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Pennsylvania's **SUPPLY/ DEMAND GAP ANALYSIS**

A Briefing Paper

A report for Pennsylvania's
State System of Higher Education

2016



Pennsylvania's
STATE SYSTEM
of Higher Education

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GLOSSARY OF TERMS

The following descriptions provide a point of reference to understand terminology as well as the types of data and analysis undertaken in this study, reflecting historic and contemporary narratives.

Fastest Growing: A term used to describe the relative growth (percent change) of an industry or occupation in a given time period. Fastest growing industries and occupations in this study are identified by the highest relative change in jobs between 2014 and 2024.

High Demand: A term used to describe the demand for workers in a given occupation. High demand occupations are identified as having the highest number of new and replacement jobs projected between 2014 and 2024.

Industry Change: A measure of the change in employment within an industry, used to identify whether an industry is growing or declining, as well as the rate of change. Projected changes lay out expectations of growth/decline for specific industries.

Job Postings: The number of unique (de-duplicated) online postings for a job in a given occupation.

Location Quotient: A comparative statistic used to calculate the relative employment concentration of a given industry or occupation against the average employment of the industry in a larger geography (for example, countrywide). Industries with a higher location quotient (usually greater than 1.2) indicate that the region has a comparative advantage or specialization in the production of that good or service or has a high degree of specialization within its workforce.

New and Replacement Jobs: A demand-side estimate of the number of job openings in an occupation that result from new job growth as well as replacement demand. Replacement demand comprises occupation job leavers based on separations, retirement, and death.

Occupation Jobs: A measure of employment within an occupation category, used to identify which occupations have been growing or declining, as well as the rate of change. Projected changes lay out expectations of growth/decline for specific occupation categories.

Sub-regions: Geographic areas within Pennsylvania defined for more focused workforce and education gap analyses. Sub-regions were determined primarily on Partnerships for Regional Economic Performance (PREP) boundaries. PREP is Pennsylvania's network of business assistance partners, designed to help companies start, grow, and prosper. Please refer to Appendix A for mapping of the Sub-regions and PREP boundaries.

ACRONYMS USED

ACS: American Community Survey

BLS: Bureau of Labor Statistics

CIP: Classification of Instructional Programs

DOE: United States Department of Education

DOL: United States Department of Labor

EMSI: Economic Modeling Specialists International

CEW: Center on Education and the Workforce (Georgetown University)

