the only New England state to have a higher concentration in employment, and to be growing faster, than the U.S. average.
- Boston, New Haven, Hartford and Providence are among the top twenty in this industry's health care pole index. Boston ranks 1st among all metros.

Nursing & Personal Health Care Facilities Profile

Employment - Concentration, Size, and Growth



Nursing & Personal Health Care Facilities

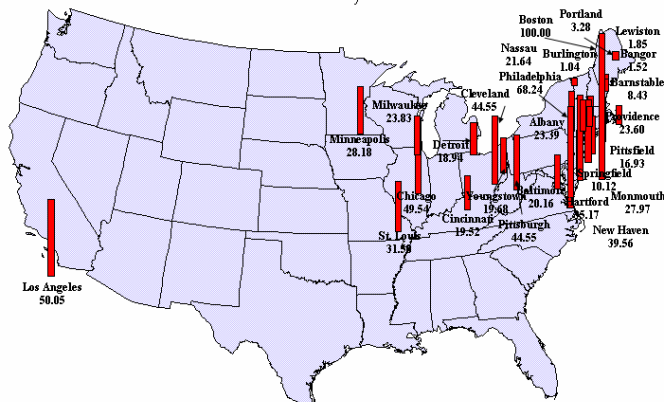
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	South Carolina	151.6	56.4	60.9	33.6	5.6
2	Wash., D.C.	399.7	166.7	87.4	21.1	3.5
3	Alaska	515.7	349.6	37.0	20.9	2.9
4	New Mexico	302.0	137.5	69.3	16.5	3.7
5	Arizona	284.1	155.0	50.6	16.1	3.2
6	New Hampshire	108.1	34.7	54.5	15.9	5.4
7	Pennsylvania	122.7	54.1	44.5	15.3	3.3
8	New York	99.8	45.7	37.2	13.5	2.4
9	Nebraska	78.7	33.5	33.9	12.7	2.4
10	Illinois	108.5	54.7	34.8	12.1	1.5
20	Maine	61.0	37.3	17.2	6.7	0.2
30	Connecticut	63.6	35.5	20.7	1.0	0.7
38	Rhode Island	56.4	28.3	21.9	-3.4	0.0
43	Vermont	61.5	56.7	3.0	-5.6	-1.8
49	Massachusetts	45.4	31.6	10.5	-8.0	-1.0
New England		55.8	33.8	16.4	-2.6	0.0
United States		80.8	42.0	27.3	6.7	2.5

Sources: Economy.com, Milken Institute.

Nursing & Personal Care Facilities

Health Pole, 2001



Nursing & Personal Care Facilities

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Boston MA-NH	100.00
2	Philadelphia PA-NJ	68.24
3	New York NY	56.42
4	Los Angeles-Long Beach CA	50.05
5	Chicago IL	49.54
6	Cleveland-Lorain-Elyria OH	44.55
7	New Haven-Meriden CT	39.56
8	Hartford CT	35.17
9	Pittsburgh PA	34.16
10	St. Louis MO-IL	31.50
11	Minneapolis-St. Paul MN-WI	28.18
12	Monmouth-Ocean NJ	27.97
13	Milwaukee-Waukesha WI	23.83
14	Providence-Fall River-Warwick RI-MA	23.60
15	Albany-Schenectady-Troy NY	23.39
16	Nassau-Suffolk NY	21.64
17	Baltimore MD	20.16
18	Youngstown-Warren OH	19.68
19	Cincinnati OH-KY-IN	19.52
20	Detroit MI	18.94

Sources: Milken Institute, Economy.com.

