

The Delaware Valley Life Science Workforce:

An Analysis of Current and Future Needs

2003 Update



Life Science Career Alliance

Commissioned by the
Life Science Career Alliance
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Preface

The Delaware Valley faces unprecedented opportunities in harnessing the life science as a strategy for regional development. Such a strategy promises both greater economic vitality for the region and improved health for its residents. Achieving this promise, however, depends on the region's ability to recruit, train and keep the needed workforce. The Life Science Career Alliance is a collaborative partnership designed to assure that this promise becomes a reality. Its mission is to maintain and increase the strength of life science in the Delaware Valley by maintaining and improving the regional life science workforce. Its goals:

- Mobilize regional resources to ensure the availability of a skilled workforce available to support the life science sector of our economy including hospitals, pharmaceutical and biotechnology organizations;
- Systematically identify and monitor regional workforce supply/demand for life science;
- Publicize the opportunities for life science careers in the region; and
- Promote collaboration on workforce development among life science sector.

Information about the characteristics of the life science workforce in the region is the basis for effective action to build and maintain that workforce. This *2003 Update* of the assessment conducted two years ago provides an updated systematic analysis of current and forecasted life science workforce regional supply, demand and shortages. It serves as another step in the creation of a common regional information infrastructure to guide the accomplishment of the objectives of the alliance. We hope that the update will be used by all of the region's life science educational and research institutions, service providers, payers, governments, workforce systems and other concerned parties. From discovery to production to distribution and delivery of health services, they are all critical parts of the engine that will drive the region's economy in the 21st Century. The information provided in this update will help guide the challenging voyage we have all undertaken together.

We are indebted to many who have enthusiastically joined in this collaborative effort. The Independence Foundation provided the funding for the update. The alliance board, whose distinguished members are listed on the next page, helped to shape the development of this report. We appreciate the assistance of the Bucks, Chester, Delaware, Montgomery and Philadelphia County Workforce Investment Boards that provided financial support and guidance to the project. We especially appreciate the efforts of Brian Wyant and Todette Holt of the Pennsylvania Department of Health and Laurette Keiser of the Department of State for their assistance in providing a summary for the Philadelphia region derived from their re-licensure and nursing program surveys. The support and initiatives that the first report generated for the alliance were heartening. We look forward with this update to continuing the work of the alliance and to realizing the promise that sparked its creation.

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Executive Summary

This workforce update is a product of the Life Science Career Alliance. The life science sector of the economy is composed of hospitals and other healthcare providers; pharmaceutical companies; biotechnology firms; medical devices companies; medical informatics; insurers; education and research institutions. Healthcare employment is the largest component of the overall life science sector and hospitals comprise the largest component of health care.

The objectives of this report are to:

- Compile and distill the most recent existing data on the region's healthcare/life science workforce into a useful resource.
- Refine a model to better describe the current dynamics of supply and demand as they impact life science employers in the region.
- Provide an updated forecast of future workforce supply and requirements.
- Suggest a structure for the emergence of an on-going life science workforce monitoring process that can best assist employers and training programs.

The report is organized into four sections, following an outline similar to many workforce analyses. The first section describes the factors affecting demand and the second the factors affecting supply. The third section assesses current shortages and forecasts future ones. The final section explores alternative ways that an on-going monitoring system can be developed to support the development of a regional life science workforce strategic plan and to assess the success of its initiatives.

Because of different data availability for different specific analyses, the "region" for the purposes of this assessment is either defined broadly as the Philadelphia Primary Metropolitan Statistical Area (PMSA) or as the smaller the Philadelphia Metropolitan Statistical Area ((MSA). The PMSA includes the five Pennsylvania counties of Bucks, Chester, Delaware, Montgomery and Philadelphia and the four adjoining New Jersey counties of Burlington, Camden, Gloucester and Salem. The MSA includes only the five Pennsylvania Counties. The MSA serves as the major focus of the alliance and offers some state data resources for analysis that are not consistently available across the entire PMSA.

Demand

Trends in demographics, the economy, health status, technology, financing and the organization of services have shaped life science sector employment demands.

- **The crest of the regional post World War II baby boom will reach 65 in 2025, producing a critical imbalance in which workforce needs will be far greater than supply. ***

- Just as with other forms of employment, **health employment and residence tie the five counties of the Philadelphia MSA together**, with 35% of those employed in the City living outside and 25% of those living in the City working outside of Philadelphia.
- **Age adjusted hospital days per 1,000 dropped 55% and the average length of stay 31% in the last twenty five years** in the United States, reducing the hospital share of health services employment in the region from 64% to 40% and increasing the intensity of services that must be provided to patients in the hospital.
- **Philadelphia PMSA employment in the life science sectors has doubled in the last twenty-five years to more than a quarter million while its share in the total regional workforce has grown from about six percent to more than 11%.** It has become an ever more important backbone for the regional economy.
- **Hospital sector employment declined in the early 1990s.** The perception that the hospital sector lacks financial stability has adversely affected recruitment efforts. These recruitment problems were further aggravated by low general unemployment rates in the region and the financial constraints faced by many hospitals.
- About **180,000 persons in health services practitioner, technical and support occupations** are currently employed in the Philadelphia MSA.
- Employment in all life science and health services related occupations is **projected to increase by more than 20,000 and total employment in these occupations will exceed 200,000** in the Philadelphia MSA by 2010.
- Employers will have sought **a total of 59,370 new and replacement positions between 2000 and 2010.**
- These **projections in job growth are lower than the ones published in our earlier report using 1998-2008 projections** and reflect the influence of the recent downturn in the regional economy.
- **Pharmaceutical employment growth will outpace growth in health care in the Philadelphia MSA (12.8% vs. 5.3%) but will continue to constitute less than 10% share of total regional life science employment.**
- In part reflecting the transformation of hospitals into health systems, **hospital employment will decline** as a percent of total health services employment and **office practice and home health employment will grow** at more rapid rates.
- The **“high growth” occupations**, those projected to grow by 20% or more during this period are: **physician assistant, audiologist, respiratory therapists, speech-language pathologist, cardiovascular technologists and technicians, emergency medical technicians and paramedics, pharmacy technicians, respiratory therapy technicians, medical records and health information technicians, occupational and physical therapist assistants and aides, and medical assistants.** Most of these “high growth” occupations

are ones requiring less extensive training and tend to address the needs of an aging population. These shifts in the workforce may slow the growth in health care cost and reduce the overall level of pay for health care jobs in the future.

- **The largest absolute increases in employment will be for Registered Nurses, Licensed Practical Nurses, Nursing Aides and Attendants and Home Health Aides.**
- **During the next ten years in the Philadelphia MSA, health care occupations will account for about 20% of the growth in jobs and life science industries as a whole will account for 36% of the overall growth in employment.**

Supply

The total supply of individuals licensed or credentialed for particular occupations is influenced by regional trends in demographics, educational opportunities and the career preferences of age cohorts. The actual supply or workforce participation rate is a function of the age composition of the occupational group, the work environment and the relative attractiveness of other sources of employment.

- **The 721,000 school age children in the five county area of Southeastern Pennsylvania are the major pipeline** that will supply the region's life science workforce over the next twenty years.
- **The inability to afford the cost of health science post secondary school training and the persistence of gender tracking** in some in life science training programs will restrict the potential supply.
- **The total RN workforce for the Philadelphia MSA in 2002 is estimated to be 43,218 and 7,752 LPNs.** In spite of some increases on program enrollment the overall number of RNs and LPNs is projected to decline over the next eight years.
- A similar set of projections for the region is developed for other health related occupations using the more limited information available for these occupations.

Shortages

We used three alternative approaches to assess workforce imbalances in the Philadelphia MSA: (1) a more qualitative assessment based on industry reports and listings of job openings, (2) a comparison of occupational employment to population ratios in the Philadelphia MSA and national ones and (3) a comparison of forecasts of supply and employment for a selected group of occupations.

- The more qualitative assessment suggests that there will be difficulty particularly in filling nursing and pharmaceutical occupational positions.
- The population ratios indicate that:
 - Correcting for the age structure of the region's population, allied health employment-to- population ratios in the Philadelphia MSA are generally higher than national ones, reflecting the concentration of specialized care in the region.

- The region has high physician population ratios resulting in an overall health services workforce skill mix that is higher than that of the nation as a whole. This reflects the Philadelphia region's role as a center for teaching, research and specialized care and its attractiveness as destination for receiving specialized services.
- Forecasts of supply and demand indicate:
 - Assuming equilibrium between supply and demand in 2000 and those conditions remain the same; the nursing shortage will grow to more than 9,000 RNs and 1,500 LPNs or an 18% shortage of RNs and a 16% shortage of LPNs for the region by 2010. The forecasted shortage of RNs is about twice as large as our earlier forecast. This more recent forecasts benefits from the availability of more accurate estimates from the analysis of current training programs reports and re-licensure surveys of nurses cooperatively conducted by the Pennsylvania Department of Health and the Department of State's Bureau of Professional and Occupational Affairs.
 - Of the other fields for which estimates could be projected, shortages are also projected for Cardiovascular Technologists, Clinical/Medical Lab Technicians, Medical Assistants and Surgical Technologists.
 - After 2010, projected shortages are likely to worsen, and shortages will appear in other occupations as the first impact of the Post World War II baby boom begins to produce accelerated rates of retirement in an aging life science workforce and by the growing service needs of an aging regional population.

Conclusions

- Earlier national and regional forecasts failed to anticipate the impact of the general economy on life science related supply and demand and the overall resilience of demand in the health sector. It suggests the need for caution in interpreting the current forecasts presented in this report.
- A longer-term strategy should be pursued to avert the serious shortages that loom in ten to twenty years. Success in averting these longer-term shortages will strongly influence the region's economic vitality and the health of its residents in this coming century of breath taking technological and organization change in the life science.
- The strategy needs to address a combination of factors: a smaller overall workforce and a larger population requiring care, changes in basic and advanced skills of the workforce, opportunities in other economic sectors, a continuing shifting mix in the occupations needed within healthcare, progressive changes in the population's care needs, rapid technological change and the changes in the work environment and the resources available for workers in health care.
- A necessary condition for success is the development of an adequate information infrastructure to plan and assess regional workforce strategies.

- The first step in developing an adequate information system would be to establish a regional center for workforce analysis to facilitate better use of existing information and to facilitate its improvement.

A solid information infrastructure to guide the development of the Life Science Workforce Initiative is essential.

Introduction

This update is a product of the *Life Science Career Alliance*. The life science sector of the economy is composed of hospitals and other healthcare providers; pharmaceutical companies; biotechnology firms; medical devices companies; medical informatics; insurers; education and research institutions. Healthcare employment is the largest component of the overall life science sector but it includes the entire “supply chain” or continuum from discovery to development to production to distribution and delivery of health services. According to a recently released study by the Milken Institute, *America’s Health Care Economy*, the Philadelphia region ranks a close third to Boston and New York as a national “health pole,” or concentration of such activities. As such, it attracts resources and talent and serves as an engine for regional economic growth. ⁽¹⁾ The Life Science Career Alliance was formed to develop ways to more effectively address the changing workforce needs in order to fully take advantage of this key component of the regional economy.

This is an update of *The Quantitative Assessment of the Delaware Valley Life science Workforce Needs for the 21st Century* that was released in March 2002. The update was requested by Life Science Career Alliance to help it address the challenges it faces in a rapidly changing environment. The *Life Science Career Alliance* sees the successful recruitment and development of a talented life science workforce as a major basis for the economic viability of the region and the health of its residents. They also see the emergence of a regional information infrastructure to assist in workforce planning and development as one of the keys to success of such efforts.

One of the most pressing concerns of health services providers continues to be the difficulty they experience in recruiting nurses, pharmacists and some other key technical staff. Concerns over health services workforce shortages have stimulated many thoughtful national and state reviews. A general decline in interest in life science related careers can be seen in the 29% national drop in the number of applicants to medical schools from 1996 to 2002. ⁽²⁾ Among Pennsylvania residents, the number of applicants dropped by 40% during this same period. National population projections lead to an estimated 40% decline in the ratio of caregivers to people needing care between 2010 and 2030. ⁽³⁾ Others have noted that the healthcare workforce and, particularly nursing, is aging faster than the population as a whole as a result of the decline in women choosing nursing as a profession. One study projects that, as a result of this aging, the national RN workforce will be 20% below required levels by 2020. ⁽⁴⁾ There was a six year decline nationally in entry level enrollment, in part reflecting the downturn in the economy, reversed in 2001, increasing by 3.7%. ⁽⁵⁾ Nursing schools in Pennsylvania fared better than in other states. Reflecting increased media attention and efforts by providers and schools, entry level enrollment increased by 23.9 percent. Hospital based nursing education programs rebounded even more strongly with a 48% increase in entry level enrollment. ^(6: 2)

However, reflecting declines in entry-level enrollment in previous years, the number of nursing students graduating in 2002 continued its decline. Nurses also report high dissatisfaction with working conditions in hospitals, a growing problem apparently not unique to the United States.⁽⁷⁾ In one recent study, lower nurse staffing was associated with higher levels of dissatisfaction and burnout on the part of nurses and a slightly higher risk of patient mortality.⁽⁸⁾

In Pennsylvania, vacancy rates for hospital RNs increased to 11.1% and turnover increased to 13.1% in 2001.⁽⁶⁾ The highest vacancy rates in the Southeastern region of the state were for emergency departments (17.1%) and for pediatric critical care (13.5%). Hospitals have attempted to compensate for these vacancies in various ways including increased use of part-time, per diem staff and hospital float pools.⁽⁹⁾

Some hospitals, faced with persistent shortages have sought to recruit foreign nurses. In a survey of hospitals in Pennsylvania in 2002, 32% reported that they were considering the recruitment of foreign nurses and 13% reported that they were actively engaged in such recruitment.^(6 p. 15) The most common sources identified in the survey were the Philippines and Canada.

In contrast to steadily worsening shortage in nursing, there has been a sudden shortage in pharmacists in the last three years. This is described as a “dynamic” shortage reflecting a significant increase in the volume of prescriptions dispensed, growing demand for pharmacists in retail pharmacies and growing demand for pharmacists by hospitals reflecting their increasing involvement in patient care.⁽¹⁰⁾ The pharmacist shortage has been further exacerbated by a growth in credentialing requirements and by the growing attention to medication safety in hospitals.

As a result of the professional liability crisis and resulting exodus of physicians from areas like Philadelphia where unusually high jury awards are frequent, supply of primary care physicians and specialists in the region, has begun to be a concern. Historically because of its role as a world-class center for medical training, the Philadelphia region has been well supplied with medical talent. Yet, between 1997 and 2002, the City lost about 450 physicians or approximately 20% of its physician workforce.⁽¹¹⁾ Statewide there have been significant declines in the last five years in the number of practicing orthopedic surgeons, neurosurgeons, anesthesiologists and obstetricians.

At the same time, rapid developments in the life science and information technology are placing new demands on health care providers and posing new challenges to life science researchers. These advances are not only transforming the way specific diseases are prevented, monitored, and treated, but also radically transforming the organization of the entire enterprise.

Yet, in spite of the sense of urgency and new efforts by Pennsylvania Department of Health to generate better workforce information, it continues to be difficult to assess the workforce needs at the regional level. Data continues to come from a bewildering array of sources, have many limitations and often use incompatible categories, geographic regions and time periods. At a national level there are at least 62 separate national data sources from more than 39 different federal agencies and national professional associations. ⁽¹²⁾ At the local level data are even more fragmented and incomplete. Thus, local level health care providers and educational programs still feel they are navigating their airplanes blind, without maps, instruments or radios. This update continues the task of filling the regional information void, clarifying cyclical dynamics and longer-term trends and refining strategies for assuring the emergence of an effective regional information infrastructure that can provide to better guidance for the actions of educational programs and employers in the future.

Organization of the Report

The objectives of this report are to:

- Compile and distill the most recent existing data on the region's healthcare/life science workforce into a useful resource.
- Refine a model to better describe the current dynamics of supply and demand as they impact life science employers in the region.
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The report is organized into four sections following an outline similar to many workforce analyses. The first section describes the factors affecting demand and the second the factors affecting supply. The third section assesses current shortages and forecasts future ones. The final section explores alternative ways that an on-going monitoring system can be developed to support the development of a regional life science workforce strategic plan and to assess the success of its initiatives.

The "region" for the purposes of this assessment is defined in two ways:

- (1) **The Philadelphia Primary Metropolitan Statistical Area (PMSA):** The Philadelphia PMSA includes the five Pennsylvania counties of Bucks, Chester, Delaware, Montgomery and Philadelphia and the four adjoining New Jersey counties of Burlington, Camden, Gloucester and Salem. It provides a broad approximation of the regional life science/health services labor market. It encompasses a population of more than five million and

includes the full complex array of life science, information and biotechnology research, development, and delivery activities envisioned by the *Life Science Career Alliance*. It also represents the media market area in which the Workforce Initiative's promotional and development activities will take place.

- (2) **The Philadelphia Metropolitan Statistical Area (MSA):** The Philadelphia MSA includes the central city (Philadelphia) and its surrounding Pennsylvania counties (Bucks, Chester, Delaware and Montgomery). It is a more tightly tied together in terms of the organization of health services and health services employment. For program planning purposes it is also the central focus of the Life science Alliance. In addition, using this unit of analysis allowed us to take advantage of several newly available state data sources that added to the precision of the analysis.

This report will provide a statistical analysis of the Delaware Valley Life Science Workforce needs. A more detailed description of the data sources and their limitations are in the accompanying endnotes. Much of the data used to support this analysis is available in more detail and can be updated from the websites identified in these endnotes.