IPEDS: Integrated Postsecondary Education Data System

LAUS: Local Area Unemployment Statistics

LEHD: Longitudinal Employment and Housing Dynamics

NAICS: North American Industry Classification System

NCES: National Center for Education Statistics

OES: Occupational Employment Statistics

O*NET: Occupational Network

PUMS: Public Use Microdata Sample

QCEW: Quarterly Census of Employment and Wages

SOC: Standard Occupational Classification

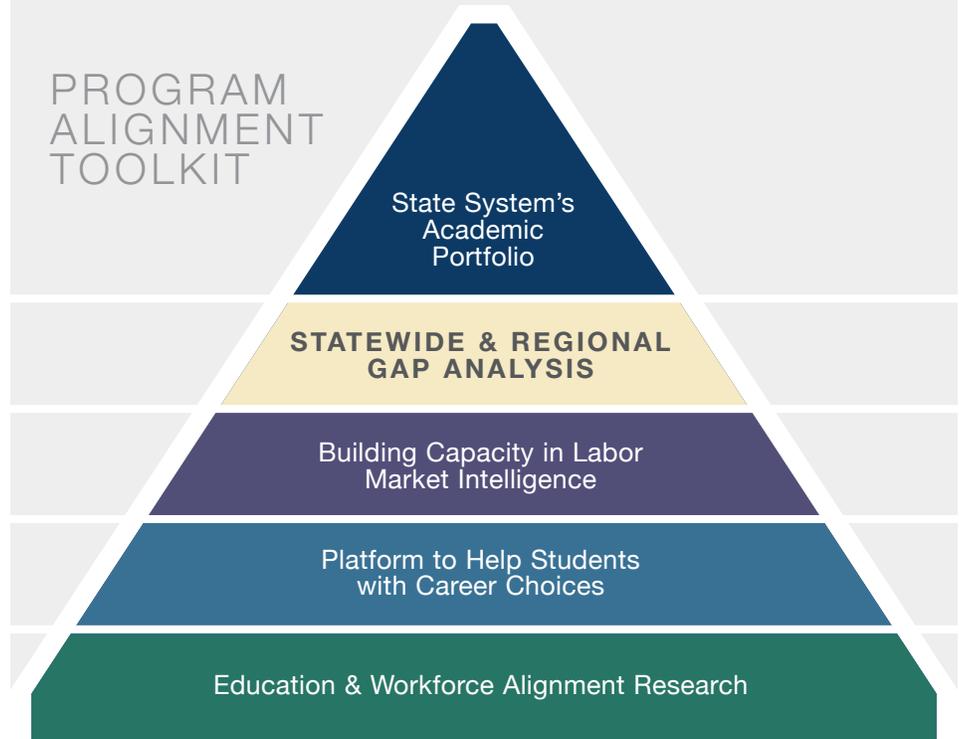
BACKGROUND

Pennsylvania's State System of Higher Education (State System) commissioned this education supply and workforce demand gap analysis report. This education gap analysis project is in direct response to the State System's strategic plan, *Rising to the Challenge 2020* and is a means to understand the big economic picture for the commonwealth and its regions. Knowing the supply of graduates in a given area and the relative employer demand for those graduates helps university stakeholders evaluate the economic eco-system and determine areas that deserve their attention.

The gap analysis is only one component of a larger resource base that the State System and universities can use for strategic planning, engagement with businesses and support for current and prospective students. Other factors that could influence decision-making in these areas include higher education trends, student aspirations, university goals, live data analysis, and direct employer input. The purpose of this education supply/demand gap analysis is to identify areas where education output in Pennsylvania does not meet market need (as defined by employer demand), or if there exists a high surplus of program graduates in the labor market (as compared to employer demand for those graduates).

The results of the State System's Gap Analysis project will become part the State System's Program Alignment Toolkit (see Fig. 1) — an infrastructure of resources that are being created to assist the State System's universities increase their individual and collective impact on Pennsylvania's economy. The Program Alignment Tool-kit complements the existing Business Intelligence Environment the State System has created to support data driven decision-making. An environment that includes forward-thinking, data-rich projects such as the Financial Risk Dashboard, the Data Warehouse project, and the Upcoming Student Success Dashboard.

Fig. 1: Pennsylvania's State System of Higher Education Program Alignment Toolkit Outline



The research contained in the State System's Gap Analysis project was guided by questions in three primary areas:

1. Evaluating Pennsylvania's employer demand, now and into the future

- How are Pennsylvania's industries changing and which sectors are driving new job growth?
- How are Pennsylvania's occupations changing and which skilled occupations show the highest future demand?

2. Evaluating Pennsylvania's education supply

- What is the current education output from Pennsylvania's institutions of higher education?

3. Evaluating the Gap

- What is the alignment between occupation demand and education program output?

- What is the excess employer demand for occupations in the commonwealth?

This briefing paper provides a high level answer to these questions. The full report, Pennsylvania's Supply/Demand Gap Analysis, provides in-depth presentation of the analysis. Additionally, Supply/Demand Gap Analysis reports have been produced for five broad Pennsylvania sub-regions. The results from the regional analysis are included in this Briefing Report (see Appendix 1).

To analyze Pennsylvania's economy, its jobs, and the education preparation needed for these jobs, original research was conducted in the following five areas:

- 1. Baccalaureate Analysis:** This research, produced by Georgetown University's Center on Education and the Workforce (CEW), demonstrates the economic value of post-secondary education in context of Pennsylvania's economy. This research was possible due to a unique collaboration between the State System and CEW. The full report, *'Degrees of Value: College Majors and the Pennsylvania State System's Contribution to the Workforce'* delves into the increasing importance of bachelor's degree holders in the commonwealth's workforce and the critical role the State System plays as a part of Pennsylvania's bachelor's degree sector.
- 2. Identification of Pennsylvania Regions:** To highlight the regional economic diversity in Pennsylvania, a research effort identified broad Pennsylvania sub-regions and customized university-specific labor sheds. The regions were created for the current project (State System's Gap Analysis project) but can be leveraged in multiple ways including engagement with workforce and economic development stakeholders.
- 3. Definition of Skilled Occupations:** Skilled jobs or skilled occupations in the State System's Gap Analysis project are defined using terminology from the O*NET program. The O*NET program is the nation's primary source of occupational information. Central to the project is the O*NET database, which contains information on hundreds of standardized and occupation-specific descriptors. The database, which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation.
- 4. Updated of Employment Projections:** Production of statewide and regional industry and occupation employment projections using a base year of 2014 projected to 2024 (current projections for the state and its regions available from the Bureau of Labor Statistics are from 2012 to 2022).