Appendix - Hospital Industry Profile

Hospital Industry

Top States Ranked by Employment Concentration, 2001

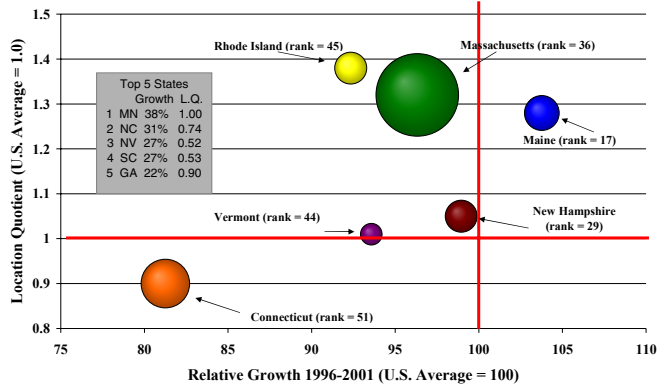
Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	North Dakota	1.64	5.1	16.9
2	West Virginia	1.57	4.8	35.7
3	Montana	1.47	4.5	18.0
4	Pennsylvania	1.46	4.5	257.8
5	South Dakota	1.45	4.5	17.1
6	Rhode Island	1.38	4.3	20.5
7	Massachusetts	1.32	4.1	136.3
8	Maine	1.28	3.9	24.1
9	Michigan	1.25	3.9	178.5
10	New Jersey	1.24	3.8	154.1
22	New Hampshire	1.05	3.2	20.3
27	Vermont	1.01	3.1	9.4
31	Connecticut	0.90	2.8	46.9

Sources: Economy.com, Milken Institute.

- Rhode Island, Massachusetts and Maine are among the top ten states in this industry's employment concentration.
- Although Massachusetts employs 136,300 workers in the hospital industry, Maine is the only New England state to have a higher employment concentration and to be growing faster than the U.S. average.
- Boston ranks 5th among all metros in the health pole index for hospitals.

Hospital Industry Profile

Employment - Concentration, Size, and Growth



Hospitals

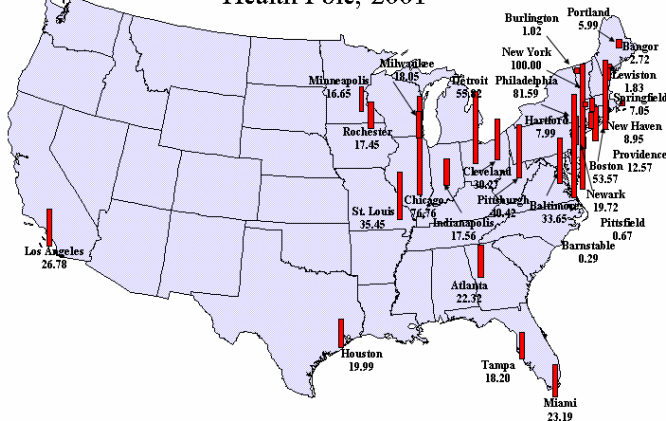
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Minnesota	47.4	7.8	36.7	38.0	5.0
2	North Carolina	111.3	54.1	37.1	30.7	4.9
3	Nevada	178.8	80.3	54.7	26.8	5.6
4	South Carolina	123.0	58.4	40.8	26.7	6.6
5	Georgia	309.1	126.5	80.6	26.0	6.5
6	Idaho	87.3	27.6	46.8	21.9	6.4
7	Alaska	124.1	83.2	22.4	19.5	4.3
8	Indiana	57.4	28.3	22.7	16.1	4.3
9	Nebraska	33.8	13.5	17.9	15.7	3.5
10	South Dakota	76.7	34.7	31.2	15.3	2.9
17	Maine	36.4	18.8	14.8	11.8	2.0
29	New Hampshire	81.3	65.9	9.3	6.3	2.7
36	Massachusetts	16.8	12.2	4.1	3.5	1.7
44	Vermont	31.8	28.8	2.3	0.5	0.5
45	Rhode Island	30.7	27.3	2.7	-0.8	1.2
51	Connecticut	7.3	31.1	-18.2	-12.7	-2.0
New England		21.3	21.2	0.0	0.5	1.0
United States		45.1	29.0	12.4	7.5	2.7

Sources: Economy.com, Milken Institute.