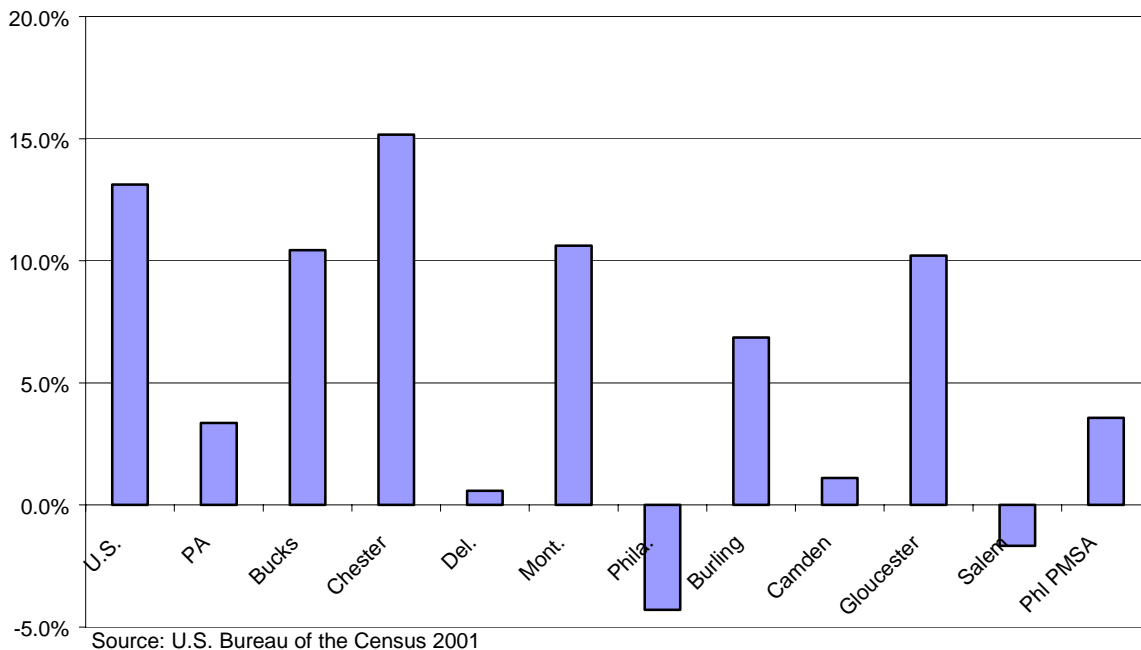
Part 1: Workforce Demand

Many factors influence the number of physicians, nurses, pharmacists, life scientists and other health workers needed in the Philadelphia PMSA. Trends in demographics, health and financing shape demand.

a. Demographics

The size, rate of growth and age composition of a region's population are a major determinant of both life science workforce requirements and the ability to fill those requirements. As indicated in **Figure 1.1**, the population in the Philadelphia nine county PMSA grew 3.6% between 1990 and 2000 to 5,100,931. It is expected to grow at about the same rate over the next decade. The state of Pennsylvania is projected to increase by only 5% between 1995 and 2025, while New Jersey, which shares four counties in the Philadelphia PMSA, is expected to grow by 20% during this same thirty year period. The City of Philadelphia, while encompassing 43% of the population in the Philadelphia MSA, is projected to continue to decline over the next decade by about 5%.

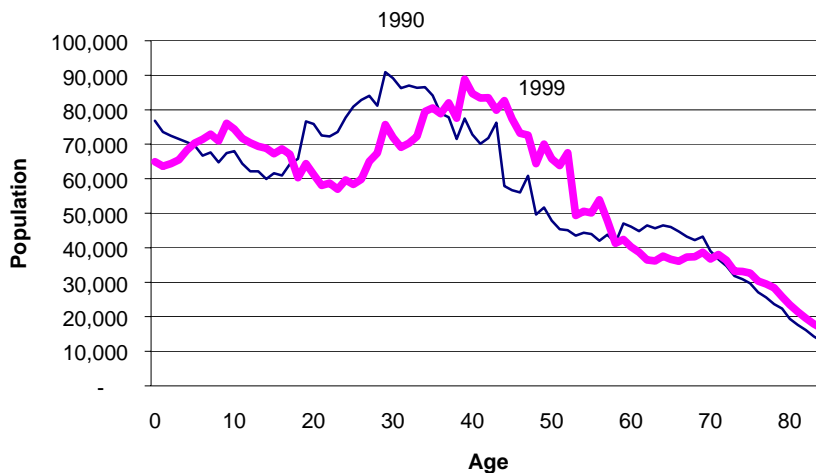
**Figure 1.1 Percent Change in Total Population 1990-2000:
U.S., Pennsylvania and the 9 County Philadelphia PMSA**



The over 65 population in the region grew at about half the rate of the total population over the last decade and this relatively slow rate of growth will continue for the next decade. This will,

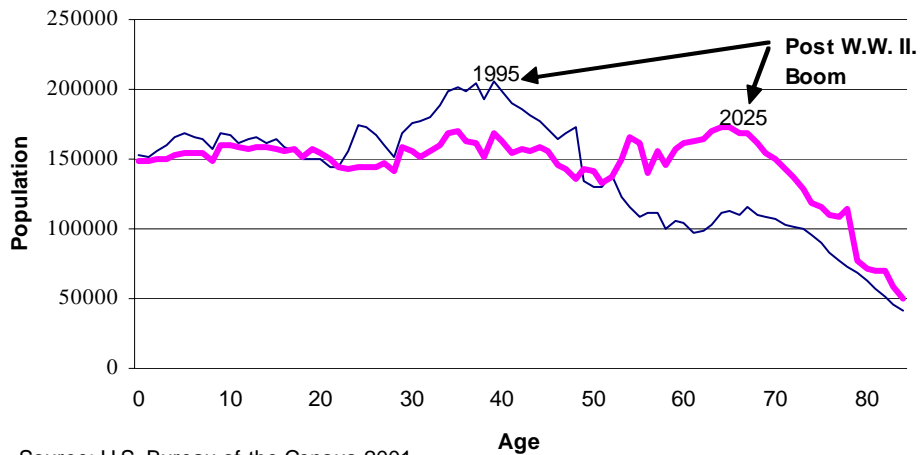
however, change dramatically in the decades after 2010. The elderly require more health services. The elderly population is projected to grow more slowly over the next decade. Were the growth of elderly to be faster than forecasted, the staffing problems faced by area health services providers would make it even more difficult to provide care. As indicated in **Figure 1.2**, low regional birth rates during the 1920s and 1930s in the Philadelphia PMSA produced slow growth in the over 65 population between 1990 and 1999, with the crest of the post World War II baby boom passing 40 at the end of the decade. ⁽¹³⁾ i Population forecasts for Pennsylvania, shown in **Figure 1.3**, indicate that there will be a dramatic flattening out of the age distribution as the crest of the post World War II baby boom reaches age 65 in 2025. By that point, conditions will have change so much that we will no longer be able to use current assumptions to make good forecasts. It is very important not to be misled about our workforce needs because of the slow growth in the elderly population over the next few years resulting from this historical fluctuation in birth rates within the region.

**Figure 1.2 Philadelphia PMSA Population by Age:
1990-1999**



Source: U.S. Bureau of the Census 2001.

**Figure 1.3 Pennsylvania Population Projections
1995-2025**



Source: U.S. Bureau of the Census 2001.

Housing and employment markets shape commuting patterns and tie the Philadelphia MSA together. As indicated in Figure 1.4, 25% of Philadelphia’s residents are employed in the suburbs and beyond and 35% of those employed in the City live in the suburban counties and beyond. In terms of health care, as reflected in budgeted positions described in the next section, many higher skilled professionals residing in suburban counties fill positions in the city while city residents fill many of the more unskilled positions in the suburban counties. A similar pattern of migration takes place with patients. Ten percent of the patients hospitalized in the Philadelphia MSA come from outside the region and 29% of the patients hospitalized in Philadelphia come from outside the City.

Figure 1.4 Philadelphia Residents and the Philadelphia Workforce

<u>Where Philadelphia Residents Work</u>		<u>Where the Philadelphia Workforce Lives</u>	
Philadelphia	429,667	Philadelphia	429,667
Montgomery	59,970	Montgomery	54,576
Bucks	23,248	Delaware	48,151
Delaware	21,802	Camden	32,962
Chester	7,810	Bucks	31,892
Camden	7,196	Burlington	17,661
Burlington	5,087	Gloucester	13,778
New Castle	1,856	Chester	10,568
Mercer	1,676	New Castle	5,386
Gloucester	1,502	Mercer	1,548
Atlantic	831	Atlantic	1,359
New York City	695	Cape May	711
Other	8,421	Other	11,791
Total	569,761	Total	660,050
Percent Commute out of City	24.6%	Percent Commute to City	34.9%

Source: 2000 U.S. Census

b. Health

The health of a population exerts a strong influence on health care workforce requirements. Some slack workforce capacity is needed to successfully handle unpredictable events. Periodically, virulent flu viruses or extremes in weather have flooded clinics, emergency departments and hospital floors in the region. New acute and chronic conditions ebb and flow in the region's population, posing changing care and treatment challenges. For example, the over 85 population is projected to continue to grow in the region. The prevalence rate of Alzheimer's in the over 85 population is estimated to be as high as 47.2%. However, new preventive and treatment approaches may greatly change workforce needs. Nationally age adjusted disability in the over 65 population has dropped by 10% since 1982 and this has corresponded to an almost 50% decline in the use of nursing homes during this period.⁽¹⁴⁾ In general, the suburban counties have health status indicators significantly above and the City of Philadelphia, significantly below those of Pennsylvania and the nation as a whole. These differences in health status are reflected in differences in demand for health services.

c. Financing

Health services providers have to align expenses with revenues. Workforce is the major component of these expenses. Changes in hospital net patient revenues between Fiscal Year 1999 and 2002 for hospitals in the Philadelphia MSA averaged about 8%, roughly matching the increase in operating expenses. The operating margins declined with the city hospitals achieving an overall 2.2% operating margin in Fiscal Year 2002 and the suburban county hospitals a margin of -.18%.⁽¹⁵⁾ Projecting this pattern forward, one would conclude that:

- Medicare, Medicaid and private employee health plans will keep hospital net patient revenue increases at little higher than the rise in the cost of living, assuming that the over all condition of the economy improves.
- Whatever increases in staffing or salary levels that will be necessary in some areas of hospital operations will have to be offset with reductions in staffing and costs in other areas.
- It will continue to be difficult for most hospitals to "buy their way out" of existing shortages by raising wages or increasing staffing to reduce work pressures and improve the quality of the work environment.

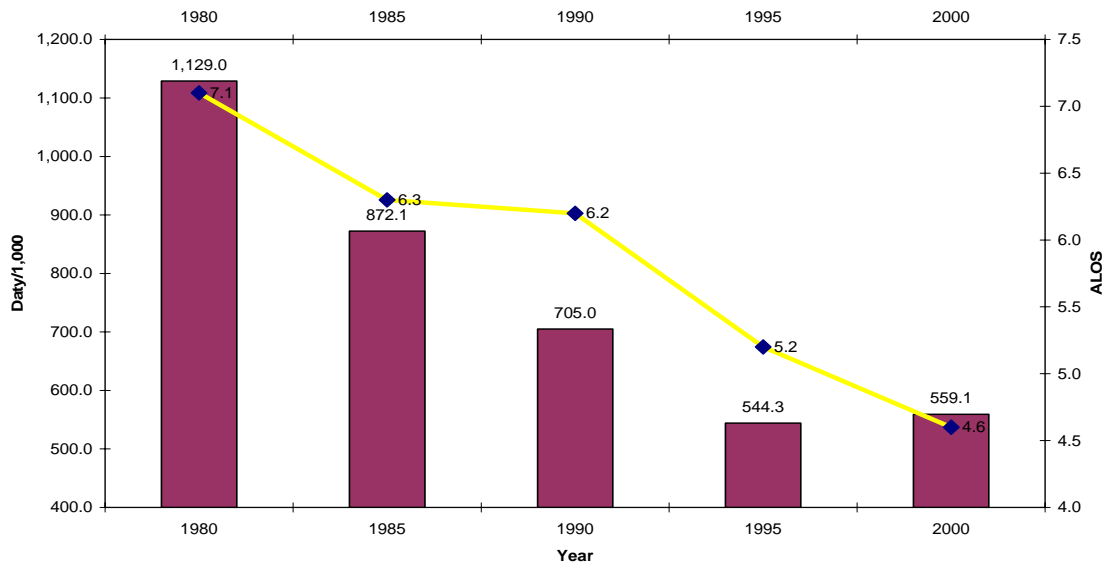
d. Utilization

Part of the strategy Medicare, Medicaid and private health insurance plans have adopted to control their cost increases has been to create financial arrangements with hospitals that discourage inpatient use and reduce length of stay. This has resulted in dramatic declines in average length of stay in the last two decades. Nationally, as indicated **Figure 1.5**, age-adjusted acute hospitals days per 1,000 dropped 50% from 1,129 to 559 days per 1,000 between 1980 and 2000. Average length of stay (ALOS) dropped 31%, from 7.1 to 4.6 days during this same

period. In the Philadelphia Five County Area, average length of stay and days per 1,000 (not age adjusted) declined about a 40% during this same period, as indicated by **Figure 1.6**. While both nationally and in the Philadelphia MSA hospital use rates appear to have “bottomed out” changes in patterns of hospital use over the last two decades have:

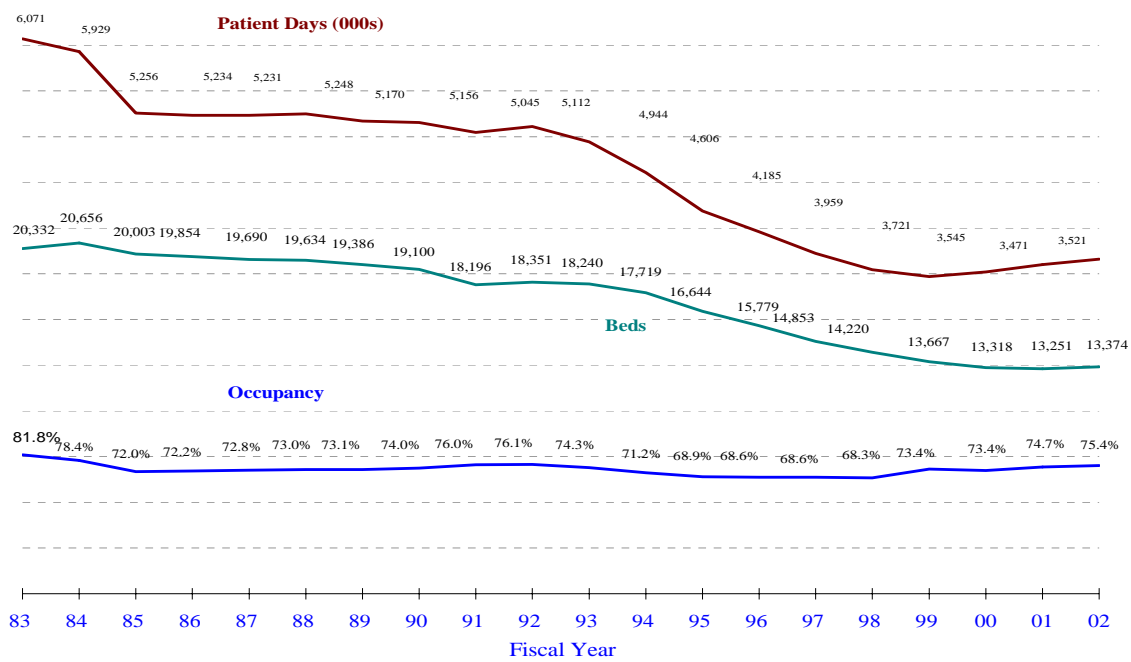
- Dramatically increased the average intensity of care provided hospital inpatients during ever-briefer stays.
- Radically altered the hospital work environment, placing greater demands on its workforce.
- Created growing staffing challenges in the face of a shrinking supply able to work in a new, financially constrained environment.