5. Enhanced Occupation to Instructional Program Crosswalk: The traditional taxonomy of education to occupation crosswalk was enhanced using American Community Survey data that demonstrates a broader spectrum of connections between education programs and occupations.

While the State System’s Gap Analysis project is critical to understanding the connections between education programs and occupations, it is important to note a few caveats of this Gap Analysis report:

- When considering making adjustments to programs in degree areas related to occupations displaying gaps, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.
- Government data that captures labor market demand lags real-time employer demand as well higher education industry trends. As such, the gap analysis findings may lag these market changes.
- This analysis only focuses on program output as a supply pool (i.e. new graduates). However, regional workforces comprise additional pools of supply—specifically: employed workers, skilled unemployed workers, and skilled underemployed workers. When evaluating gaps, this analysis focuses on new and replacement demand, as opposed to job churn. This helps to mitigate some of the issues involving the employed workforce.

EVALUATING EMPLOYER DEMAND

In this supply/demand gap analysis project, employer demand is derived from a combination of publically available data sources at the national, state, and county level. In order to capture the most recent economic trends, the State System used 4-digit NAICS (industry) and 5-digit SOC (occupation) data to produce projections from 2014 to 2024 at the county level for Pennsylvania. The projections incorporate Quarterly Census of Employment and Wages (QCEW) data through 2014, and therefore contain the most recent employment data.

This section provides an analysis of projected changes across both industry and occupation classifications in Pennsylvania, highlighting the demand for skilled occupations. Skilled jobs or skilled occupations in the State System's Gap Analysis project are defined using terminology from the O*NET program. The O*NET program is the nation's primary source of occupational information. Central to the project is the O*NET database, containing information on hundreds of standardized and occupation-specific descriptors. The database, which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation.

Specifically for this analysis a skilled occupation is defined as an occupation in O*NET Job Zones Three (3), Four (4), or Five (5). A Job Zone is a group of occupations that are similar in how much education people need to do the work, how much related experience people need to do the work, and how much on-the-job training people need to do the work.¹ The Job Zones range from 1 (lowest) to 5 (highest). Job Zones 3, 4, and 5 require some level of post-secondary education specifically:

- Most occupations in Job Zone 3 requiring training in vocational schools, related on-the-job experience, or an associate's degree,
- Most occupations in Job Zone 4 requiring a four-year bachelor's degree,
- Most occupations in Job Zone 5 requiring graduate school (for example, they may require a master's degree, and some require a Ph.D., M.D., or J.D.).

¹ <https://www.onetonline.org/help/online/zones>

In the remainder of this report, the term “occupations aligning to associate’s degrees” refers to occupations in Job Zone 3 while the term “occupations aligning to bachelor’s and graduate degrees” refers to occupations in Job Zone 4 and 5.

Pennsylvania’s Workforce

The Pennsylvania economy had 5.6 million jobs in 2014, which is projected to grow to 6.2 million in 2024 – an increase of about 536,200 jobs or a 9.5 percent change.

Of the 6.2 million jobs the commonwealth is projected to have in 2024, 50 percent require some amount of post-secondary education preparation. These are defined as skilled jobs or skilled occupations in the State System’s Gap Analysis project using terminology from the O*NET program as described in the previous section.

It is important to note that the share of Pennsylvania jobs in 2024 that will require some post-secondary education will increase from 2014, indicating employer demand for skilled workers will continue to grow. In fact, the growth in jobs that require some level of post-secondary education in 2024 is projected to be 10.9 percent as compared to 8.1 percent for those that require no post-secondary education.

Fig. 2 shows the number of jobs in Pennsylvania by skilled occupations (Job Zones 3-5) and low skilled occupations (Job Zones 1-2) in 2014 and projected growth out to 2024 for each set of occupations.