Hospitals

Health Pole, 2001



Hospitals

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	New York NY	100.00
2	Philadelphia PA-NJ	81.59
3	Chicago IL	76.76
4	Detroit MI	55.82
5	Boston MA-NH	53.57
6	Pittsburgh PA	40.42
7	St. Louis MO-IL	35.45
8	Baltimore MD	33.65
9	Cleveland-Lorain-Elyria OH	30.27
10	Los Angeles-Long Beach CA	26.78
11	Nassau-Suffolk NY	24.17
12	Miami FL	23.19
13	Atlanta GA	22.32
14	Houston TX	19.99
15	Newark NJ	19.72
16	Tampa-St. Petersburg-Clearwater FL	18.20
17	Milwaukee-Waukesha WI	18.05
18	Indianapolis IN	17.56
19	Rochester MN	17.45
20	Minneapolis-St. Paul MN-WI	16.65

Sources: Milken Institute, Economy.com.

Appendix - Medical & Dental Lab Industry Profile

Medical & Dental Labs

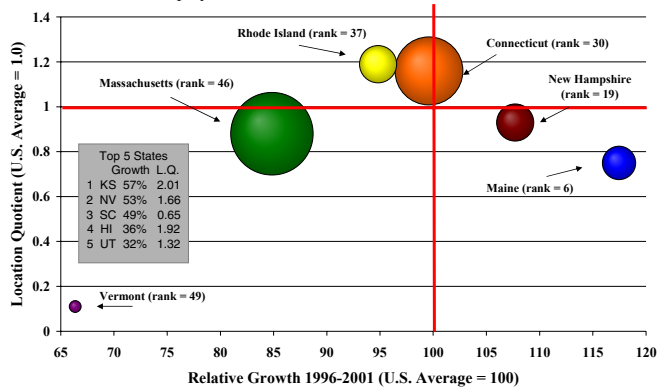
Top States Ranked by Employment Concentration, 2001

Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Kansas	2.01	0.3	4.6
2	Hawaii	1.92	0.3	1.8
3	New Jersey	1.81	0.3	12.2
4	Nevada	1.66	0.3	2.9
5	Utah	1.32	0.2	2.4
6	Florida	1.24	0.2	14.9
7	Alabama	1.21	0.2	3.9
8	Tennessee	1.20	0.2	5.4
9	Rhode Island	1.19	0.2	1.0
10	Maryland	1.16	0.2	4.8
11	Connecticut	1.16	0.2	3.3
23	New Hampshire	0.93	0.2	1.0
28	Massachusetts	0.88	0.1	4.9
36	Maine	0.75	0.1	0.8
50	Vermont	0.11	0.02	0.1

Sources: Economy.com, Milken Institute.

- Rhode Island ranks 9th among all states in this industry's employment concentration.
- Although Connecticut rank 11th highest in employment concentration, it is the only New England state that comes close to growing at the same pace as the U.S. average in the medical and dental lab industry.
- Boston ranks 10th in this industry's health pole index.

Medical & Dental Laboratories Profile
Employment - Concentration, Size, and Growth