Figure 1.5 Age Adjusted Acute Hospital Days per 1,000 and ALOS in the United States 1980-2000

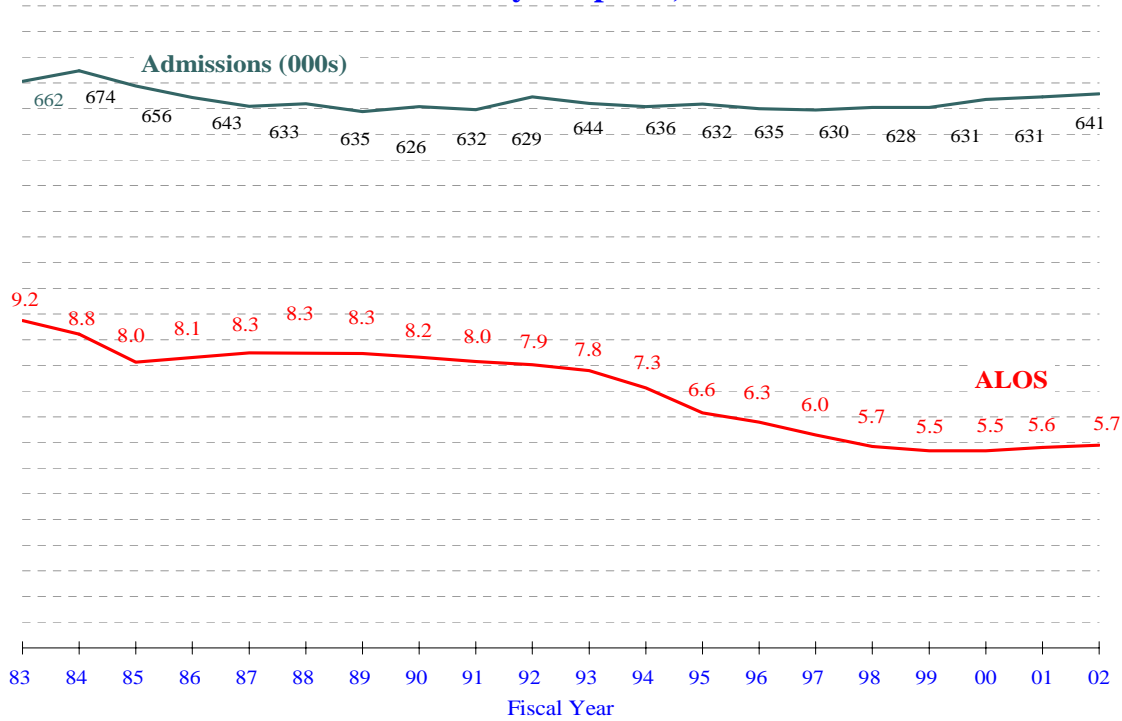


Source: Department of Health and Human Service 2002

Figure 1.6. Delaware Valley Hospital Utilization Trends
Staffed Beds* and Patient Days
All Delaware Valley Hospitals, FY83 - FY2002



Admissions and Average Length of Stay
All Delaware Valley Hospitals, FY83 - FY2002

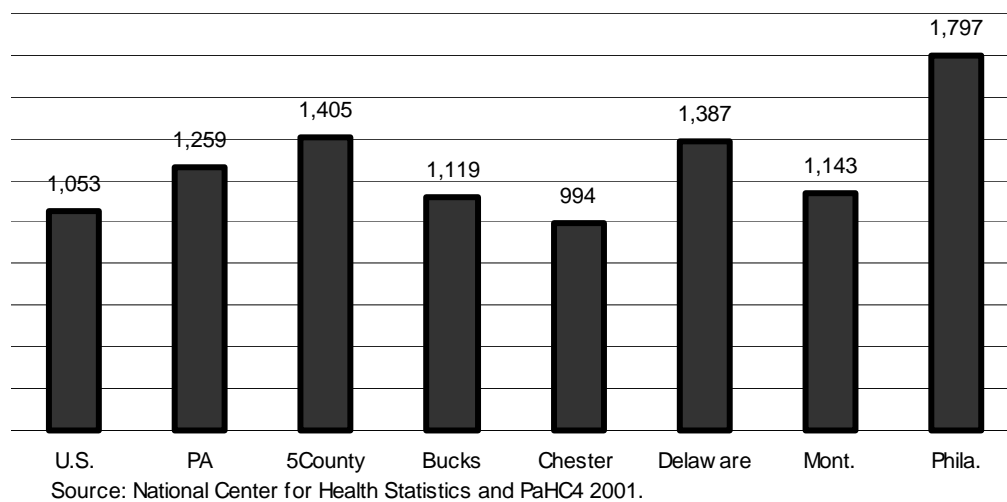


Source: Delaware Valley Healthcare Council Hospital Utilization Reports 2003

Declines in hospital use are not uniform across the Philadelphia region and, in part, reflect differences in underlying morbidity. As indicated in **Figure 1.7**, overall utilization rates vary significantly within the Philadelphia region.

- Chester County has age-adjusted admission rates lower than state and national figures
- Philadelphia's age-adjusted rates are 1.8 times higher than national age adjusted admission rates.
- These variations in use within the region reflect differences in morbidity associated with poverty and population decline. (In counties such as Philadelphia with a declining population, the more affluent and healthy are more likely to migrate to the suburbs, leaving a poorer, less healthy population behind).

Figure 1.7. Age-Adjusted Discharges Per 10,000 Population 1999



e. Employment

The life science sectors compete in attracting talent, not just within the sector, but also with other sectors of the economy. That competition increased as a result of a strong economy and the continuing decline in gender barriers to employment in the latter half of the 1990's. As indicated in **Figure 1.8**, health services employment is 80% female. In 2002 94% of Registered Nurses and 96% Licensed Practical Nurses employed in health care in Pennsylvania were female.^(16, 17) The gender composition of the health care workforce has remained unchanged since 1964. The female concentration in new allied health program completions in the Philadelphia area continues to mirror the national concentration of women in these occupations. However, during this period, the percent of women entering medical schools has grown progressively. Women composed 46% of the entering 2000-2001 medical school class in the United States.^(18 p. 1051) Similarly, the workforce as a whole has shifted from 34% female to 48%

female. As occupational opportunities have expanded for women, the health services sector has faced many of the “gender gap shortages” that other historically female occupations, such as elementary school teachers and secretaries, have faced. In addition, periods of low general unemployment tend to exacerbate shortages in health sector employment by increasing opportunities for alternative sources of employment. As indicated in **Figure 1.9**, unemployment rates dropped markedly in the region in the last decade but since 2001 have climbed again. This appears to have helped moderate existing nursing shortages, as it did during previous periods of high general unemployment.

As indicated in **Figure 1.10**,⁽¹⁹⁾ the health services sector employment in the Philadelphia PMSA has:

- More than doubled in the last twenty-five years and now provides jobs for more than a quarter of a million people. Indeed, in the City of Philadelphia it was the only major sector growing significantly during this period.
- Moderated but continued to grow after 2000.

However, as indicated **Figure 1.11**, the hospital sector in the Philadelphia PMSA: ⁱⁱ

- Mirrored the growth in overall employment only up until 1992.
- Lost more than 10,000 jobs between 1992 and 1995.
- Produced the probably inaccurate perception that non-hospital employment was more stable, making the current recruitment job for hospitals more challenging.

Figure 1.8 Gender Composition of the Total and Health Services Workforce in the United States 1964-2000

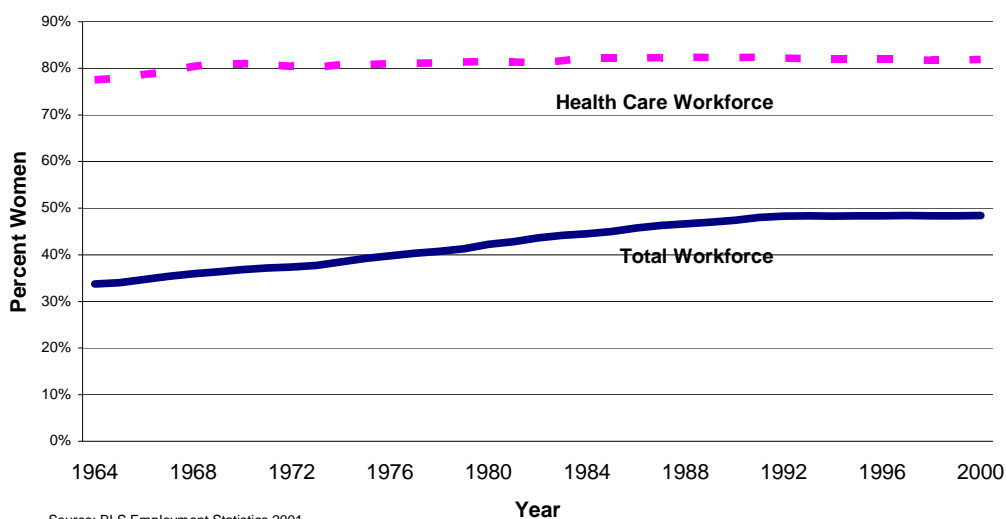
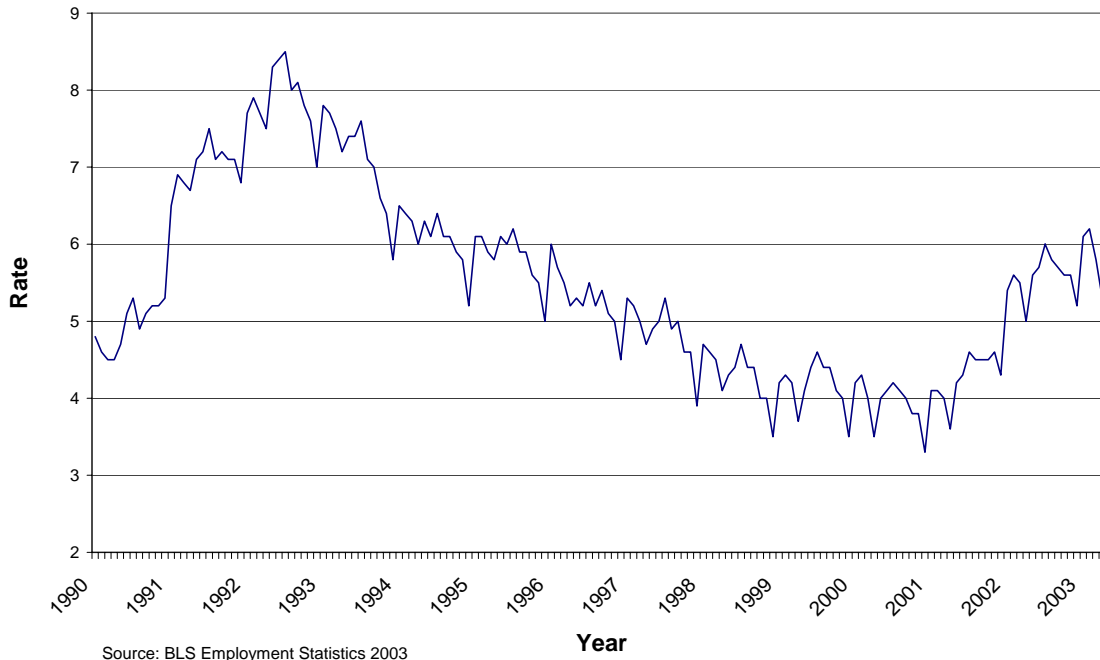


Figure 1.9 Philadelphia PMSA Unemployment Rate 1990-2003



As indicated in **Figure 1.12**, the shift in the health services sector employment away from hospitals has been a long-term trend:

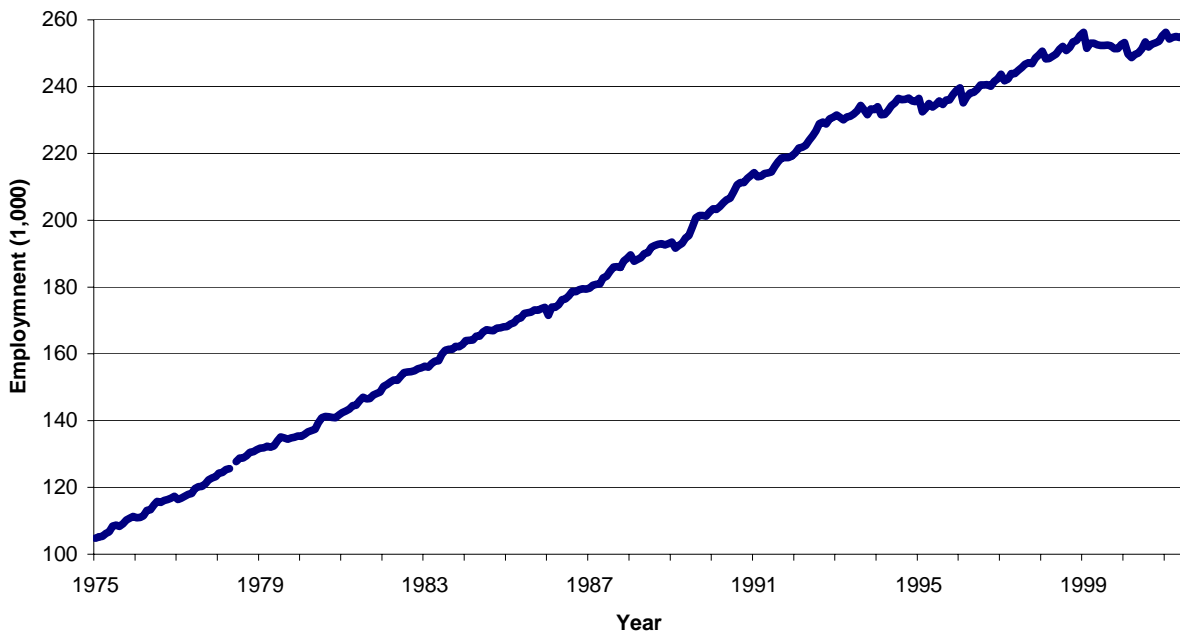
- Hospitals as a percentage of health services employment has dropped in the region from 64% in 1975 to less than 40% in 2003.
- The most significant drop in the hospital share of health services employment took place between 1992 and 1995. Both hospital and non-hospital healthcare employment has since stabilized.
- Employment in ambulatory and, to a lesser extent, nursing and residential care settings have continued to absorb a larger share of overall health services employment.

As indicated in **Figure 1.13**, health services employment has played an increasingly important role in the regional economy over the past quarter century.

- Health services related employment grew from less than 6% to more than 10.5% of all employment in the region. (Total life science employment now accounts for more than 14% of regional employment).⁽²⁰⁾
- The major jump in its share in the regional employment picture took place between 1989 and 1992 and, with this strong overall employment picture in the region in the last part of the 1990s, its share stabilized. Coinciding with the rise in overall unemployment rates in 2002, the health services and hospital share of overall employment have begun to increase again.

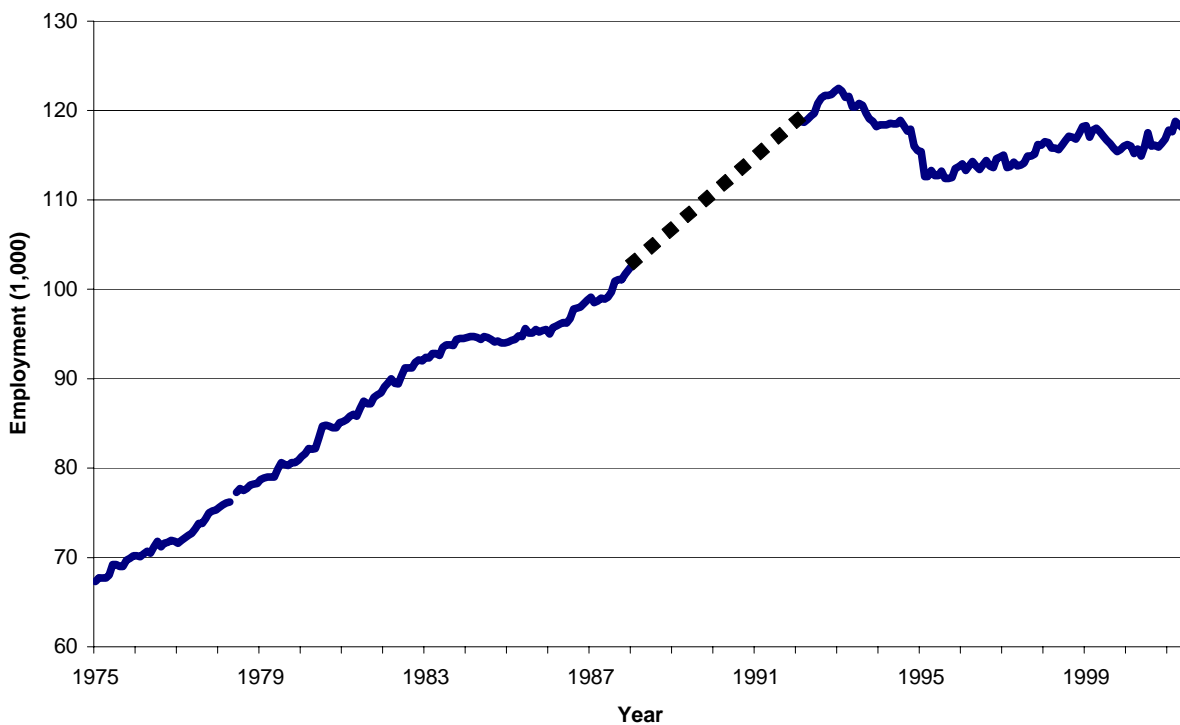
The health services sector has long served as a source of employment stability and a buffer from the cyclical nature of the economy as a whole. For the job seeker, it has been long perceived as a source of stable and secure employment. In the City of Philadelphia, it now provides employment for more than 17% of the city's workforce.⁽²⁰⁾ This figure understates the importance of health services employment, since many other sectors, such as insurance, information technology, and others provide supplies and services to the health services sector and rely heavily on this sector for business. The health services multiplier effect is estimated to be 1.53 for employment and 1.76 for output.⁽²¹⁾ In other words, two jobs in health care support another one outside this field and the \$6.75 billion in direct spending for hospitals in the region generates an additional \$5.13 billion in spending. The health sector, however, has not been immune to the shift from more highly paid technical to lower paid service jobs noted in the region's overall economy.⁽²²⁾ The shift from inpatient hospital employment to ambulatory and long term care settings may reflect a similar shift in health services towards the growth in more lower skilled and lower paid employment.