Fig. 2: Projected Job Growth in Pennsylvania by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
Pennsylvania, Total Jobs	5,643,677	6,179,890	9.5%	100%	100%
Job Zones 1-2 (Low Skilled)	2,866,959	3,099,406	8.1%	51%	50%
Job Zones 3-5 (Skilled)	2,776,718	3,080,484	10.9%	49%	50%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; O*NET; Oxford Economics Projections

Skilled occupation growth is driven by the growing industries that employ skilled workers. The next section provides an overview of industry employment in Pennsylvania and identifies the fastest growing industries that are driving employment growth.

Industry Profile of Pennsylvania

Understanding the structure of Pennsylvania's industry sectors offers valuable insights into career opportunities that exist in Pennsylvania. As the State System implements strategies to increase the economic competitiveness of its workforce and ultimately the economic competitiveness of the state, it is important to understand the connection between occupations and industry jobs. This section explores the current strengths in the Pennsylvania economy by industry and examines any trends that will affect industry structure in the coming years.

Major Industry Performance in Pennsylvania²

Currently, the most sizeable 2-digit industry sectors in Pennsylvania include health care and social services; trade, transportation, and utilities; and professional and business services. As can be seen in Fig. 2, the breakdown of the largest Pennsylvania industries are as follows:

- **Health care and social assistance** account for the most jobs with more than 983,800 jobs in 2014,
- **Retail trade** showing almost 637,700 jobs in 2014,
- **Manufacturing** with almost 567,800 jobs in 2014,
- **Education services** with nearly 482,800 jobs in 2014, and
- **Accommodation and food services** employing over 447,100 jobs in 2014.

Four of the five top employing industry sectors added a significant number of new jobs between 2010 and 2014 (approximately 97,700 new jobs), reflecting both economic recovery from the recession, as well as continued sector growth, stemming in part from the place-based competitiveness of these sectors in the Northeast US.³ However, education services declined nearly 31,700 jobs between 2010 and 2014. Two industry sectors that typically demand higher skilled workers show strong growth projections over the next ten years, which will drive further need for skilled labor in Pennsylvania. The projections for these two sectors indicate,

² The industry analysis discussed in this section is done at the 2-digit NAICS level

³ The strong transportation network linkages in the Philadelphia metropolitan area, as well as strong economic ties to other areas outside of Pennsylvania, such as New York and Washington D.C. enables a high degree of place-based competitiveness for the region.

- **Healthcare and social assistance** will add an additional 190,000 new jobs between 2014 and 2024 (19% job growth),
- **Professional and technical services and management of companies and enterprises** are projected to add over 78,700 new jobs combined (17% job growth)—which will require talent in various business disciplines to support this growth.

While many sectors have experienced moderate or strong growth over the past several years, there are noted exceptions. The largest projected reduction in jobs is expected to occur in the following sectors between 2014 and 2024:

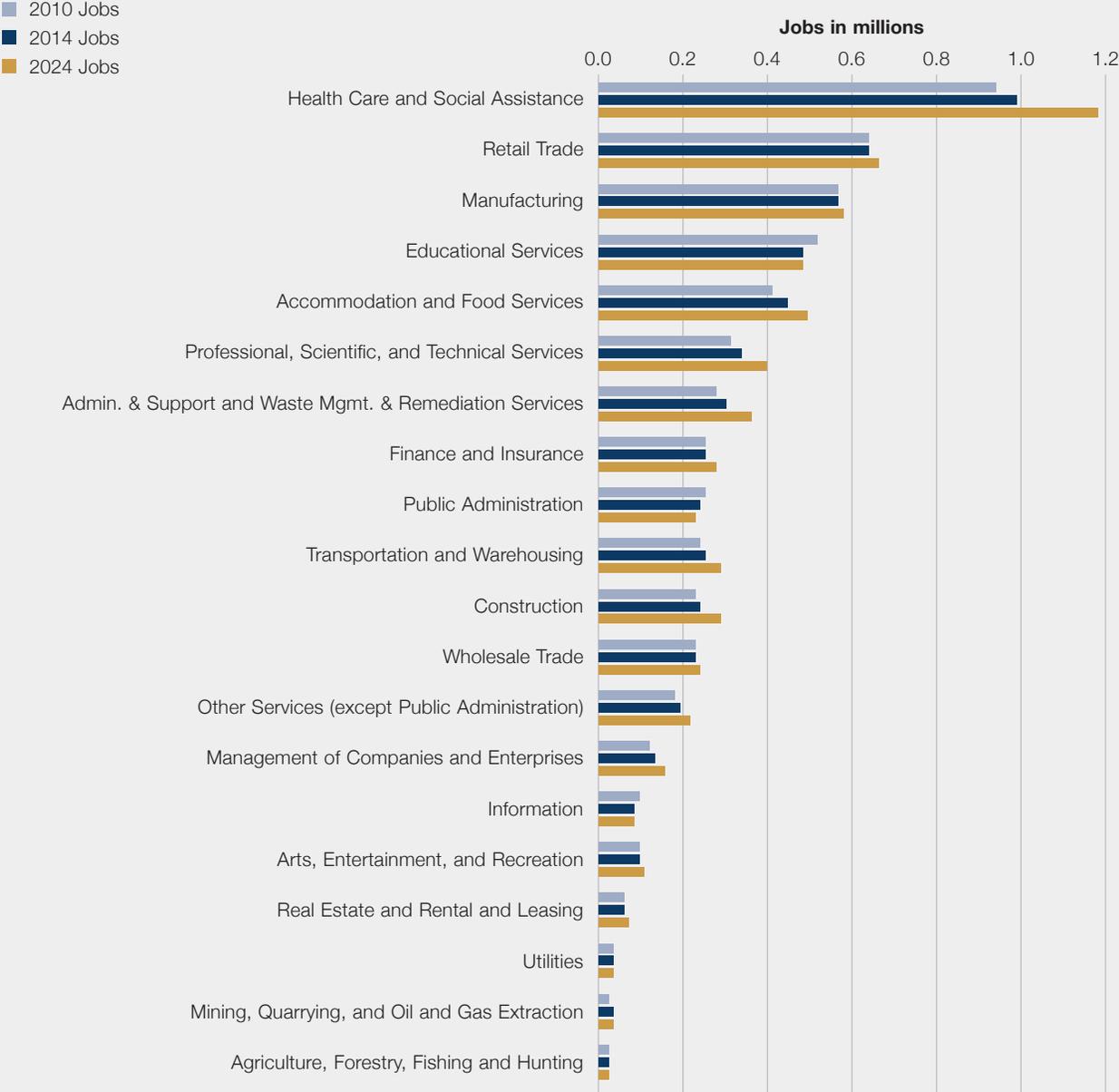
- **Public administration** is projected to decline by nearly 8,900 jobs (a 3.8% decline) over the next 10 years,
- **Education services** shows a projected decline of about 1,100 jobs (a 0.2% decline) over the next decade,
- **Information** indicates a projected decline of just under 4,000 jobs (a 4.5% decline) over the next 10 years.

The causes of these declines differ. For example, reductions in government employment reflect changes in legislative priorities and budgets, while reductions in information are largely due to the decline in newspaper and book publishers, as well as job declines in telecommunications.

Fig. 3 depicts the number of jobs in 2010, 2014, and projections out to 2024 for each of the broad industry sectors.

The next section takes a deeper look into the fastest growing industries and provides insights into the drivers of job growth in Pennsylvania.

Fig. 3: Pennsylvania’s 2-Digit Industry Employment, 2010, 2014, and 2024



Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Largest Growth 4-digit Industries in Pennsylvania⁴

The largest growth 4-digit industries are identified by the largest projected growth to occur between 2014 and 2024. The top 10 fastest growing industries will add nearly 239,500 new jobs in Pennsylvania by 2024. The growth of these industries will continue to transform the commonwealth’s industry base toward a more service based economy. Fig. 4 provides a snapshot of the projected detailed industry growth in Pennsylvania to 2024.



In Pennsylvania, many of the occupations employed by the fastest growing industries require post-secondary education. For example,

⁴ The industry analysis discussed in this section is done at the 4-digit NAICS level

- **Management of companies and enterprises** require a breadth of accountants and auditors, operation managers, financial managers, marketing specialists and human resource specialists. Projections indicate that management of companies and enterprises is slated to grow from about 132,750 jobs in 2014 to 152,050 jobs in 2024.
- About half of **computer systems design and related services** employment consists of software developers, computer system analysts, computer programmers and computer user support specialists. Most people employed in these occupations have at least a bachelor's degree. Furthermore, projections indicate the industry will grow by over 23,500 new jobs between 2014 and 2024.
- **General medical and surgical hospitals** employ a diverse range of different health care professionals at multiple different levels of educational attainment. This covers surgeons to medical secretaries, including a range of nursing professions such as nursing assistants, licensed practical nurses and registered nurses. Projections indicate the industry will add approximately 23,600 new jobs between 2014 and 2024.