Medical & Dental Laboratories

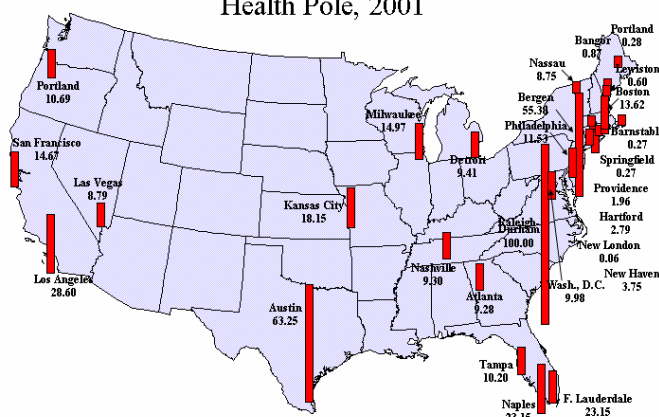
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Kansas	304.9	40.6	187.9	57.3	11.1
2	Nevada	480.7	147.8	134.3	53.1	9.6
3	South Carolina	236.5	44.2	133.3	49.2	11.3
4	Hawaii	284.0	99.5	92.4	35.6	6.1
5	Utah	314.2	120.7	87.7	32.0	7.3
6	Maine	229.4	104.5	61.1	31.0	5.1
7	Nebraska	102.5	35.8	49.1	30.0	5.5
8	Alaska	227.8	127.8	43.9	29.7	5.5
9	Arkansas	187.1	56.7	83.2	26.8	5.1
10	Colorado	123.3	32.8	68.2	26.5	7.6
19	New Hampshire	193.6	117.3	35.1	19.7	6.0
30	Connecticut	107.9	80.8	15.0	10.8	2.4
37	Rhode Island	158.2	129.7	12.4	5.4	1.6
46	Massachusetts	42.1	35.3	5.1	-5.7	0.6
49	Vermont	-11.1	55.6	-42.9	-25.4	-5.4
<i>New England</i>		80.7	60.0	12.9	3.8	1.9
<i>United States</i>		134.8	85.4	26.6	14.0	5.2

Sources: Economy.com, Milken Institute.

Medical & Dental Laboratories

Health Pole, 2001



Medical & Dental Laboratories

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Raleigh-Durham-Chapel Hill NC	100.00
2	Austin-San Marcos TX	63.25
3	Bergen-Passaic NJ	55.38
4	Los Angeles-Long Beach CA	28.60
5	Naples FL	23.15
6	Kansas City MO-KS	18.15
7	Milwaukee-Waukesha WI	14.97
8	San Francisco CA	14.67
9	Fort Lauderdale FL	13.76
10	Boston MA-NH	13.62
11	Philadelphia PA-NJ	11.53
12	Portland-Vancouver OR-WA	10.69
13	Tampa-St. Petersburg-Clearwater FL	10.20
14	Washington DC-MD-VA-WV	9.98
15	Detroit MI	9.41
16	Nashville TX	9.30
17	Atlanta GA	9.28
18	Las Vegas NV-AZ	8.79
19	Nassau-Suffolk NY	8.75
20	Honolulu HI	8.26

Sources: Milken Institute, Economy.com.

Appendix - Home Health Care Services Profile

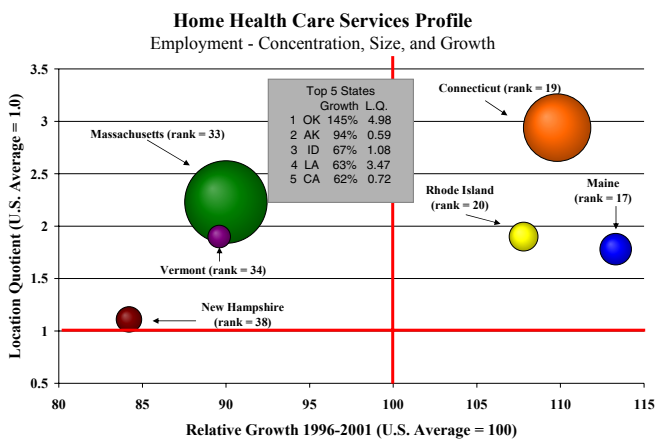
Home Health Care Services

Top States Ranked by Employment Concentration, 2001

Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Oklahoma	4.98	2.4	36.2
2	Louisiana	3.47	1.7	32.3
3	Texas	3.43	1.6	157.2
4	Connecticut	2.94	1.4	23.8
5	Massachusetts	2.23	1.1	35.8
6	Vermont	1.90	0.9	2.7
7	Rhode Island	1.90	0.9	4.4
8	West Virginia	1.79	0.9	6.3
9	Maine	1.78	0.9	5.2
10	New York	1.78	0.9	74.0
23	New Hampshire	1.11	0.5	3.4

Sources: Economy.com, Milken Institute.