**Figure 1.10 Health Services Employment in the Philadelphia PMSA
1975 to 2001**



Source: BLS Employment Statistics 2001

Figure 1.11 Hospital Employment in the Philadelphia PMSA 1975 to 2001



Source: BLS Employment Statistics 2001, (Data not reported for 1988-91)

Figure 1.12 Percent of Total Health Services Employment in the Philadelphia PMSA 1990-1993

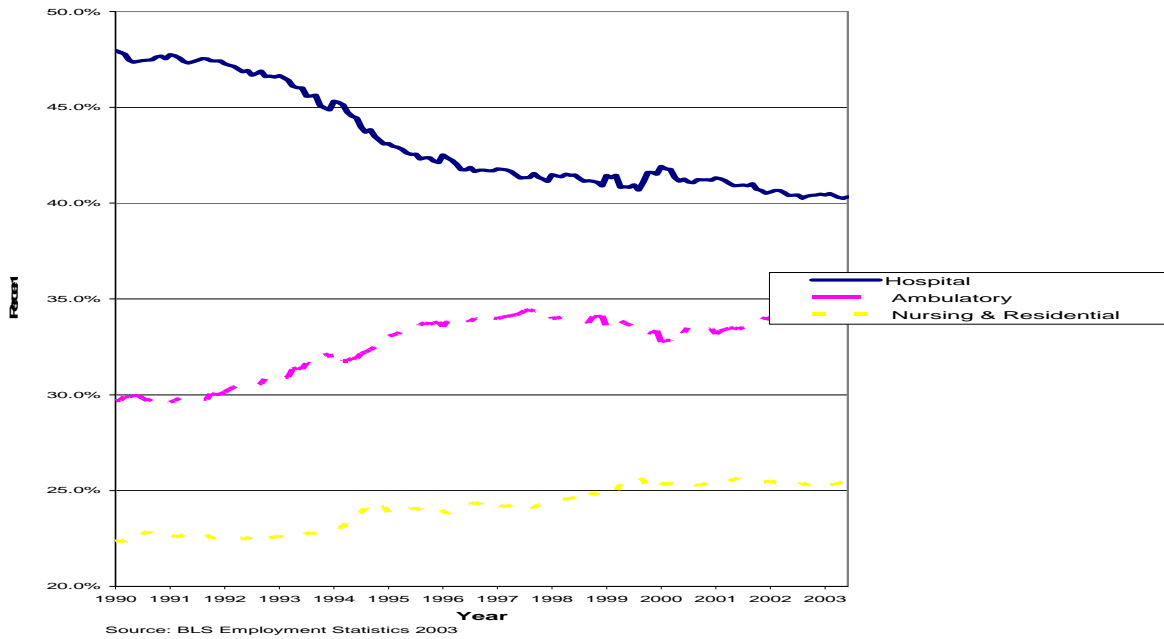
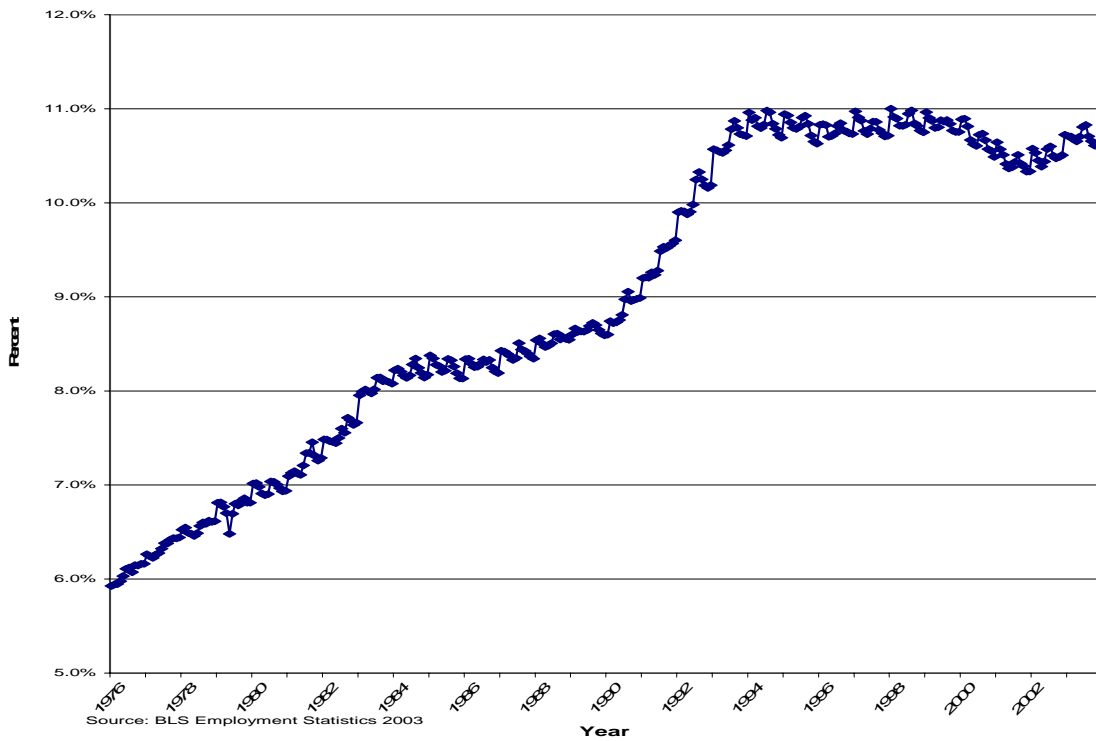


Figure 1.13 Health Services Employment as Percent of All Employment in Philadelphia PMSA 1975-2002



There are two different ways to measure life science employment: (1) counting the number of individuals employed in life science industries and (2) counting the number of individuals employed in life science occupations. The two counts overlap but are not the same. Accountants find employment in the health services industry but accounting is not considered a health services occupation. Registered nurses find employment in the health services industry but they also find employment in other sectors such as schools, insurance companies and business consulting firms not considered part of the health services industry. **Figure 1.14** summarizes total employment and median annual salaries for different health occupations in the Philadelphia PMSA, based on the Bureau of Labor Statistics Occupational Employment Statistics Survey, for 2001, the most current year for which the data are available. ⁽¹⁹⁾ Specific occupations listed in the table were those for which roughly reliable estimates could be obtained from the BLS sample. ⁱⁱⁱ

- An estimated 196,180 individuals in the Philadelphia PMSA are employed in health services occupations.
- Of this total, 67% are employed in healthcare practitioner and technical occupations, requiring relatively extensive preparation and providing an average salary of \$51,780.
- The remaining 33% are employed in health services occupations that require brief or on the job training and provide an average annual salary of \$23,060. In terms of their overall share of health services employment, these lower skilled, lower pay positions edged up 2% in two years.

The self-employed are excluded from the Bureau of Labor Statistics estimates, so these figures understate total employment. In addition, many individuals in non-health services occupations find employment in the health services sector (e.g. custodians and accountants). Altogether the health services industry in the Philadelphia PMSA employed 250,000 persons in 2000.

Figure 1.14. 2001 Philadelphia PMSA Health Services Employment and Mean Annual Salary*

a. Healthcare Practitioners and Technical Occupations

<u>Occupation Title</u>	<u>Employment</u>	<u>Confidence Interval*</u>		<u>Mean Salary</u>
		<u>Low</u>	<u>High</u>	
a. Healthcare Practitioners and Technical Occupations	131,920	126,749	137,091	\$53,540
Chiropractors	130	103	157	\$65,120
Dentists	1,350	1,120	1,580	\$122,920
Dietitians and Nutritionists	1,040	995	1,085	\$39,840
Pharmacists	4,060	3,869	4,251	\$68,250
Anesthesiologists	720	493	947	\$128,620
Family and General Practitioners	3,870	3,248	4,492	\$116,340
Internists, General	780	682	878	\$120,260
Obstetricians and Gynecologists	430	309	551	\$133,480
Psychiatrists	620	524	716	\$129,520
Surgeons	1,100	884	1,316	\$138,230
Physician Assistants	890	839	941	\$62,170
Podiatrists	80	74	86	\$80,670
Registered Nurses	51,540	50,934	52,146	\$51,780
Occupational Therapists	2,340	2,216	2,464	\$56,780
Physical Therapists	3,320	3,183	3,457	\$62,080
Radiation Therapists	290	275	305	\$51,420
Recreational Therapists	750	721	779	\$31,130
Respiratory Therapists	1,900	1,852	1,948	\$41,820
Speech-Language Pathologists	2,410	2,292	2,528	\$55,890
Veterinarians	740	647	833	\$78,930
Medical and Clinical Laboratory Technologists	2,800	2,729	2,871	\$42,620
Medical and Clinical Laboratory Technicians	3,160	3,067	3,253	\$32,040
Dental Hygienists	3,280	3,004	3,556	\$55,980
Cardiovascular Technologists and Technicians	940	907	973	\$35,000
Diagnostic Medical Sonographers	710	692	728	\$46,530
Nuclear Medicine Technologists	360	348	372	\$48,280
Radiologic Technologists and Technicians	3,470	3,395	3,545	\$38,090
Emergency Medical Technicians and Paramedics	5,070	4,543	5,597	\$27,010
Dietetic Technicians	370	333	407	\$25,480
Pharmacy Technicians	3,910	3,780	4,040	\$20,270
Psychiatric Technicians	830	796	864	\$28,080
Respiratory Therapy Technicians	470	430	510	\$35,110
Surgical Technologists	1,990	1,795	2,185	\$27,080
Veterinary Technologists and Technicians	1,060	1,002	1,118	\$26,920
Licensed Practical and Licensed Vocational Nurses	12,950	12,493	13,407	\$39,630
Medical Records and Health Information Technicians	2,220	2,146	2,294	\$26,490
Opticians, Dispensing	460	381	539	\$31,240
Orthotists and Prosthetists	40	24	56	\$55,940
Occupational Health and Safety Specialists and Technicians	1,040	867	1,213	\$51,880
Athletic Trainers	330	288	372	\$34,990

b. Healthcare Support Occupations

<u>Occupation Title</u>	<u>Employment</u>	<u>Confidence Interval*</u>		<u>Mean Salary</u>
		<u>Low</u>	<u>High</u>	
b. Healthcare Support Occupations	64,260	62,749	65,771	\$23,060
Home Health Aides	9,850	9,599	10,101	\$19,120
Nursing Aides, Orderlies, and Attendants	25,850	25,445	26,255	\$21,810
Psychiatric Aides	1,240	1,187	1,293	\$27,040
Occupational Therapist Assistants	530	509	551	\$36,650
Occupational Therapist Aides	240	219	261	\$24,020
Physical Therapist Assistants	880	823	937	\$35,670
Physical Therapist Aides	740	712	768	\$21,850
Massage Therapists	190	167	213	\$36,750
Dental Assistants	3,390	2,925	3,855	\$29,870
Medical Assistants	7,590	6,906	8,274	\$24,340
Medical Equipment Preparers	460	449	471	\$24,570
Medical Transcriptionists	2,520	2,406	2,634	\$28,250
Pharmacy Aides	1,060	1,006	1,114	\$16,590
Veterinary Assistants and Laboratory Animal Caretakers	550	523	577	\$19,240
Total	196,180			

Source: BLS, *Occupational Employment Statistics 2003*.

*Estimates exclude self-employed. **The range represents the 95% Confidence Interval for the sample estimates of employment. Only occupations with a sample size sufficient to allow reasonable estimates are included in the table.

More detailed information on employment based on reported payroll for hospitals and long term care institutions is presented in **Figure 1.15** for the Philadelphia MSA. In 2001 hospitals in this region reported a total full time payroll of 63,640 and long-term care facilities reported a total full time payroll of 13,812. Registered nurses represent the largest component of the hospital workforce (24%) and unlicensed assistants the largest component of the long-term care facility workforce (39%).

In both hospitals and nursing homes about 30% of the staff and 40% of the registered nurses work part-time. The large part-time component of the workforce poses a particular challenge to facility specific quality improvement and on the job training programs. It also reflects the efforts of hospitals and nursing homes to attract staff for which family and child care responsibilities make them reluctant to assume the responsibilities of full time employment.

A large and central component of the life science workforce is the physician. Most are self employed and not captured in surveys of employers. The size and specialty characteristic of the physician work force drives demand for other components of the health care workforce. **Figure 1.16** summarizes the total composition of medical staffs at hospitals in the Philadelphia Five County Area. While many physicians have multiple privileges inflating these numbers, it gives a rough estimate of the size and distribution by specialty in the region. In the five county area there are 18,290 board certified appointments to hospital staffs with internal medicine representing the largest specialty department. The Philadelphia MSA includes 41% of all hospital appointments in Pennsylvania as a whole. The distribution of these appointments by

department is roughly similar to the state as a whole. There are approximately 1.3 hospital staff appointments for every active physician in the Philadelphia MSA. It should be noted, however, that the growth of full time salaried physicians as hospitalists may reduce the traditional hospital responsibilities of the attending staff significantly in the future.

Figure 1.15 Health Care Employer Payroll in the Philadelphia MSA 2001

Hospital Payroll as of June 30, 2001

	Total Full-Time	Total Part-Time	Percent Part-Time	Estimated Total FTEs*
Administrators/Admin Assts	844	18	2.1%	850
Physicians	626	296	32.1%	725
Medical Interns and Residents	3,971	4	0.1%	3,972
Dentists	6	4	40.0%	7
Dental Interns and Residents	33	0	0.0%	33
Licensed Midwives	11	30	73.2%	21
RNs(Excl. RN Anesthetists)	13,931	9,416	40.3%	17,069
Physicians Assistants	131	42	24.3%	145
RN Anesthetists	87	32	26.9%	98
Certified RN Practitioners	359	112	23.8%	396
Operating Room Technicians	416	91	17.9%	446
Licensed Practical Nurses	1,114	453	28.9%	1,265
Unlicensed Assistive Personnel	4,136	1,850	30.9%	4,753
Medical Record Admin& Tech	867	221	20.3%	941
Pharmacy Personnel	1,091	695	38.9%	1,323
Clinical Lab Personnel	2,085	1,096	34.5%	2,450
Dieticians and Dietetic Techs	208	123	37.2%	249
Radiologic Personnel	2,265	1,297	36.4%	2,697
Occupational Therapists	288	188	39.5%	351
Physical Therapist	547	420	43.4%	687
Respiratory Therapists	766	617	44.6%	972
Recreational Therapists	115	25	17.9%	123
Speech Pathologists/Audiologists	132	101	43.3%	166
Other Rehab/Mental Health	1,852	762	29.2%	2,106
Other Health Professnl/Technical	8,068	2,231	21.7%	8,812
Other Nonhlth Profess/Nontech	19,691	7,116	26.5%	22,063
Total	63,640	27,240	30.0%	72,719

Long-Term Care Facilities Payroll as of December 31, 2001

Administrators/Asst Admin	211	11	5%	215
Physicians	7	38	84%	20
Psychiatrists	0	3	100%	1
Dentists	0	4	100%	1

LTC Facilities Payroll (cont.)	Total Full-Time	Total Part-Time	Percent Part-Time	Estimated Total FTEs*
Registered Nurses	1,420	973	41%	1,744
Cert. RN Practitioners	84	37	31%	96
Practical Nurses	1,419	657	32%	1,638
Unlicensed Asst Personnel	5,541	1,991	26%	6,204
Pharmacists	9	13	59%	13
Dieticians/Diet Techs	135	114	46%	173
Occupational Therapists	56	43	43%	70
Occupational Therapists Assts	40	22	35%	47
Physical Therapists	73	38	34%	86
Phys Therapy Asst	98	32	25%	109
Recreation Therapists	307	99	24%	340
Respiratory Therapists	29	57	66%	48
Med/Psych Soc Workers	172	29	14%	182
Medical Technologists	7	10	59%	10
Med Record Administrators	83	16	16%	88
Psychologists	0	3	100%	1
Speech Path/Audiologists	19	33	63%	30
All Other Health	348	133	28%	392
All other Non Health	3,754	1,714	31%	4,325
Total	13,812	6,070	31%	15,833

* Part-time .33 of full time.

Figure 1.16 Medical Staff Hospital Clinical Privileges by Department June 30, 2001

Service	Philadelphia MSA		Pennsylvania		Philadelphia MSA Percent of State Total
	Board Cert.	Other	Board Cert.	Other	
Allergy/Immunology	107	19	243	32	46%
Anesthesiology	754	89	1,797	218	42%
Cardiology	1,169	104	2,791	218	42%
Colon/Rectal Surgery	66	8	190	35	33%
Dentistry	87	116	243	419	31%
Dermatology	230	18	459	28	51%
Emergency Medicine	490	183	1,244	488	39%
Family Practice	1,177	410	4,122	856	32%
Internal Medicine	3,302	569	8,148	1,127	42%
Neurological Surgery	147	42	493	96	32%
Nuclear Medicine	61	17	200	48	31%
OB/GYN	812	154	1,893	368	43%

Service	Philadelphia MSA		Pennsylvania		Philadelphia MSA Percent of State Total
	Board Cert.	Other	Board Cert.	Other	
Oncology	405	69	921	129	45%
Ophthalmology	807	59	1,670	149	48%
Oral surgery	203	66	525	147	40%
Orthopedic Surgery	730	98	1,919	293	37%
Otolaryngology	379	28	863	81	43%
Pathology	340	17	881	44	39%
Pediatrics	1,262	193	2,849	455	44%
Physical-Medicine/Rehab	282	38	776	81	37%
Plastic Surgery	203	19	522	58	38%
Podiatry	370	151	940	346	41%
Preventive Medicine	20	1	59	5	33%
Psychiatry/Neurology	1,111	272	2,200	495	51%
Radiology	875	38	2,124	107	41%
Surgery	865	276	2,501	465	38%
Thoracic Surgery	197	30	615	69	33%
Urology	361	49	1,013	98	37%
All other	1,478	291	3,449	573	44%
Total	18,290	3,424	45,650	7,528	41%

Source: Pennsylvania Department of Health Annual Hospital Questionnaire; Reporting Period July 1, 2000 to June 30, 2001.

f. Employment Forecasts

The 2000-2010 projections for the Philadelphia MSA developed by the Pennsylvania Bureau of Labor and Industry, in conjunction with Bureau of Labor Statistics (BLS) data collection activities, provide the most currently available industry and occupational employment forecasts. The BLS compiles estimates on more than 250 industries and 500 occupations. The occupational forecasts, updated every two years, rely on data from the Current Employment Statistics Survey, the Occupational Employment Survey, the Current Population Survey and other sources. The six-step projection methodology has undergone continuous refinement over the thirty-five years that the BLS has provided these forecasts.^{iv} As with any projections, of course, they are subject to error because of the many unknown factors that will affect the economy and the life science/health services sector and because local conditions may not be fully taken into account in a national model. The overall weakness in the United States economy in the last several years is reflected in projections that substantially reduced job growth in the 2000-2010 forecasts as opposed to the 1998-2008 forecasts used in the earlier report on the Philadelphia PMSA. While the unemployment rate climbed in the Philadelphia region, it remained below the national rate in 2001 and 2002.⁽²³⁾

(1) Industry Forecasts

The “Life Science Industry” includes the health services and pharmaceutical manufacturing industries for which the BLS forecasts employment. Other industries identified by the BLS, such as electronic equipment manufacture, insurance, and computer and data processing services include some of life science industry as envisioned by this workforce initiative, but it is not possible to identify them within the existing classifications. For example, the rapidly evolving biotechnology sector, or the use of cellular and molecular processes to solve problems and make products, includes many individuals employed in the pharmaceutical manufacturing and health services sector but also others. National comparisons between the pharmaceutical and health services industries indicate:

- The drug-manufacturing sector employed 315,000 persons in 2000, only 2.6% the size of the 10.095 million persons employed by the health services sector.
- Employment in the drug manufacturing industry is projected to grow by 22% between 2000 and 2010, faster than the 16% increase in non farm wage and salary employment projected for the economy as a whole but slower than the 25% growth projected in employment in the health services sector.⁽²⁴⁾ The drug manufacturing industry, however, generates high revenues per employee and thus employment statistics understate its influence on national and regional economy.
- Nationally, hospitals now account for about 40% of the health services sector employment. This share is projected to continue to decline as office practices, nursing homes and home health services absorb an increasing share of health services sector employment over the next decade. Yet, as hospitals continue to diversify into non acute care areas, it is still unclear whether they will have a diminished or expanded role in terms of overall health sector employment in the future..
- In terms of forecasted industry national employment growth, residential care and health services not elsewhere classified rank second and third only to computer and data processing services in terms of forecasted increases in overall national employment growth. The residential care industry is forecasted to grow in employment by 50% and the not elsewhere classified health services industry by 46% between 2000 and 2010.

As indicated in **Figure 1.17**, industry employment in the Philadelphia MSA for the most part mirrors the national pattern. The pharmaceutical manufacturing sector accounts for a small proportion of total life science employment. However, employment in the pharmaceutical sector is forecasted to grow at a faster rate than the health services sector (12.8% v. 5.3%). The forecasts presented in Figure 1.17 indicate:

- A 7.5% overall growth in employment in these life science related industries in the Philadelphia MSA area and an increase of 22,740 jobs between 2000 and 2010 (about half the increase projected in the previously published 1998-2008 forecast).

- The most rapid employment growth will be in residential care (19.5%), offices and clinics of medical doctors (14.3%), and Pharmaceutical manufacture (12.8%).
- An estimated 36% of all the new jobs that will be created in the Philadelphia MSA between 2000 and 2010 will be in the life science sector.

Figure 1.17 Philadelphia MSA Life Science Industry Employment Estimated 2000 & Projected 2010

SIC	Industry Title	Employment		Change		Average Annual Change
		Estimated 2000	Projected 2010	Level	Percent	
	Total Nonfarm Jobs	1,886,700	1,949,790	63,090	3.3%	6,309
	Health Related					
283	Drugs	28,650	32,310	3,660	12.8%	366
384	Medical Instruments & Supplies	3,400	3,770	370	10.9%	37
512	Drugs, Proprietaries & Sundries	6,290	6,990	700	11.1%	70
591	Drug Stores & Proprietary Stores	12,730	13,450	720	5.7%	72
632	Medical Service & Health Insurance	11,460	12,130	670	5.8%	67
80	Health Services	215,730	227,230	11,500	5.3%	1,150
801	Offices & Clinics of Medical Doctors	26,070	29,790	3,720	14.3%	372
802	Offices & Clinics of Dentists	10,450	10,820	370	3.5%	37
803	Offices of Osteopathic Physicians	3,120	3,210	90	2.9%	9
804	Offices of Other Health Practitioners	8,030	8,410	380	4.7%	38
805	Nursing & Personal Care Facilities	35,680	38,300	2,620	7.3%	262
806	Hospitals	107,130	111,040	3,910	3.6%	391
807	Medical & Dental Laboratories	5,530	5,180	-350	-6.3%	-35
808	Home Health Care Services	9,180	9,860	680	7.4%	68
809	Health & Allied Services, NEC	10,530	10,630	100	0.9%	10
836	Residential Care	26,130	31,230	5,100	19.5%	510
	Total Health Related	304,380	327,120	22,740	7.5%	2,274
	Health as Percent of Total Nonfarm	16.1%	16.8%	36.0%	223.4%	36.0%

Source: Pennsylvania Department of Labor and Industry August 2003
<http://www.dli.state.pa.us/landi/cwp/view.asp?a=140&q=196381>

(2) Occupational Forecasts

The Pennsylvania Department of Labor and Industry use BLS based forecasts of employment to estimate and forecast specific occupational employment demand, as opposed to industry employment for the Philadelphia MSA. Nationally among all occupational classifications, the third largest job growth forecasted for 2000-2010 is for Registered Nurses or 561,000 new positions. In addition, personal and home health aides rank 8th (62%) and medical assistants rank 10th (57%) in terms of rate of growth. Figure 1.18 combines the estimates for individual occupations or groupings of occupations (the bold face listings in the table). The table includes forecasts of the total number of job openings in terms of replacements and expansions in the Philadelphia MSA from 2000 to 2010.

Figure 1.18 Life Science Occupational Employment Philadelphia MSA Estimated 2000 and Projected 2010

Occupational Title	Employment		Percent Change	Average Annual Openings		
	Estimated 2000	Projected 2010		Due to Growth	Due to Replace ¹	Total ²
Medical & Health Services Managers	4,760	5,360	13%	60	83	143
Life Scientists	4,250	4,770	12%	52	142	194
Health Specialties Teachers, Postsecondary	1,310	1,480	13%	17	36	52
Nursing Instructors & Teachers, Postsecondary	550	630	15%	8	14	22
Healthcare Practitioners & Technical Occupations	110,700	123,210	11%	1,251	2,135	3,228
<u>Health Diagnosing & Treating Practitioners</u>	71,520	80,140	12%	862	1,613	2,531
Dentists	1,990	2,000	1%	1	36	36
Dietitians & Nutritionists	780	810	4%	3	31	34
Optometrists	610	670	10%	6	9	12
Pharmacists	3,440	3,860	12%	42	91	131
Anesthesiologists	790	850	8%	6	26	38
Family & General Practitioners	3,450	3,630	5%	18	50	67
Internists, General	690	760	10%	7	9	14
Obstetricians & Gynecologists	360	400	11%	4	9	15
Pediatricians, General	320	350	9%	3	4	8
Psychiatrists	540	630	17%	9	8	17
Surgeons	660	710	8%	5	10	15
Physicians & Surgeons, Other	770	830	8%	6	10	16
Physician Assistants	650	840	29%	19	14	31
Podiatrists	70	70	0%	0	2	2
Registered Nurses	43,870	49,370	13%	550	788	1,280
Audiologists	860	1,070	24%	21	120	200
Occupational Therapists	1,680	1,920	14%	24	39	61
Physical Therapists	2,710	3,020	11%	31	62	91
Radiation Therapists	140	140	0%	0	14	19

Figure 1.18 Life Science Occupational Employment Philadelphia MSA 2000-2010(continued)

Occupational Title	Employment			Average Annual Openings		
	Estimated 2000	Projected 2010	Percent Change	Due to Growth	Due to Replace ¹	Total ²
<u>Health Diagnosing & Treating Practitioners (cont.)</u>						
Recreational Therapists	610	670	10%	6	15	21
Respiratory Therapists	830	1,040	25%	21	21	42
Speech-Language Pathologists	1,270	1,560	23%	29	31	60
Veterinarians	690	810	17%	12	13	25
Health Diagnosing & Treating Practitioners, Other	2,620	2,760	5%	14	56	70
<u>Health Technologists & Technicians</u>						
Medical & Clinical Laboratory Technologists	2,370	2,350	-1%	-2	56	54
Medical & Clinical Laboratory Technicians	2,790	2,700	-3%	-9	67	58
Dental Hygienists	2,020	2,350	16%	33	29	62
Cardiovascular Technologists & Technicians	660	810	23%	15	14	29
Diagnostic Medical Sonographers	540	590	9%	5	13	18
Nuclear Medicine Technologists	220	240	9%	2	5	7
Radiologic Technologists & Technicians	2,870	2,990	4%	12	62	74
Emergency Medical Technicians & Paramedics	3,330	4,320	30%	99	84	183
Dietetic Technicians	350	380	9%	3	8	11
Pharmacy Technicians	2,660	3,390	27%	73	69	142
Respiratory Therapy Technicians	130	160	23%	3	3	6
Surgical Technologists	840	940	12%	10	22	32
Veterinary Technologists & Technicians	630	710	13%	8	16	24
Licensed Practical & Licensed Vocational Nurses	9,820	10,100	3%	28	253	281
Medical Records & Health Information Tech.	1,560	1,920	23%	36	36	72
Opticians, Dispensing	880	860	-2%	-2	16	14
Other Healthcare Practitioners & Technical Occupations						
<u>Occupational Health & Safety Specialists & Tech.</u>	780	860	10%	8	21	29
<u>Athletic Trainers</u>	170	170	0%	0	5	5
<u>Healthcare Practitioner & Technical Workers, Other</u>	3,370	3,600	7%	23	87	110
Healthcare Support Occupations						
<u>Nursing, Psychiatric & Home Health Aides</u>	32,140	34,810	8%	267	409	676
Home Health Aides	7,090	7,930	12%	84	90	174
Nursing Aides, Orderlies & Attendants	23,390	25,260	8%	187	299	486
Psychiatric Aides	1,680	1,640	-2%	-4	19	15
Occupational & Physical Therapist Assistants & Aides	2,100	2,510	20%	41	62	103
Occupational Therapist Assistants	190	230	21%	4	7	13
Physical Therapist Assistants	790	940	19%	15	26	43
Physical Therapist Aides	590	710	20%	12	49	103
Other Healthcare Support Occupations	18,750	21,800	16%	305	431	690
Massage Therapists	150	160	7%	1	7	16
Dental Assistants	3,370	3,850	14%	48	60	107
Medical Assistants	5,500	7,040	28%	154	148	301
Medical Equipment Preparers	190	190	0%	0	5	5

Figure 1.18 Life Science Occupational Employment Philadelphia MSA 2000-2010(continued)

Occupational Title	Employment			Average Annual Openings		
	Estimated 2000	Projected 2010	Percent Change	Due to Growth	Due to Replace ¹	Total ²
<u>Nursing, Psychiatric & Home Health Aides (cont.)</u>						
Medical Transcriptionists	2,200	2,470	12%	27	55	77
Pharmacy Aides	610	700	15%	9	17	26
Veterinary Assistants & Laboratory Animal Caretakers	270	290	7%	2	24	48
Healthcare Support Workers, Other	6,120	6,700	9%	58	154	195
<u>Medical Secretaries</u>	5,890	5,980	2%	9	92	96
<u>Medical Equipment Repairers</u>	340	390	15%	5	8	12
Total of Selected Life Science Occupations	180,780	200,970	11.2%	2,019	3,869	5,937
Total, All Life Science Occupations	1,998,720	2,096,270	4.9%	9,754	47,900	57,654
Selected Life science as Percent of Total	9.0%	9.6%	228.8%	20.7%	8.1%	10.3%

Source: Pennsylvania Department of labor and industry, 2003. Data may not add to totals due to rounding and suppression of occupational employment due to employer confidentiality constraints. Occupations with employment less than 10 are not shown but are included in all sub-total and total employment values. ¹Labor force net replacements due to death, retirement, disability or withdrawal for personal reasons. ²Total openings equal replacements plus annual growth, except for cases when negative growth is greater than annual replacements, where total openings are expressed as zero.

These forecasts indicate that for the job categories listed above:

- Total life science related occupational employment or demand will grow by 11.2% between 2000 and 2010 in the Philadelphia MSA, creating 20,090 new jobs that employers will seek to fill.
- The “high growth” occupations, those projected to grow by 20% or more during this period are: physician assistant, audiologist, respiratory therapists, speech-language pathologist, cardiovascular technologists and technicians, emergency medical technicians and paramedics, pharmacy technicians, respiratory therapy technicians, medical records and health information technicians, occupational and physical therapist assistants and aides, medical assistants and personal and homecare aides. Most of these “high growth” occupations are ones requiring less extensive training and may serve to slow the growth in the cost of providing care for an aging population.
- The largest absolute increases in employment will be for Registered Nurses, Licensed Practical Nurses, Nursing Aides and Attendants and Home Health Aides.
- Combined with replacements through retirements and career changes, employers in the region seeking persons qualified in these life science occupations will be recruiting for a total 59,370 positions during this ten year period and the total regional employment in these occupations will increase to 200,970.
- The 2000-2010 forecasted growth in life science occupational employment has been adjusted downward and is about half the job growth previously forecasted in the 1998-2008 projections. Demand is shaped in part by the overall conditions in the economy. Those conditions changed dramatically between 1998-2008 projections and the more recently released 2000-2010 projections. The life science occupational employment forecasts reflect this change.

- 21% of all new jobs created in the Philadelphia MSA between 2000 and 2010 will be in the life science, a rate of growth 2.3 times the rate of growth for all jobs in the region.

Part 2: Workforce Supply

This section provides:

- A brief overview of the factors shaping life science workforce supply.
- An estimate of the current supply and forecast of supply to 2010 of registered nurses and licensed registered nurses.
- An estimate of the current supply of other selected health occupations and forecast of supply to 2010.

a. Factors Shaping Regional Life Science Workforce Supply

Five factors influence regional life science workforce supply: (1) the size of the population that could potentially seek entry, (2) the adequacy of their primary and secondary school preparation, (3) their career choices, (4) the resources available for post secondary education in life science career preparation and (5) the opportunities for employment outside the Philadelphia region or outside the life science occupation for which an individual has the credentials for employment.

The Philadelphia MSA has three strengths in terms of expanding life science workforce supply: (1) a growing population of young persons who could potentially seek positions in the field, (2) a rich array of regional resources for post secondary education in the life science and (3) the availability of attractive jobs within the region for graduates of these programs.

The school age population in the Philadelphia MSA contracted between 1980 and 1990 but then expanded between 1990 and 2000 (**Figure 2.1**). The five county area now includes a school-aged population of more than 721,000 that will serve as the major workforce resource for the life science occupations in the region for the next two decades. The output from this educational pipeline can be influenced by the initiatives of the Life Science Career Alliance, especially its work with the Philadelphia School District and the materials provided to school counselors that are designed to reverse the decline in interest in life science and health services careers and the adequacy of the science preparation provided in the primary and secondary schools in the region.

The Philadelphia PMSA is well endowed with programs for post secondary preparation in the life science and health services occupations. Five Academic Health Centers attract researchers and individuals seeking specialized training from all over the world. An additional ten four year colleges and universities provide preparation for life science and health services careers. Eight community colleges provide associate degree programs for nursing and allied health professions. In addition, many of the area hospitals and freestanding technical schools provide preparation for allied health technicians and care providers. Pharmaceutical firms and biotech companies ring the outskirts of Philadelphia, adding to the attraction of the region as a destination for life science training and as a place to continue one's career. It is, as observed by the recent Milken Institute Report, one of three major "health poles" or concentrations of such activity in the nation.⁽¹⁾

**Figure 2.1 Change in School Age Population Philadelphia MSA
1980 to 2001**

County	School Age Population - Ages 5 to 17			% Change School Age 1980 to 1990	% Change School Age 1990 to 2000
	1980	1990	2000		
Bucks	109,212	99,184	115,198	-9.2%	16.1%
Chester	69,661	66,053	84,252	-5.2%	27.6%
Delaware	108,011	88,344	102,439	-18.2%	16.0%
Montgomery	127,270	107,068	133,855	-15.9%	25.0%
Philadelphia	328,956	263,550	285,308	-19.9%	8.3%
TOTAL	743,110	624,199	721,052	-16.0%	15.5%

Source: U.S. Census, Pennsylvania State Data Center

The Philadelphia PMSA is well endowed with programs for post secondary preparation in the life science and health services occupations. Five Academic Health Centers attract researchers and individuals seeking specialized training from all over the world. An additional ten four year colleges and universities provide preparation for life science and health services careers. Eight community colleges provide associate degree programs for nursing and allied health professions. In addition, many of the area hospitals and freestanding technical schools provide preparation for allied health technicians and care providers. Pharmaceutical firms and biotech companies ring the outskirts of Philadelphia, adding to the attraction of the region as a destination for life science training and as a place to continue one's career. It is, as observed by the recent Milken Institute Report, one of three major "health poles" or concentrations of such activity in the nation.⁽¹⁾

However, the resources available both to potential students and to training programs place limits on the ability to meet demand. The growing costs of these educational opportunities present barriers for many. Undergraduate tuition costs average more than \$2,000 a year at Pennsylvania community colleges and more than \$16,000 a year at its private colleges⁽²⁵⁾. The estimated total costs for attending medical school ranges from \$30,000 to \$50,000 a year.⁽²⁶⁾ More than 36% of the children in the Chester-Upland and Philadelphia school Districts live in poverty. In terms of poverty of their students, these two school districts are among the top ten in the State.⁽²⁷⁾ For many students, even community college costs present difficulties. In addition, training programs have their own resource constraints in terms of their ability to recruit faculty and expand the class, laboratory and clinical resources to effectively accommodate expanded cohorts of students. *The major challenge for the Life Science Career Alliance in expanding supply will be in designing financial support, career paths and work-study arrangements that can assist in overcoming the financial barriers faced by students while providing training programs with the resources they need.*

Successful completion of the educational and credentialing requirements for a life science occupation, however, is no guarantee that an individual will be employed in that occupation. The workforce supply is a function of two numbers:

- (1) Total qualified** – The number of persons licensed or certified to perform a job or position within a health services organization. Professional licensure (nurses, pharmacists, physicians, physical, occupational and speech therapists, social workers) and/or completion of a health occupational course of study (medical assistants, medical sonographers, radiation/medical technicians) define the total pool of qualified persons.
- (2) Actual supply**- the full time equivalent subset of licensed or certified individuals who are willing and able to work in positions requiring such credentials.