- Five out of six New England states rank among the top ten in terms of employment concentration for this industry.
- Connecticut, Rhode Island and Maine all have higher concentrations of employment and are growing relatively faster than the U.S. average.
- Boston and New Haven show up on the top twenty health pole index. They rank 7th and 10th, respectively.



Home Health Care Services

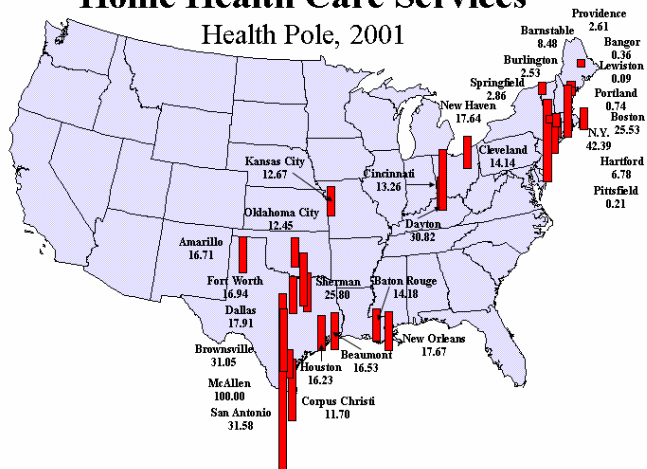
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Oklahoma	5445.5	123.0	2386.5	144.8	20.4
2	Alaska	3600.0	44.4	2461.5	94.3	23.1
3	Idaho	874.9	26.6	670.1	67.4	15.5
4	Louisiana	2466.5	135.5	989.8	62.7	13.7
5	California	553.0	97.0	231.5	61.8	9.1
6	Delaware	1240.8	358.4	192.5	61.7	9.1
7	South Carolina	1583.9	200.3	460.7	61.1	12.7
8	West Virginia	38066.7	5720.0	555.8	60.2	10.5
9	Kansas	1245.4	187.1	368.7	58.7	9.4
10	North Carolina	2457.3	360.6	455.2	55.9	11.1
17	Maine	646.7	129.9	224.8	45.1	5.8
19	Connecticut	771.5	135.7	269.8	40.7	7.0
20	Rhode Island	857.4	112.3	351.0	38.1	7.7
33	Massachusetts	1200.5	324.1	206.7	15.3	3.8
34	Vermont	1451.4	460.1	177.0	14.8	2.2
38	New Hampshire	554.4	251.6	86.1	7.9	1.8
New England		929.4	221.9	219.8	25.0	5.0
United States		686.5	169.2	192.1	28.1	5.6

Sources: Economy.com, Milken Institute.

Home Health Care Services

Health Pole, 2001



Home Health Care Services

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	McAllen-Edinburg-Mission TX	100.00
2	New York NY	42.39
3	San Antonio TX	31.58
4	Brownsville-Harlingen-San Benito TX	31.05
5	Dayton-Springfield OH	30.82
6	Sherman-Denison TX	25.80
7	Boston MA-NH	25.53
8	Dallas TX	17.91
9	New Orleans LA	17.67
10	New Haven-Meriden CT	17.64
11	Forth Worth-Arlington TX	16.94
12	Amarillo TX	16.71
13	Beaumont-Port Arthur TX	16.53
14	Houston TX	16.23
15	Baton Rouge LA	14.18
16	Cleveland-Lorain-Elyria OH	14.14
17	Cincinnati OH-KY-IN	13.26
18	Kansas City MO-KS	12.67
19	Oklahoma City OK	12.45
20	Corpus Christi TX	11.70

Sources: Milken Institute, Economy.com.

Appendix - Health & Allied Services Profile

Health & Allied Services

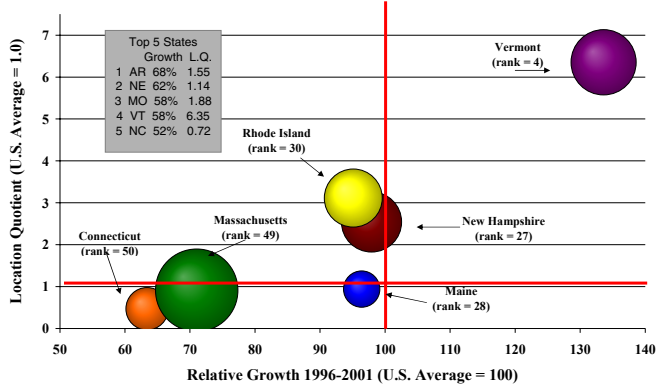
Top States Ranked by Employment Concentration, 2001

Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Vermont	6.35	1.7	5.2
2	Rhode Island	3.11	0.9	4.1
3	New Hampshire	2.54	0.7	4.4
4	Alaska	2.02	0.6	1.6
5	Missouri	1.88	0.5	14.1
6	Kentucky	1.82	0.5	9.2
7	West Virginia	1.82	0.5	3.7
8	Arizona	1.60	0.4	10.0
9	Pennsylvania	1.57	0.4	24.6
10	Arkansas	1.55	0.4	4.9
25	Maine	0.94	0.3	1.6
27	Massachusetts	0.91	0.2	8.3
46	Connecticut	0.47	0.1	2.2

Sources: Economy.com, Milken Institute.

- Vermont, Rhode Island and New Hampshire are the top three states, respectively, in terms of employment concentration in the health and allied services industry.
- Not only is Vermont's employment concentration six times higher than the U.S. average in the health and allied sector, but it is also the only New England state to grow faster than the U.S.
- Boston and Providence rank among the top twenty metros in this industry's health pole index.

Health & Allied Services Profile
Employment - Concentration, Size, and Growth



Health & Allied Services

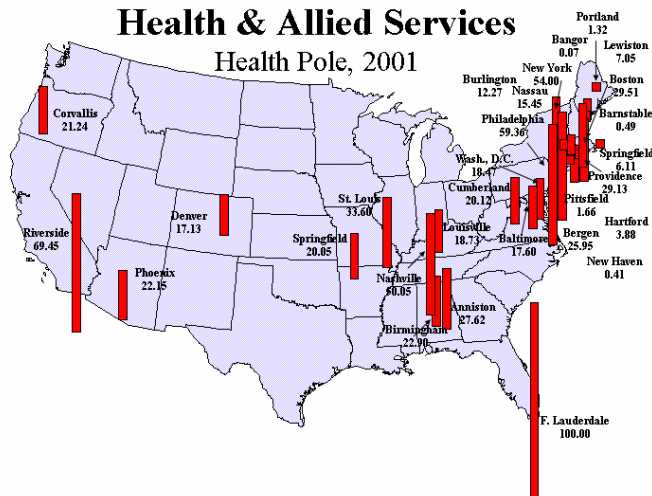
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Arkansas	1078.9	255.5	231.7	68.0	11.8
2	Nebraska	726.6	212.0	164.9	62.1	9.7
3	Missouri	602.0	128.8	206.8	57.6	12.1
4	Vermont	284.1	1.9	277.0	57.5	11.9
5	North Carolina	1344.4	424.3	175.5	52.1	9.6
6	South Dakota	1100.0	379.4	150.3	48.3	7.3
7	Nevada	989.8	338.8	148.4	46.1	8.3
8	Alaska	157.9	11.0	132.4	39.7	8.7
9	Arizona	431.9	119.0	142.9	38.4	7.9
10	Montana	375.2	143.2	95.4	35.1	4.9
27	New Hampshire	137.6	57.8	50.5	15.4	5.2
28	Maine	288.8	209.8	25.5	13.9	1.5
30	Rhode Island	60.5	6.5	50.6	12.2	2.9
49	Massachusetts	89.7	79.6	5.7	-16.3	-2.9
50	Connecticut	-34.1	-7.6	-28.7	-25.3	-5.2
<i>New England</i>		82.1	38.7	31.3	3.1	2.1
<i>United States</i>		160.9	73.9	50.0	16.1	3.9

Sources: Economy.com, Milken Institute.