The “total qualified” licensed professionals can be obtained from licensure and credentialing bodies. “Actual supply” however, is a moving target reflecting the labor market. It changes with shifts in labor force participation and the age composition of an occupational group. It is affected by wages, work environment and the relative attractiveness of alternative employment opportunities offered to members of an occupational group. In the remainder of this part of the report we will present supply estimates and forecasts for a limited number of life science occupations that help illustrate the more general pattern. We will look at nurses separately, since they represent the largest single occupational group and their perceived shortage has been a major focus of concern among health services providers in the region.

b. The Supply of Registered and Licensed Practical Nurses

(1) Current Supply

Registered nurses (RNs) and licensed practical nurses (LPNs) make up make up 49% of all those employed in healthcare practitioner and technical jobs in the region. Estimates of the supply of RNs and LPNs was obtained from surveys done in conjunction with licensure renewals in 2002 by the Pennsylvania Department of Health in collaboration with the Pennsylvania Department of State.^(16, 17) Licensure renewals for RNs come due for four equal sized cohorts at different times over a two year period. Two cohorts, the April 2002 and October 2002 ones, were included in the current survey and 87% of all renewals completed the survey. As suggested in the Health Department’s survey report, the total number of currently licensed RN in the Philadelphia MSA was estimated by dividing the counts obtained in the survey by the response rate (87%) and then multiplying by two. The LPN survey was done in conjunction with the June 2003 re-licensure of all LPNs and had a response rate of 95%. Similar to the RN estimates, the total number of currently licensed LPNs in the Philadelphia MSA was obtained by dividing the count by the response rate.

As of 2002 an estimated 43,218 RNs and 7,752 LPNs currently licensed in Pennsylvania reside in the Philadelphia MSA. This probably understates the total supply since, given the concentration of health care employers in the Philadelphia MSA, there is likely to be net migration of RNs and LPNs residing outside the Philadelphia MSA to jobs within it.

As indicated in **Figure 2.2** and in more detailed analysis of this survey:

- 80% of all currently licensed registered nurses and 79% of all currently licensed LPNs are employed in health care.
- 2.2% of RNs and 4.2% of LPNs are unemployed and currently seeking work while the overall unemployment rate for the region during that year was about 5.5%. The national unemployment rate dropped below 4.0% in 2000, a thirty year low. Thus the pool of nurses residing in the Philadelphia MSA seeking to fill positions in 2002 was About 963 RNs and 1,470 LPNs.
- 22% of the RNs in the Philadelphia MSA reside in Philadelphia and 32% of the LPNs. In contrast, 60.1% of the budgeted full time RN positions in hospitals and 49.5% of the RN positions in Nursing Homes are located in the City. For LPNs, the difference between location of employment and residence is only slightly less with 47% of the full time hospital positions and 52% of the nursing home positions located in the City (See Figure 1.15).
- About 4.7% of those currently licensed as LPNs or RNs were employed in non health care jobs.
- Only about 7% of currently licensed RNs and LPNs reported being retired. Another 13% in the Philadelphia MSA are not currently working in health care.
- Only 70% of the Registered Nurses and 82% of the LPNs currently employed in health care settings in the Philadelphia MSA reported providing direct patient care.
- The most common employment setting for LPNs in the Philadelphia SMA were Nursing Homes (47%) and the most common employment setting for RNs was the hospital (60%).

Figure 2.2 Estimates of RN and LPN Supply in Philadelphia MSA in 2002

RN Population Estimates from April and October 2002 Licensure Survey*

	Healthcare Employment	Unemployed Seeking	Unemployed Not Seeking	Other	Total
Bucks	7,221	236	478	1,022	8,957
Chester	4,677	162	526	954	6,320
Delaware	6,130	162	348	871	7,511
Montgomery	8,998	231	688	1,809	11,727
Philadelphia	7,580	172	194	757	8,703
Total Philadelphia MSA	34,607	963	2,235	5,414	43,218
Percent	80.1%	2.2%	5.2%	12.5%	100.0%
Pennsylvania	115,256	2,752	8,337	21,990	148,335
Percent	77.7%	1.9%	5.6%	14.8%	100.0%

* Total estimates were based on the assumption that 50 percent of all nurses were in the April 2002 and October 2002 cohorts. Thus estimate equals: (count/response rate of .8744) x 2

LPN Population Estimates from June 2002 Licensure Survey**

	Healthcare Employment	Unemployed Seeking	Unemployed Not Seeking	Other	Total
Bucks	1,315	71	89	202	1,677
Chester	755	37	48	107	947
Delaware	967	48	47	141	1,204
Montgomery	1,119	51	73	179	1,423
Philadelphia	1,953	118	76	354	2,502
Total Philadelphia MSA	6,109	326	334	984	7,752
Percent	78.8%	4.2%	4.3%	12.7%	100.0%
Pennsylvania	32,050	1,470	2,443	5,640	41,603
Percent	77.0%	3.5%	5.9%	13.6%	100.0%

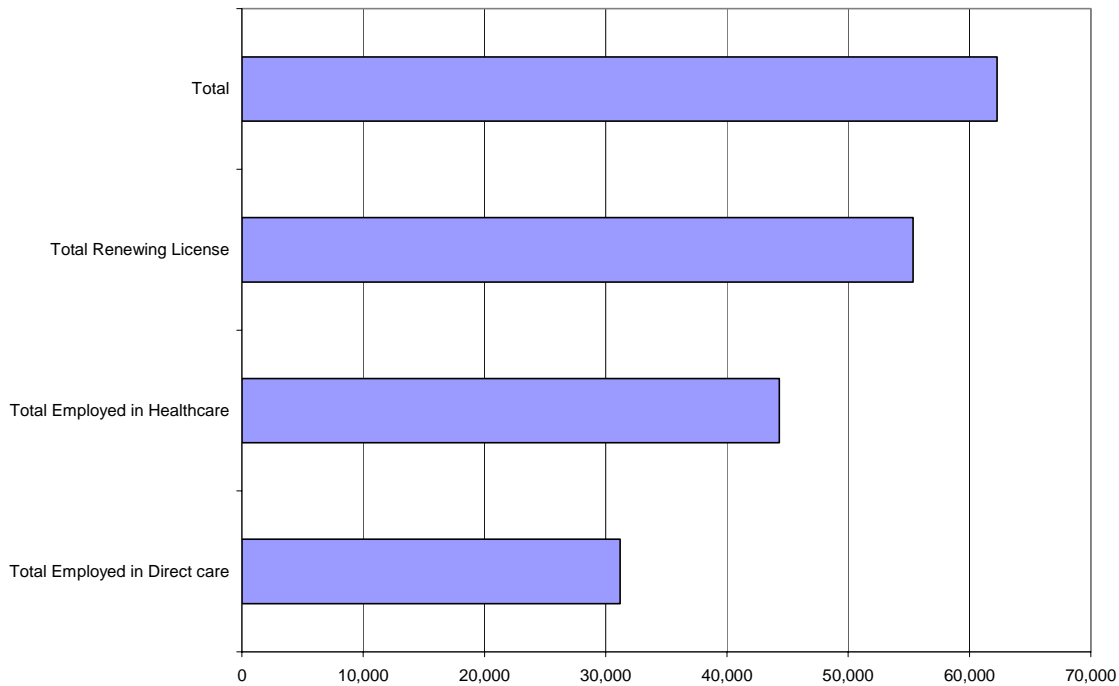
** Total estimates were based on dividing the number reporting by the response rate: count/0.95455

Sources: PA Department of Health, June 2003 and PA Department of Health, March 2003

As summarized in **Figure 2.3**, the “pipeline” supplying RNs for direct patient care in the Philadelphia MSA has many “leaks.” Assuming that state based estimates apply to the Philadelphia MSA, about 12.5% of RNs due for renewal in 2002 did not renew their license. About half of these chose to revert to inactive status and half just allowed their licensure to expire. Reverting to inactive status eases re-entry into employment as a licensed nurse and those reverting in this category tended to be older, perhaps more committed to nursing as a profession. The younger RNs who allowed their license to lapse are perhaps more likely to have left the occupation permanently. The attrition rate for those not seeking relicensure is roughly equal in age cohorts between 30 and 70. Only 38% of those not renewing their licenses were over the age of 60 where retirement was a likely explanation for the not keeping their license active. Thus, once one has accounted for those not renewing their license, not currently

employed in health care or employed other health related activities, only about 50% of the RNs residing in the Philadelphia MSA in 2002 were currently employed in a health setting in the provision of direct patient care. *One of the key issues faced by the Life Science Alliance is whether this is good or bad and what should be done about it.*

Figure 2.4 RNs in the Philadelphia MSA 2002: Erosion of the Direct Care Workforce



Source: Pennsylvania Department of Health 2003

(2) Future Supply

Forecasting the future supply of nurses requires adjusting current estimates of supply for anticipated entries and exits from the regional workforce.

(a) Entry

As of March 21, 2003, there were a total twenty-three approved registered nurse and nine licensed practical nurse training programs the Philadelphia MSA. ⁽²⁸⁾ As indicated in Figure 2.4, a total of 1,119 individuals completed RN training and 155 completed LPN training in these Philadelphia MSA programs in 2002. The number of RN graduates appears to have bottomed out in 2001, edging upward in 2002, but the number of LPN graduates dropped. Enrollment in all of the different kinds of RN programs and LPN programs has grown since 2000 with a marked 25% jump in total RN program enrollment between 2001 and 2002.

Figure 2.4 Nursing Program Enrollment and Graduation in Southeast Pennsylvania, by Program Type, 1999-2002

Total Enrollment	1999	2000	2001	2002
RN BS	1743	1615	1788	2193
RN DIP	735	628	688	892
RN AD	827	833	964	1203
RN Total	3305	3076	3440	4288
LPN	220	290	392	464
Graduation Rates	1999	2000	2001	2002
RN BS	604	462	447	515
RN DIP	237	276	202	213
RN AD	331	376	331	391
RN Total	1172	1114	980	1119
LPN	177	139	193	155

Source: Pennsylvania Department of State, Nursing Education Program Annual Reports 1999-2002

Enrollment appears to fluctuate in response to the overall job market. A combination of the downturn in the overall regional economy and widespread attention to the nursing shortage in 2001 appears to have been reflected in a spurt enrollment in 2002. It is too early to tell whether this reflects a longer term growth trend or cyclical fluctuation. We base our forecasts of new supply of RNs and LPNs on the following assumptions:

- *15% attrition of nursing program completers who will fail the licensure exam, choose not to become licensed or choose not to be employed as a nurse.^v*
- *Program completions will remain stable at 10% above 2002 levels.*
- *25% of Bachelor of Science in Nursing (BSN) program completers are “duplicate counts.” These are nurses who became eligible for licensure as a result of previous Diploma or Associates Degree in nursing program completions.^{vi}*
- *The number of in-area program completers who will seek employment out of the area will equal out-of-area program completers who will seek employment in the Philadelphia PMSA. In other words, out-migration and in-migration will leave the new actual supply unaffected. Out of area migration is high for physicians and pharmacists trained in the Philadelphia metropolitan area and lower for most other allied health occupations. There are no local estimates of the migration patterns of allied health occupations and, while it simplifies the analysis to assume that in and out migration are equal, we don’t know whether in fact this is the case.*
- *The admission capacity of programs will change more slowly than labor market conditions. In other words, under normal circumstances even if there were a sharp increase in demand reflecting changed labor market conditions or financial aid incentives that would increase the number of program applicants, there would most likely be a lag of three to five years before program budgets, admissions, finding faculty and, finally, a significant increase in program completions would*

begin to affect supply. (As the Abington Hospital has demonstrated, however, it is possible to expand nursing programs more quickly when they become a top priority of the larger organization in which they are imbedded.)

Using the above assumptions concerning new supply, the estimate of the annual new entrants into nursing occupations from 2001 to 2010 will be: 926 RNs and 145 LPNs.^{vii}

(b) Exit

The BLS forecasts that each year between 2000 and 2010 in the Philadelphia MSA 1,280 new RNs and 281 new LPNs will be needed to fill replacement and growth requirements (See Section 1, **Figure 1.18**). These figures may understate the need since these forecasts assume only a 20% 10- year attrition rate for RNs and a 26% attrition rate for LPNs. In the 2002 relicensure surveys, 55% of the RNs and 43% of the LPNs in the Philadelphia MSA reported planning to remain in the field less than ten years. If one were to apply the 12.5% rate of licensure non renewal to this ten year period, the forecasted attrition rate would be even higher. The nursing workforce is aging and this will increase replacement needs. 31% of the RNs and 35% of the LPNs who are currently employed in health care positions in the Philadelphia MSA were over the age of 50. Nurses appear to shift from hospital settings as they age. While only 23% of registered nurses employed by hospitals are over the age of 50 that proportion climbs to 45% for nursing homes and 43% for office practices. Thus acute care hospitals in the Philadelphia MSA are more dependent on new supply than other health care employers. At the same time, nursing homes might be more vulnerable to the retirement of older nurses.

(c) Resulting Forecast

Figure 2.5 presents the projections of supply from 2000 to 2010 based on these entry and exit assumptions for RNs and LPNs. The supply of registered nurses based on these assumptions is forecasted to decline by 3,016 and the supply of LPNs to decline by 1,214 between 2001 and 2010.

Figure 2.5 Forecasted Supply of RNs and LPNs in the Philadelphia MSA 2001-2010

<u>Year</u>	<u>RN Supply</u>	<u>LPN Supply</u>
2001	43,516	9,684
2002	43,162	9,548
2003	42,808	9,412
2004	42,454	9,276
2005	42,100	9,140
2006	41,746	9,004
2007	41,392	8,868
2008	41,038	8,732
2009	40,684	8,596
2010	40,330	8,460

Source: Estimated derived PA Bureau of Labor and Industry and projections and Pennsylvania Department of State Nursing Education Program

(d) Supply of Other Health-Related Occupations

There are more than 250 occupational classifications in a typical community hospital. We are able to provide supply estimates only for those occupations for which (1) there are clearly identifiable training programs within the region and for which (2) these training programs correspond to the Standard Occupational Codes used in reporting occupational employment statistics. We used the BLS estimates of the number of individuals employed in 2000 as a conservative estimate of current supply and 70% of the currently reported program capacity in AMA certified programs in the Philadelphia MSA as an estimate of new supply.⁽²⁹⁾ We forecasted future supply by subtracting BLS annual average estimates of replacement needs and adding the estimate of new supply. **Figure 2.6** presents the projected supply for sixteen allied health occupations. With the exception of cardiovascular technologists, clinical lab technologists and technicians, diagnostic medical sonographers, medical assistants and surgical technologists, the supply is forecasted to grow. These results should be treated with caution. Recruitment by employers and choices of employment of Philadelphia MSA program graduates are not limited to the region. Migration patterns, changes in attrition rates, in program capacity. In the work environment and in the attractiveness of staying in the region may alter actual future supply.

Figure 2.6. Philadelphia MSA Health Occupation Forecasted Supply 2000-2010

Health Occupation	Est. MSA Supply 2000	Current Reported Program Capacity	Annual Est. New Entries (70%)	Annual Est. Replacement	Est. Supply 2010	Est. Change in Supply 2000-2010
Cardiovascular Technologist	660	16	11	14	632	(28)
Clinical Lab Scientist/Medical Technologist	2,370	72	50	56	2314	(56)
Clinical / Medical Lab Technician	2,790	50	35	67	2470	(320)
Diagnostic Medical Sonographer	540	60	42	13	830	290
Health Information Administrator and Technician	1,560	102	71	36	1914	354
Medical Assistant	5,500	76	53	148	4552	(948)
Occupational Therapist	1,680	150	105	39	2340	660
Occupational Therapy Assistant	190	52	36	7	484	294
Physical Therapist	2,710	354	248	62	4568	1,858
Physical Therapist Assistant	790	48	34	26	866	76
Physician Assistant	650	155	109	14	1595	945
Radiation Therapist	140	38	27	14	266	126
Radiographer	2,870	182	127	62	3524	654
Respiratory Therapist	610	74	52	15	978	368
Respiratory Therapy Technician	130	14	10	3	198	68
Surgical Technologist	840	16	11	22	732	(108)

Note: Reported program capacity from *AMA Health Professions Career and Education Dictionary 2003*. MSA estimated supply from 2000 employment estimates of BLS and Pennsylvania Department of Labor & Industry. The estimated net yield (70%) assumes attrition from the programs and employment within the area of 30 percent. Forecast assumes no change in program capacity and no substitutions of more informal agreements in the preparation of persons for employment openings. Some of the area training programs, such as for Physical Therapy, Occupational Therapy and Physician Assistants supply graduates to a larger regional or national labor market.

Part 3: Assessing Workforce Imbalances

The complexity of the factors influencing both supply and demand summarized in the first two sections of this report and the limitation of existing sources of data, which will be summarized in the final section, make forecasting of workforce imbalances challenging. As with a similar effort conducted by Mathematica Research, we address the inevitable uncertainty associated with such estimates by looking at a variety of indicators.⁽³⁰⁾ First we will summarize the more qualitative industry and occupational group assessments of the shortages. Second, we will compare occupational employment to population ratios in the Philadelphia MSA with national ones. Finally, for selected occupations, we will contrast the forecasted estimates of employment presented in the first section of this report with the forecasted estimates of supply presented in second section. If all of these indicators point in the same direction, one can feel a higher degree of confidence in the conclusions.

a. Local Workforce Estimates

The somewhat impressionistic reports of employers provide a useful guide. **Figure 3.1** lists seventeen life science and health care services occupations that were identified by employers as “high demand” occupations in at least one of the five counties in the Philadelphia MSA. Pennsylvania Departments of Labor and Industry analysts compiled these county lists.^{viii} The numbers in the table, such as “10+” or “50+,” represent a rough estimate of the magnitude of demand. These estimates have been summed across the five counties to provide an overall estimate of this magnitude in the Philadelphia MSA. LPNs, Medical Assistants, Nursing Aides and RNs were identified as particularly high demand occupations.

A scan of job listings on the Internet for the major health care systems in the Philadelphia MSA in July 2003 confirms a strong demand for most of these occupations. Registered nurse openings overwhelmed the listings on these sites but radiological technicians, pharmacists and billing and collection clerks were also consistently present.