Health & Allied Services

Health Pole, 2001



Health & Allied Services

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Fort Lauderdale FL	100.00
2	Riverside-San Bernardino CA	69.45
3	Philadelphia PA-NJ	59.36
4	New York NY	54.00
5	Nashville TX	50.05
6	St. Louis MO-IL	33.60
7	Boston MA-NH	29.51
8	Providence-Fall River-Warwick RI-MA	29.13
9	Anniston AL	27.62
10	Bergen-Passaic NJ	25.95
11	Birmingham AL	22.90
12	Phoenix-Mesa AZ	22.15
13	Corvallis OR	21.24
14	Cumberland MD-WV	20.12
15	Springfield MO	20.05
16	Louisville KY-IN	18.73
17	Washington DC-MD-VA-WV	18.47
18	Baltimore MD	17.60
19	Denver CO	17.13
20	Nassau-Suffolk NY	15.45

Sources: Milken Institute, Economy.com.

Appendix - Overall Health Care Industry Profile

Top Health Care Industry States

Top States Ranked by Employment Concentration, 2001

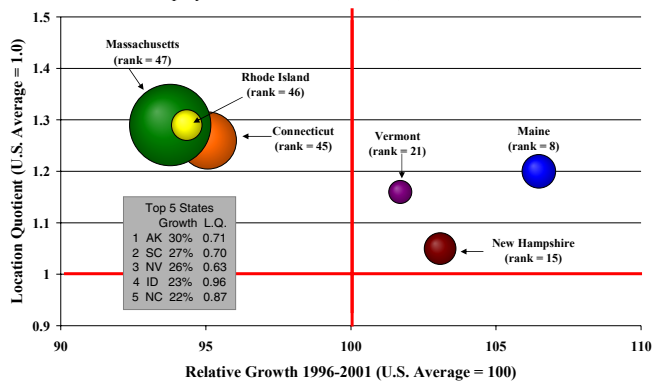
Rank	State	Location Quotient	% of State Total Emp.	Emp. (Ths.)
1	Pennsylvania	1.31	11.9	682.9
2	Rhode Island	1.29	11.8	56.4
3	Massachusetts	1.29	11.8	393.0
4	New Jersey	1.29	11.7	471.3
5	Connecticut	1.26	11.4	193.1
6	North Dakota	1.26	11.4	38.1
7	Maine	1.20	10.9	66.9
8	West Virginia	1.19	10.9	80.0
9	Vermont	1.16	10.5	31.7
10	New York	1.14	10.4	900.0
18	New Hampshire	1.05	9.5	59.9

Sources: Economy.com, Milken Institute.

- Five out of six New England states comprise the top ten states in the overall health care employment concentration.
- Maine, New Hampshire and Vermont all have higher employment concentrations and are growing relatively faster than the U.S. average.
- Boston ranks 1st in the overall health care pole index.

New England Health Care Profile

Employment - Concentration, Size, and Growth



Health Care - All Related Industries

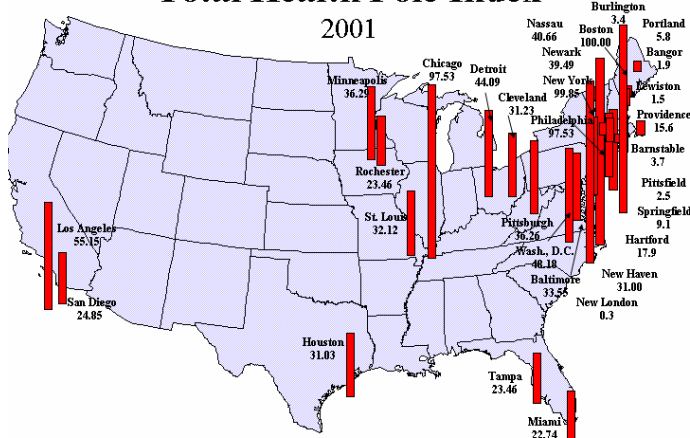
Employment Growth, Ranked by 1996-2001 Growth

Rank	State	Percent (%) Growth by Time Period				
		'80-'00	'80-'90	'90-'00	'96-'01	'00-'01
1	Alaska	188.6	81.5	59.0	29.7	6.4
2	South Carolina	173.9	72.6	58.7	26.8	6.0
3	Nevada	190.5	81.6	60.0	26.1	5.4
4	Idaho	118.8	39.5	56.9	23.4	5.8
5	North Carolina	167.8	70.5	57.1	21.6	3.9
6	Minnesota	95.1	39.2	40.1	18.9	3.0
7	Arizona	200.3	94.4	54.4	18.7	4.0
8	Maine	99.2	45.7	36.7	17.7	2.5
9	Delaware	134.9	71.7	36.8	16.4	4.0
10	Nebraska	65.9	28.0	29.6	16.1	2.5
15	New Hampshire	132.8	76.6	31.8	14.0	4.0
21	Vermont	111.9	53.4	38.1	12.4	2.8
45	Connecticut	69.2	42.4	18.8	5.1	1.4
46	Rhode Island	62.2	32.7	22.2	4.3	1.7
47	Massachusetts	65.1	36.4	21.1	3.7	1.8
<i>New England</i>		73.6	41.0	23.1	6.2	1.9
<i>United States</i>		90.8	47.8	29.1	10.6	2.8

Sources: Economy.com, Milken Institute.

Total Health Pole Index

2001



Total Health Care

Top Twenty Metropolitan Areas by Health Pole, 2001

Rank	Metropolitan Area	Health Pole
1	Boston MA-NH	100.00
2	New York NY	99.85
3	Philadelphia PA-NJ	97.53
4	Chicago IL	92.20
5	Los Angeles-Long Beach CA	55.15
6	Washington DC-MD-VA-WV	48.18
7	Detroit MI	44.09
8	Nassau-Suffolk NY	40.66
9	Newark NJ	39.49
10	Minneapolis-St. Paul MN-WI	36.29
11	Pittsburgh PA	36.26
12	Baltimore MD	33.55
13	St. Louis MO-IL	32.12
14	Cleveland-Lorain-Elyria OH	31.23
15	Houston TX	31.03
16	New Haven-Meriden CT	31.00
17	San Diego CA	24.85
18	Rochester MN	23.46
19	Tampa-St. Petersburg-Clearwater FL	23.46
20	Miami FL	22.74

Sources: Milken Institute, Economy.com.

About the Authors

Ross DeVol is Director of Regional and Demographic Studies at the Milken Institute where he oversees the Institute's research efforts examining the dynamics of comparative regional growth performance. His interest lies in the quantification of those factors that determine the relative economic success of regions, particularly in the United States. He is examining the effects of information technology, international trade, education and labor-force skills training, cost of doing business, early-stage financing and quality-of-life issues on the geographic distribution of economic activity. He is the author of numerous studies on the impact of technology on regional and metropolitan economies, among them, *America's High-Tech Economy: Growth, Development, and Risks for Metropolitan Areas*. He also authored *The Impact of September 11 on U.S. Metropolitan Economies* and is the creator the annual Forbes/Milken Institute "Best Places for Business and Careers" rankings. Prior to joining the Institute, DeVol was senior vice president of WEFA, Inc. (formerly Wharton Econometric Forecasting), where he supervised their Regional Economic Services group. DeVol appears on national television and radio programs to discuss a variety of economic topics. He is frequently quoted in print media such as *The Wall Street Journal*, *Investor's Business Daily*, *Los Angeles Times*, *Forbes* and others. DeVol earned his M.A. in economics from Ohio University.

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