Figure 3.1 Philadelphia SMA Demand Occupations 2003: Estimated Annual Openings

	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
Biochemists and Biophysicists			10+			10+
Biological Technician			10+			10+
Dental Assistants	10+			10+		20+
Emergency Medical Technicians	10+	10+	10+	10+	50+	90+
Health Specialties Teacher Post Secondary				10+		10+
Home Health Aides	10+	10+	10+	10+	B	40+
LPN	10+	10+	50+	50+		120+
Medical & Health Services Manager	10+	10+	10+	10+	50+	90+
Medical Assistants	10+	b	10+	50+	100+	170+
Medical Secretaries	10+		10+		B	20+
Medical Transcriptionists				10+		10+
Nursing Aides, Orderlies, etc.		10+	50+		100+	160+
Personal and Home Care Aides	10+	10+	10+	b	50+	90+
Pharmacists	b	10+	10+	10+	50+	80+
Physical Therapists		10+	10+			20+
Pharmacy Technicians	10+	10+	10+	10+		40+
Registered Nurses	100+	10+	100+	200+	200+	610+

Source: Pennsylvania Department of Labor & Industry, 2003

Note: Includes openings due to growth and replacements unavailable.

b. Workforce Population Ratios: How does the Philadelphia MSA Health and Life Science Workforce Compare to the Nation as a Whole?

Employment as described in Section 1 reflects many factors other than just the clinical need for services in a population. One commonly used way to assess regional health care workforce “need,” as opposed to “demand” that is reflected in employment, is to compare workforce-to-population ratios. Other things being equal, one would expect occupational employment-to-total population ratios to be similar in different geographic areas. However, since Philadelphia is a major national life science and health services center, one would expect higher workforce to population ratios for more skilled and technical occupations. In addition, since the population of the Philadelphia MSA is older than that of the nation as a whole, one would expect that the population would need a higher ratio of health services providers. We have attempted to estimate this effect by adjusting for the effect that age would have on the use of hospital services.^{ix} **Figure 3.2** compares employment population ratios for different life science and health related occupations in the Philadelphia MSA with those of the United States as a whole and summarizes both the crude and age adjusted percent differences in this workforce to 100,000 population ratios. Three observations can be extracted from this table:

- Philadelphia MSA healthcare occupational employment to population ratios is generally higher than those for United States even after one adjusts for the age structure of the

Philadelphia area population. This may reflect its role in serving a population considerably larger than that encompassed by the Philadelphia MSA, including the four counties of New Jersey that are part of the Philadelphia PMSA.

- Health technologist and technician positions are 2% below adjusted national staffing ratios while health diagnosing and treating practitioner ratios are 21% above national staffing ratios. This may reflect some substitution by more extensively trained staff.
- Employment ratios for Podiatrists, Physician Assistants, Respiratory Therapists and Respiratory Therapy Technicians, Home Health Aides, Pharmacy Aides are well below national employment ratios.
- Employment ratios for optometrists, registered nurses, audiologists, physical, occupational and recreational therapists, clinical laboratory technicians, paramedics, medical transcriptionists and medical secretaries are substantially higher than the national ratios.

Figure 3.2 Selected Life science Occupational Employment Estimates and Occupational Ratios per 100,000 Population Ratios for the U.S. and the Philadelphia MSA*

Occupational Title	Philadelphia		United States		Difference	Adjusted Difference**
	Employed	Pop. Rate	Employed	Pop. Rate		
Medical & Health Services Managers	4,760	123.6	249,515	88.7	39%	32%
Life Scientists	4,250	110.4	184,432	65.5	68%	60%
Healthcare Practitioners & Technical Occs.	110,700	2,875.6	6,378,743	2,266.6	27%	21%
Health Diagnosing & Treating Practitioners	71,520	1,857.8	3,921,423	1,393.4	33%	27%
Dentists	1,990	51.7	152,450	54.2	-5%	-9%
Dietitians & Nutritionists	780	20.3	48,740	17.3	17%	11%
Optometrists	610	15.8	31,417	11.2	42%	35%
Pharmacists	3,440	89.4	216,865	77.1	16%	10%
Physician Assist.	650	16.9	57,813	20.5	-18%	-22%
Podiatrists	70	1.8	17,909	6.4	-71%	-73%
Registered Nurses	43,870	1,139.6	2,194,224	779.7	46%	39%
Audiologists	860	22.3	12,790	4.5	392%	367%
Occupational Therapists	1,680	43.6	78,306	27.8	57%	49%
Physical Therapists	2,710	70.4	131,822	46.8	50%	43%
Radiation Therapists	140	3.6	15,572	5.5	-34%	-38%

Figure 3.2 (continued)

Occupational Title	Philadelphia		United States		Difference	Adjusted Difference**
	Employed	Pop. Rate	Employed	Pop. Rate		
Recreational Therapists	610	15.8	29,078	10.3	53%	46%
Respiratory Therapists	830	21.6	83,010	29.5	-27%	-31%
Speech-Language Pathologists	1,270	33.0	87,931	31.2	6%	0%
Veterinarians	690	17.9	58,634	20.8	-14%	-18%
Health Diagnosing & Treating Practitioners, Other	2,620	68.1	57,062	20.3	236%	219%
Health Technologists & Technicians	34,830	904.8	2,457,320	873.2	4%	-2%
Medical & Clinical Laboratory Techs	2,370	61.6	148,380	52.7	17%	11%
Medical & Clinical Laboratory Techs	2,790	72.5	146,793	52.2	39%	32%
Dental Hygienists	2,020	52.5	146,629	52.1	1%	-4%
Cardiovascular Technologists & Technicians	660	17.1	38,663	13.7	25%	19%
Diagnostic Medical Sonographers	540	14.0	32,815	11.7	20%	14%
Nuclear Medicine Technologists	220	5.7	18,219	6.5	-12%	-16%
Radiologic Technologists & Technicians	2,870	74.6	167,413	59.5	25%	19%
Emergency Med. Technicians & Paramedics	3,330	86.5	172,110	61.2	41%	34%
Dietetic Techs.	350	9.1	25,648	9.1	0%	-5%
Pharmacy Techs.	2,660	69.1	189,847	67.5	2%	-3%
Respiratory Therapy Techs.	130	3.4	26,818	9.5	-65%	-66%
Surgical Techs.	840	21.8	71,185	25.3	-14%	-18%
Veterinary Techs & Technologists	630	16.4	49,408	17.6	-7%	-11%
Licensed Practical & Licensed Vocational Nurses	9,820	255.1	699,600	248.6	3%	-3%
Medical Records & Health Information Technicians	1,560	40.5	135,733	48.2	-16%	-20%
Opticians, Dispensing	880	22.9	67,803	24.1	-5%	-10%
Other Healthcare Practitioners & Technical Occupations	4,330	112.5	266,300	94.6	19%	13%

Figure 3.2 (continued)

Occupational Title	Philadelphia		United States		Difference	Adjusted Difference**
	Employed	Pop. Rate	Employed	Pop. Rate		
Occupational Health & Safety Specialists/Technicians	780	20.3	34,929	12.4	63%	55%
Athletic Trainers	170	4.4	14,508	5.2	-14%	-19%
Healthcare Practitioner & Technical Workers, Other	3,370	87.5	211,533	75.2	16%	11%
Healthcare Support Occupations	53,000	1,376.7	3,196,461	1,135.8	21%	15%
Nursing, Psychiatric & Home Health Aides	32,140	834.9	2,053,291	729.6	14%	9%
Home Health Aides	7,090	184.2	615,381	218.7	-16%	-20%
Nursing Aides, Orderlies & Attendants	23,390	607.6	1,373,206	488.0	25%	18%
Psychiatric Aides	1,680	43.6	64,705	23.0	90%	80%
Occupational & Physical Therapist Assistants & Aides	2,100	54.6	25,045	8.9	513%	482%
Occupational Therapist Assistants	190	4.9	16,537	5.9	-16%	-20%
Physical Therapist Assistants	790	20.5	43,937	15.6	31%	25%
Physical Therapist Aides	590	15.3	35,902	12.8	20%	14%
Healthcare Support Occupations	53,000	1,376.7	3,196,461	1,135.8	21%	15%
Nursing, Psychiatric & Home Health Aides	32,140	834.9	2,053,291	729.6	14%	9%
Home Health Aides	7,090	184.2	615,381	218.7	-16%	-20%
Nursing Aides, Orderlies & Attendants	23,390	607.6	1,373,206	488.0	25%	18%
Psychiatric Aides	1,680	43.6	64,705	23.0	90%	80%
Occupational & Physical Therapist Assistants & Aides	2,100	54.6	25,045	8.9	513%	482%
Occupational Therapist Assistants	190	4.9	16,537	5.9	-16%	-20%
Physical Therapist Assistants	790	20.5	43,937	15.6	31%	25%
Physical Therapist Aides	590	15.3	35,902	12.8	20%	14%

Figure 3.2 (continued)

Occupational Title	Philadelphia		United States		Difference	Adjusted Difference**
	Employed	Pop. Rate	Employed	Pop. Rate		
Other Healthcare Support Occupations	18,750	487.1	756,916	269.0	81%	72%
Massage Therapists	150	3.9	34,400	12.2	-68%	-70%
Dental Assistants	3,370	87.5	246,970	87.8	0%	-5%
Medical Assistants	5,500	142.9	328,649	116.8	22%	16%
Medical Equipment Preparers	190	4.9	33,267	11.8	-58%	-60%
Medical Transcriptionists	2,200	57.1	101,864	36.2	58%	50%
Pharmacy Aides	610	15.8	56,797	20.2	-21%	-25%
Veterinary Assistants & Laboratory Animal Caretakers	270	7.0	55,219	19.6	-64%	-66%
Healthcare Support Workers, Other	6,120	159.0	181,119	64.4	147%	135%
Medical Secretaries	5,890	153.0	313,902	111.5	37%	30%
Medical Equipment Repairers	340	8.8	28,482	10.1	-13%	-17%
Total of Selected Life Science Occupations	180,780	4,696.0	10,351,535	3,678.3	28%	21%
Total All Occupations	1,998,720	51,919.6	145,593,847	51,735.1	0%	-5%
Percent of Total	9.0%		7.1%			
Population U.S. Census	3,849,647		281,421,906			

Source: Pennsylvania Department of Labor & Industry, 2003; 2000 U.S. Census

Notes: * Occupations of insufficient size for reliable estimates were excluded. ** Age adjusted percentage difference reduced Philadelphia MSA occupation/100,000 by .95. See endnote.

The Philadelphia region's high health services workforce skill mix reflects its role as a major center for research, teaching and specialized care. This is also reflected in higher physician to population ratios in the Philadelphia MSA. This may in part be a reflection of the higher proportion of physicians in the Philadelphia area who divide their time between research, teaching and direct patient care and may, consequently overstate the physician supply. Nevertheless, as indicated in **Figure 3.3:**

- The direct care physician to population ratios is 58% above the national ratio.
- There are more than twice as many physicians in hospital residency programs per capita than in the nation as a whole. According to the Pennsylvania Department of Health 2001 survey of hospitals, 3,791 interns and residents were on the full time payroll of Philadelphia MSA hospitals.

- This Philadelphia MSA's high health services workforce skill mix reflects its role as a major center for research, teaching and specialized care. It provides it with a long run competitive advantage in both attracting individuals seeking care and those seeking training in the life science.

Figure 3.3 Physicians Population Ratios for the Philadelphia PMSA and the Unites States, 1998

	Patient Care MDs and DOs per 100,000	MD Surgical Specialists per 100,000	Hospital MD Residents per 100,000
Burlington	257	46	24
Camden	348	68	49
Gloucester	123	20	10
Salem	128	22	0
Bucks	239	42	16
Chester	210	41	9
Delaware	343	67	49
Montgomery	605	121	70
Philadelphia	443	106	162
Philadelphia PMSA	366	77	73
United States	231	55	34
Percent Comparison of PMSA and United States	158%	139%	216%

Source: Health Resources and Services Administration Area Resource File 2000

c. Forecasts of Workforce Imbalances

Finally, does forecasted demand match supply? We combine here the forecasts presented in sections 1 and 2 of this report.

(1) Registered Nurses and LPN

Figures 3.4 and **3.5** compare the projections of supply from **Figure 2.5** with the demand projections from **Figure 1.15** for registered nurses and LPNs. A shortage of 9,040 RNs and 1,640 LPNs is forecasted for 2010. In other words, 2010 there will be an estimated 18% shortage in the needed number of RNs and 16% shortage in number of LPNs needed in the Philadelphia MSA.

Figure 3.4 Forecasted Shortages of Registered Nurses in Philadelphia MSA

<u>Year</u>	<u>Actual Supply</u>	<u>Demand</u>	<u>Shortage</u>	<u>Shortage as % of Demand</u>
2001	43,516	44,420	-904	-2.0%
2002	43,162	44,970	-1,808	-4.0%
2003	42,808	45,520	-2,712	-6.0%
2004	42,454	46,070	-3,616	-7.8%
2005	42,100	46,620	-4,520	-9.7%
2006	41,746	47,170	-5,424	-11.5%
2007	41,392	47,720	-6,328	-13.3%
2008	41,038	48,270	-7,232	-15.0%
2009	40,684	48,820	-8,136	-16.7%
2010	40,330	49,370	-9,040	-18.3%

Figure 3.5 Forecasted Shortages of LPNs in the Philadelphia MSA

<u>Year</u>	<u>Actual Supply</u>	<u>Demand</u>	<u>Shortage</u>	<u>Shortage as % of Demand</u>
2001	9,684	9,848	-164	-1.7%
2002	9,548	9,876	-328	-3.3%
2003	9,412	9,904	-492	-5.0%
2004	9,276	9,932	-656	-6.6%
2005	9,140	9,960	-820	-8.2%
2006	9,004	9,988	-984	-9.9%
2007	8,868	10,016	-1,148	-11.5%
2008	8,732	10,044	-1,312	-13.1%
2009	8,596	10,072	-1,476	-14.7%
2010	8,460	10,100	-1,640	-16.2%

(2) Other Health Professionals

Figure 3.6 forecasts workforce imbalances for the selected health-related occupations for which sufficient information was available. It combines the projected supply presented in **Figure 2.2** with the projected demand presented in **Figure 1.18**. Shortages are forecasted for Cardiovascular Technologists, Clinical Medical Lab Technicians, Medical Assistants, Physical Therapists Assistants and Surgical Technologists. The results should be interpreted with caution, since local program capacity can change quickly, formal training in such programs may not be a requirement for employment and both recruitment and placement of graduates in many of these programs extends well beyond the boundaries of the metropolitan area.

Figure 3.6 Philadelphia MSA Forecasted Health Workforce Imbalances 2010

Health Occupation	Reported Program Capacity	Est. Net Yield (70%)	2000 MSA Employment	Annual Openings	Surplus/Shortage Forecast 2010
Cardiovascular Technologist	16	11	660	29	(196)
Clinical Lab Scientist/Medical Technologist	72	50	2,370	54	(40)
Clinical / Medical Lab Technician	50	35	2,790	58	(253)
Diagnostic Medical Sonographer	60	42	540	18	264
Health Information Administrator and Technician	102	71	1,560	72	(7)
Medical Assistant	76	53	5,500	301	(2,726)
Occupational Therapist	150	105	1,680	61	484
Occupational Therapy Assistant	52	36	190	13	257
Physical Therapist	354	248	2,710	91	1,725
Physical Therapist Assistant	48	34	790	43	(103)
Physician Assistant	155	109	650	31	853
Radiation Therapist	38	27	145	19	84
Radiographer	182	127	2,710	91	400
Respiratory Therapist	74	52	610	21	339
Respiratory Therapy Technician	14	10	130	6	42
Surgical Technologist	16	11	840	32	(229)

Notes: Reported program capacity from *AMA Professions Career and Education Dictionary 2003*. MSA estimated employment and annual openings from BLS and Pennsylvania Department of Labor & Industry 2000-2010 forecasts. The estimated net yield (70%) assumes attrition from the program and employment with the area of 30 percent. Forecast assumes no change in program capacity and no substitutions of more informal arrangements in the preparation of persons for employment openings. Some of the area training programs, such as physical therapy, occupational therapy and physician assistants, supply graduates to a larger regional or national labor market.

d. Longer Term Forecasts

Although the precision of specific estimates of the short-term local shortages presented in the last section could be challenged, two significant facts are certain: (1) the current supply of RNs and some other health occupations is very tight and (2) if longer term steps are not taken now, it will get much worse in fifteen years. Shortages can be expected to widen dramatically after 2010 when the first effects of the retirement and growing dependency needs of the post World War II baby boom population begin to be felt. The real storm on the horizon over which there is little disagreement is the one forecasted to begin after 2010. After this time, the straight-line projections of retirements used in Figure 3.4 begin to grow exponentially. Large cohorts of

health workers will reach retirement age at the same time as the need for their services to address an aging population expands.

e. Unknowns That May Affect the Forecasted Size of the Workforce Gaps

The accuracy of these forecasted gaps is shaped by seven unknown factors:

- **Changes in the Unemployment Rate:** Higher rates of general unemployment will increase the available supply. Shortages in nursing and some other allied health services increase in periods of low unemployment.
- **Changes in Licensure and Credentialing Requirements:** Providers must comply with licensure, and credentialing requirements and some will have a direct impact on the size of workforce gaps. For example, new staffing requirements for nursing home licensure and certification for Medicaid funds will affect demand for nurses and other allied health professionals.
- **Changes in Reimbursement:** Changes in what and how services are paid for by Medicare, Medicaid and private insurance affects workforce gaps. For example, changes in Medicare payments for physical therapy will impact the demand for physical therapists.
- **Changes in Technology:** Technological advances in treatment may eliminate whole categories care and workforce needs while creating new ones.
- **Changes in Health Services Organization:** Changes in the organization of care and shifts in the settings of care from hospital, to outpatient and home settings will affect workforce demand. Changes in workplace design and technology will affect the choice of a healthcare career.
- **Changes in Workforce Migration Patterns:** We assume in the forecasts presented here no migration effect. That is, we assume in the absence of other evidence, that the in and out migration of the life science workforce balance each other. New efforts to attract life science occupations to the area and the efforts of other areas to recruit in the Philadelphia region will affect local supply. The apparent growing foreign nurse recruitment activities of hospitals will also affect supply.
- **Changes in Regional Training Capacity:** The decisions of local hospitals and educational institutions to invest in expanding existing capacity and in the recruitment of students will affect local supply.
- **Changes in primary and secondary education and other characteristics:** These will affect the preparation and choice of health careers.
- **Changes in government support and the outcomes of local initiatives:** The success of the Life Science Career Alliance initiatives will affect both local supply and demand.

The effect of unpredictable changes in all of these factors needs to be assessed on an on-going basis.

Conclusions and Recommendations

As described in the last section, shortages are beginning to appear in nursing and some other health related occupations in the Philadelphia MSA. The weakening economy, continued temporary slowing of the growth in the elderly population, combined with the steps already being taken by hospitals and the alliance have perhaps moderated the current shortages. The most encouraging news in these immediate difficulties is that they have focused attention on some of the more fundamental problems that are essential to address if the longer range, broader and far more substantial regional workforce challenges are to be met. Indeed, the convergence of demographic, utilization, financial, training and workforce trends on the twenty-year horizon distilled in this report suggest that the “Perfect Storm” looms.^x Addressing the short- and longer-term threats will require a concerted regional effort. Only if those threats are successfully addressed can the Philadelphia region benefit from the full potential of the life science sector as its most powerful engine of economic development in the 21st Century.

This is not the first attempt to take stock of regional health economies and assess workforce needs. The track record of prior forecasts provides an appropriate caution for our own. Forecasts are made more difficult by the following distinctive characteristics of health economies.

- *Health services workforce supply is inversely related to business cycles in the overall regional economy.* Health sector workers were attracted to opportunities outside of the health sector and the good economic times tended to relieve some of the harsher reimbursement constraints on health services provider budgets for staffing.
- *Health services workforce demand is driven by longer-term trends in demographics, technology and consumer expectations that imbue it with resilience likely to continue to sustain growth over time.* The skill mix and location of employment has shifted overtime but, as the overall growth health sector employment in the region since 1975 has demonstrated, demand has grown.

Based on this prior experience, life science employment in the long term will continue to grow in the Philadelphia region. This growth will be dampened or accentuated by the overall economy. As noted in the introduction, nursing supply has tended to be particularly sensitive to economic cycles and hospitals have experienced shortages in periods of high general employment. The last Philadelphia regional nursing shortage took place in 1988 and 1989 and disappeared as unemployment rates rose in the region in the early 1990s. The first notable nursing shortages in the Philadelphia region took place in the 1940s in the aftermath of Pearl Harbor. That shortage helped spur the racial integration of nursing staffs in Philadelphia. ^(32 pp. 41-45) The events set in motion by the downturn in the economy and the rise in unemployment rates that began in 2001 appears to have in the short term reduced the severity of shortages. It is important, however, to learn from this previous history and not be lulled into complacency. The relative lull is the lull before the storm. It offers an opportunity for innovation and planning that we can ill afford to ignore.

Obviously there is much additional information needed to make more accurate forecasts to assist that planning and innovation. There are many challenges in obtaining accurate workforce estimates of supply, demand, need and requirements. Most have been ably summarized elsewhere ^(12 pp. 73-92). In our own effort in compiling this report and in our discussions with many of the workforce initiative participants we found the following challenges:

- **Missing information:** While detailed information exists on physicians in terms of the educational supply pipeline, age, location and nature of practice, far more limited information is available for the allied health professions that are the focus of concern in this report. Information on program capacity, enrollment, duplicate counts of program completers, and licensure attrition rates is often not available. Age information on the licensed or employed allied health professionals, critical in assessing supply, is often missing. No reliable information is available on migration patterns. As a result, estimates, particularly about supply, are based on at least some assumptions that could not be verified. The Pennsylvania Department of Health's relicensure surveys of RNs and LPNs that was completed this year have made an important contribution in helping to fill this void.
- **Translating Supply and Demand into FTEs:** The BLS Occupational Employment Statistics count those that are employed full and part-time in positions in an organization equally. Some licensed professionals that are a part of the occupational supply may seek only limited part-time employment and others may be moonlighting with multiple jobs. Obviously, staffing hospitals and designing educational programs to respond to shortages require information that translates supply and employment into FTEs. Without such information, you can never be sure whether you are gaining or losing ground. The summary of full and part time payroll positions, in the facility surveys conducted by the Pennsylvania Department of Health this year makes a solid contribution to a better understanding of these patterns in different health services occupational groups.
- **Lack of Timeliness:** Supply numbers are reported in a far less timely fashion than demand numbers. There is a one and a half to three year lag in the availability of most supply data. Given the rapidity with which economic and employment conditions change, such data is of limited usefulness.
- **Lack of Precision:** Many of the sources of information, such as the Bureau of Labor Statistics (BLS) or the Health Resources and Services Administration (HRSA) survey of nursing, are used for national workforce assessments. Less precise estimates are made at the state and local level. For example, while the most recent national estimates of the number of nurses employed from the BLS survey of employers and from the HRSA survey of nursing are almost identical, HRSA estimates for the state of Pennsylvania are 11% higher than the BLS estimates. Yet, the HRSA estimates for New Jersey are 14% below the BLS estimates. The relative standard errors are high for small occupational groups employed in settings that employ few persons, such as office practices. Most information is collected by mail surveys, where non-sampling errors are likely to overwhelm the sampling errors.
- **Confusion Produced by Overlapping Jurisdictions:** Professionals in a service area that overlaps state boundaries are more likely to be licensed in both states or educated in one but practicing in the other. This poses special challenges in interpreting data and in correcting for duplicate counts.

- **Lack of Standardization:** Information is collected differently for every type of educational program and occupational group. Even at the national level, there are more than 62 different sources of data collected by 39 different federal agencies and national professional associations ⁽¹²⁾.
- **Inconsistencies Between Program Completion and Employment Classifications:** Classification of Instructional Program (CIP codes) is often difficult to match with the Occupational Employment Statistics (OES codes). In many cases the “pipeline” is unclear and it is uncertain how to make the translation from the number of “program completers” and new occupational employment supply.
- **Lags in Occupational and Industry Classification:** According to existing reporting mechanisms about industry and occupational employment, there is no life science sector. There is a drug manufacturing and a health services industry. The rest of the research, development and entrepreneurial ventures in information technology and biotechnology that one might classify as life science are buried within other industry classifications. Nurses and other licensed health professionals “disappear” from employment when they cross some of these industry boundaries even though their new jobs make full use of their experience and skills. Existing classifications fail to capture the growing overlap and integration among the various components of the life science supply chain as an employment sector.
- **Lack of Conceptual Clarity:** The lags in occupational and industry classification reflect a more basic difficulty in being able to see the forest for the trees. There is much overlap in the knowledge, skills, and work performed by individuals with different licensures, certifications and training. Translating data about such individuals with different credentials into information about supply, demand and need is a daunting task made worse by the limited amount of rigorous, objective longer-term analysis that has taken place. The boundaries between different occupational groups and specialties shift in response to day- to-day pressures with only limited modeling or analysis of the longer-term impact on demand and supply. More conceptual clarity would be useful, not just making better estimates and projections of supply and demand, but also in informing the design of longer-term workforce strategies that will address the looming potential shortages of the next decade.

In essence, policy makers, employers, training programs, prospective students and employees don’t have the information they need to make informed decisions. In our initial report, we suggested a few initial steps that might help address some of these information problems.

- **Explore the feasibility of better integrating existing Internet resources.** There would appear to be expanding opportunities to use Internet and web resources to compile more current and comprehensive information. For example, just a modest standardization of hospital employment web pages could make it easy to produce a regional placement resource as well as maintain more current information on demand. Much could be done to better mine existing web related resources rather than adding to what already exists. DVHC and the Life Science Career Alliance could assist in facilitating this effort.
- **Explore the feasibility of developing more standardized minimum data sets and reporting from educational programs, occupational groups and employers in the region.** If done well, this could ease the burden and enhance the usefulness of the information provided while building on state and national initiatives.

- **Support and supplement federal, state and local partners in the collection and analysis of workforce related data.** Much progress has been made in developing local forecasts and in focusing on the issues of adequate data collection at the state level. Whatever is done regionally in terms of life science workforce monitoring of supply and demand should support and supplement these efforts. Real time monitoring of supply and demand through web related resources would be useful as well as special studies and surveys that would help better describe the life science sector as it is evolving in the Philadelphia region.
- **Tie the life science workforce initiatives together with an information backbone.** This can assist in evaluating the specific strategies; refining the overall strategic plan and assuring as much synergy between the diverse initiatives that are envisioned as possible. The “information backbone,” should reflect the distinctive needs of the initiatives that are chosen and how they will be organized and tied together.

Updated Recommendations

In the interim between the initial report and this update and in responding to these initial recommendations, it has become much clearer what needs to happen to support the goals of the Life Science Career Alliance. *A Center for Workforce Analysis needs to be developed to support the existing information infrastructure and to supply end users with more useful information for decision making on an ongoing basis.*

The Existing Information Infrastructure

In summary, information concerning the life science workforce presented in this report is derived from three separate activities: (1) federal and state efforts to monitor and forecast employment, (2) state efforts to monitor and certify training programs and service providers and (3) private industry and professional association efforts to collect information on their members. These are the three legs of the stool upon which any regional analysis of the life science workforce must rely.

(1) Federal Data on Employment:

The bulk of the information used in our reports relied on the Department of Labor’s Bureau of Labor Statistics surveys and analysis. The activities are supported by the coordinated activities of the Pennsylvania Department of Labor and Industry. The surveys produce industry and occupational employment estimates. However, county based estimates, with the exception of those provided by the Decennial Census, are based on national probability samples that do not provided accurate information about smaller specific health occupations at the county level.

(2) State Data on Educational Programs and Service Providers

Through its responsibilities in licensing and monitoring health training programs and service providers, the Pennsylvania Department of Health in collaboration with other state agencies now collects much potentially relevant information. It has recently assumed responsibility for coordinating state collected health workforce information and has begun to take more advantage of its existing licensure and reporting requirements. All licensed health facilities are surveyed each year and the Department has begun to use this

information to disseminate reports on the number and characteristics of those on the payroll or medical staffs of health facilities. They have also taken advantage of the re-licensure requirements for registered nurses and LPNs to collect additional survey information these occupational groups. Reports RNs and LPN based on these surveys were published in 2003. The surveys achieved a 95% response rate and illustrate the usefulness of state licensure and reporting requirements in collecting information to monitor supply and demand. As the re-licensure processes shifts to a web-based format, so will subsequent surveys, adding to the ease and lowering the cost of data collection. Since the information is collected from every licensed facility or provider the problems of county level detail and precision faced by Labor Department collection processes are eliminated. As workforce needs become more critical, The Department, in collaboration with other public data collection efforts, needs to expand data collection in a way that optimizes its use in workforce improvement efforts.

(3) Industry and Professional Association Data

The third source of information on life science workforce supply and demand comes from data collected by the diverse industry and professional associations on their members. These include associations representing educational, professional and provider groups. Associations collect information from their members as a direct service to them or to better represent their interests. The Hospital and Health System Association of Pennsylvania has, for example, periodically collected data and disseminated reports nurse staffing in Pennsylvania hospitals. These reports track the proportion of unfilled positions and turnover rates. Member hospitals use such industry wide statistics as benchmarks for gauging their relative success in addressing the nursing shortage and to track changes in the workforce market that their institution will need to respond to. This is timely and useful information to have in gauging shortages. However, since reporting is voluntary and since the response rate of hospitals on the most recent survey was only about 50%, conclusions that can be drawn from such reports are more tenuous than one might like.

The Missing Link

These three sets of activities have involved the investment of substantial resources and some of the concerns highlighted in our review have begun to be addressed. In essence, all three legs of the stool are sturdy. They supply useful data for life science workforce analysis. What is missing is that these data resources (1) often don't fit together well, (2) are inadequately mined, and (3) often fall short of supplying information most critical to end-users. In short, the Life Science Career Alliance cannot rely on these data collection activities for its data needs. Regional assessment and planning for life science workforce needs are not the main goals of these data gathering organizations as they are for the Life Science Career Alliance. Thus a mechanism for gathering and assembling such data must be created.

A regional center for life science workforce analysis that: (1) does not duplicate what already exists, (2) provides a credible, objective third party source of information and analysis, and (3) serves as an effective interface and facilitator between the many diverse end users and providers of data is needed. It should be a part a regional life science "commons," a shared

resource. Information is a resource ideally suited for “the logic of the commons” since its use by one party does not deplete its use by others.

Existing Models

Many regional centers for workforce analysis as envisioned above already exist. In designing a center for the Delaware Valley, we can benefit from these experiences. Some of these Centers have been supported with federal funds, others with state funds and some as private foundation demonstrations. The Health Resources and Services Administration (HRSA) and the Robert Wood Johnson Foundation have supported some of these regional centers for life science workforce analysis. About a dozen academically based workforce academic centers currently operate. Ones at University of New York at Albany and the Cecil Health Services Research Center at The University of North Carolina in Chapel Hill have been successful in gaining diversified support from a variety of public and private sources. Most of these efforts involve relatively little in the way of additional resources to start up (e.g. part-time support for a senior level professional to direct the center’s activities and several graduate research assistants to assist in its projects).

A Work Plan

The center would assist end-users by plowing through detailed data, facilitating its improvement and translating it for day to day decisions. Specifically the center will assist in these activities in the first year by completing the following tasks:

- Convene and structure the activities of an end-user advisory group.
- Create an end user product that will be distributed to participants in the Life Science Career Alliance on a quarterly basis. It will be a “dashboard,” analogous to the dashboard in an airplane whose pilots need to update themselves on fuel consumption, speed, direction, weather patterns, estimated time of arrival, etc.
- Initiate a data collection activity among the participants in the life science alliance to obtain essential information that it is not possible to design into the existing federal, state and association related data collection activities outlined above. This activity will probably web or e-mail based and build on existing web based activities of employers in posting job openings and of training programs in assisting graduates in finding employment.

Conclusions

The *Life Science Career Alliance* faces many complex challenges in addressing the economic development needs of the region. The Workforce Analysis Center can assist in this challenging voyage by providing good instrumentation for pinpointing location, maps for guiding its passage and regular radio weather forecasts so that it can anticipate the storms in its path. With this step the alliance will move from supporting periodic reports of workforce information, as this and the initial report provided, into embedding this process into its on-going planning and development. This key piece of the puzzle needs to be put in place.

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Endnotes

ⁱ The Bureau of the Census does not make year specific population estimates after age 85 and this component of the population has been excluded from this chart.

ⁱⁱ BLS did not collect information hospital employment between 1988 and 1992 and, hence this period of the times series in Figures 1.12 and 1.13 is noted with a dotted line.

ⁱⁱⁱ We excluded occupational groups for which the percent relative standard error was greater than 25%. See the note in the table for and explanation of the calculation of this measure of sample precision.

^{iv} *BLS Handbook of Methods*. (http://stats.bls.gov/opub/hom/homich13_a.htm) Chapter 13 Employment Projections.

^v 15% of program completers fail the nursing examination the first time they take it. Some program completers will choose not to be employed as nurses. The assumption of a 15% attrition rate of those completing programs but either not passing the licensure exam or not becoming employed as nurses may yield an optimistic estimate of the new supply.

^{vi} The estimate of 25% is based on an informal polling of nursing faculty to ascertain the numbers of students in BSN programs who are RN to BSN candidates.

^{vii} The computation of these estimates are as follows:

Graduation	Forecasted		Attrition & Duplicates	Est. Annual New Supply
	2002	10% Growth		
RN BS	515	566.5	0.6375	361
RN DIP	213	234.3	0.85	199
RN AD	391	430.1	0.85	366
RN Total				926
LPN	155	170.5	0.85	145

Source: Pennsylvania Department of State, Nursing Education Program Annual Reports 1999-2002 (Attrition from all sources – 15% and 25% of RN BS degrees have previously been licensed as an RN).

^{viii} The Center for Workforce Information and Analysis of the Pennsylvania Department of Labor and Industry (<http://www.dli.state.pa.us/landi/cwp/view.asp?a=140&Q=57011>) compile listings of occupations in demand by employers in industries that are expected to grow respectively in the Their methodology, described in more detail at their web site, combines estimates of growing industries and hiring trends with the knowledge of regional analysts.

^{ix} As shown in the figure below, a national crude rate of days per 1,000 is 561.1 and a comparable rate for the Philadelphia MSA is computed by applying the same national age specific rates to the Philadelphia MSA population a total crude rate of 593.3 days per 1,000 or a rate 1.048 times higher. This reflects a “pure age effect” and not the effect of practice patterns (age adjusted days per 1,000 are 26% higher than the national rate in the Northeast) or hospital organization (the Philadelphia PMSA appears to have a higher proportion of RNs to LPNs and Aides than in the nation as a whole) and thus 1.35 represents a conservative adjustment for comparing national RN workforce ratios to regional ones.

Age Adjustment for Making Philadelphia MSA Days of Care Comparable to National Rates in 2000

Age	Days of Care/1,000	U.S. Age Distribution	Philadelphia MSA Age Distribution	Days of Care Weighted by Philadelphia Age Distribution
Under 18	178.3	0.257	0.252	44.9
18-44	312.3	0.399	0.388	121.1
45-54	447.5	0.134	0.134	60.2

55-64	749.1	0.086	0.087	65.0
65-74	1469.3	0.065	0.071	103.7
75+	2890.7	0.059	0.069	198.4
Total	566.1	1.000	1.000	593.3

**Age
Adjustment 1.048**

Note: Days of care from National Hospital Discharge Survey and age distribution of populations from the 2000 US Census. Age adjustment for the Philadelphia SMA was calculated by dividing the total of the age specific days of care weighted by the Philadelphia MSA population distribution (593.3) into the total days of care for the US population in 2000 (566.1).

^x Dr. Peter Doukas suggested this analogy at the Workforce Advisory Committee's first meeting.