These growing industries present opportunities for post-secondary institutions to collaborate and engage with businesses that will demand skilled workers.

While this section focused on the types of businesses where people in Pennsylvania work, the next section builds a perspective of occupational employment. The occupation section describes the types of jobs people have in Pennsylvania and identifies the skills and characteristics of those people.

Occupation Profile of Pennsylvania

Examining occupational employment considers the importance of skills, experience and knowledge of workers. It showcases the types of jobs in which Pennsylvania's workforce is currently employed and projected to be employed by 2024. As a result, the occupational data profiled include new job growth and openings due to replacement jobs from worker turnover. This provides a deeper perspective of local workforce changes and labor demand. Furthermore, detailed occupation analysis allows for better understanding of relevant education course linkages to support talent development.

Pennsylvania's employment projections indicate that between 2014 and 2024 employers will require nearly 212,700 new and replacement jobs annually to sustain productivity and growth.⁵ While this figure includes both low skilled and skilled occupations, it represents a significant need for workers over the coming years in Pennsylvania. Furthermore, the growth in skilled jobs in 2024 is projected to be 10.9 percent as compared to 8.1 percent for those jobs that require no post-secondary education preparation.

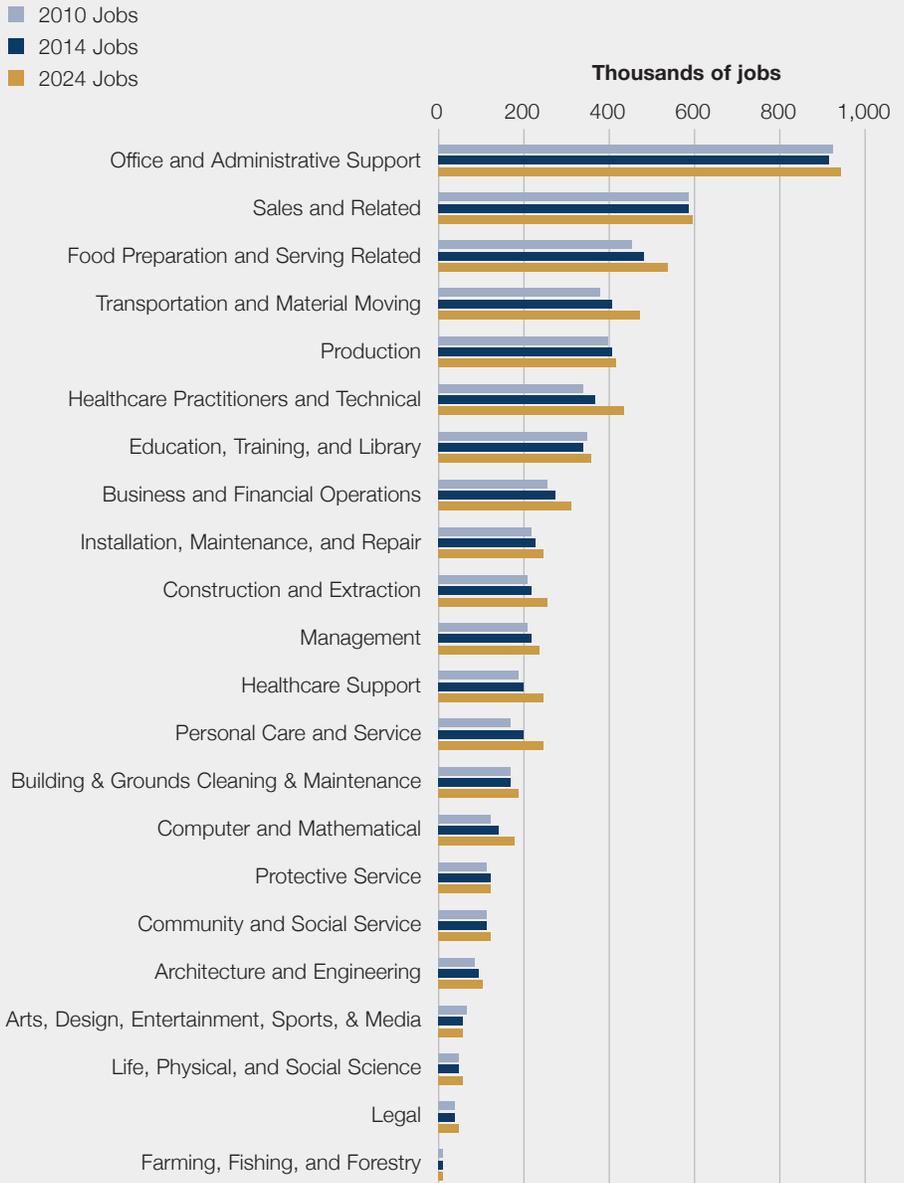
Certain major occupation categories—at the 2-digit Standard Occupation Classification (SOC) level—have seen substantial growth in recent years and are expected to continue to lead the pack. Between 2010 and 2014 Pennsylvania experienced growth in several occupation categories, which are typically aligned with post-secondary education. These include:

- **Computer and Mathematical** occupations grew by 16,400 new jobs between 2010 and 2014,
- **Healthcare practitioners and technical** occupations increased by nearly 22,400 new jobs between 2010 and 2014,
- **Personal care and service occupations** saw growth of over 21,500 new jobs between 2010 and 2014, and
- **Business and financial occupations** experienced growth of more than 17,600 new jobs between 2010 and 2014.

⁵ New and replacement jobs refer to new job creation that result from business growth, as well as replacement demand that result from retirement, death, or other permanent separation from an occupation.

Fig. 5 provides a snapshot of the projected detailed broad occupation employment in Pennsylvania in 2010, 2014, and projections to 2024.

Fig. 5: Pennsylvania's Projected 2-digit Occupation Employment, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Top High Demand Occupations Aligning to Associate’s Degrees⁶

High demand occupations are identified as having the largest projected new and replacement demand between 2014 and 2024. This section focuses on Job Zone Three occupations that typically align to associate’s degrees. Job churn and the demographic characteristics of those who are currently employed—specifically age—also influence replacement demand in this group of occupations. Occupations that employ an older demographic, specifically those 55 and older, will face increasing pressure to replace workers as older workers approach retirement age. For example, projections indicate that registered nursing employment will grow by nearly 25,800 new jobs between 2014 and 2024. Retirements and separations will require an additional 26,100 replacement workers during this time period, resulting in almost 51,900 new and replacement jobs.

Top high demand occupations that align to associate’s degrees include: registered nurses, secretaries and administrative assistants, and maintenance and repair workers. Fig. 6 and Fig. 7 highlight the top 15 high demand occupations that align to associate’s degrees, 10-year job growth projections, and new and replacement jobs.

Fig. 6: Pennsylvania’s Top High Demand Occupations Aligning to Associate’s Degrees, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

6 Occupations in O*Net Job Zone 3

Fig. 7: Pennsylvania Employment Projections for Top High Demand Occupations Aligning to Associate’s Degrees, 2014-2024

Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	10-year New and Replacement Jobs
Registered Nurses	128,807	154,599	20.0%	51,874
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	107,410	121,313	12.9%	27,860
Licensed Practical and Licensed Vocational Nurses	36,876	46,128	25.1%	18,990
Maintenance and Repair Workers, General	61,467	64,865	5.5%	16,938
First-Line Supervisors of Office and Administrative Support Workers	53,975	56,449	4.6%	15,400
Teacher Assistants	45,510	47,400	4.2%	13,200
Automotive Service Technicians and Mechanics	33,495	36,747	9.7%	12,992
Computer User Support Specialists	25,365	33,260	31.1%	12,436
Bookkeeping, Accounting, and Auditing Clerks	65,090	70,698	8.6%	12,044
Hairdressers, Hairstylists, and Cosmetologists	24,351	28,440	16.8%	10,977
Electricians	22,120	26,939	21.8%	10,844
Medical Assistants	23,869	28,903	21.1%	9,826
Medical Secretaries	21,680	27,973	29.0%	8,822
Police and Sheriff’s Patrol Officers	27,582	26,483	-4.0%	8,796
Preschool Teachers, Except Special Education	14,526	18,977	30.6%	8,622

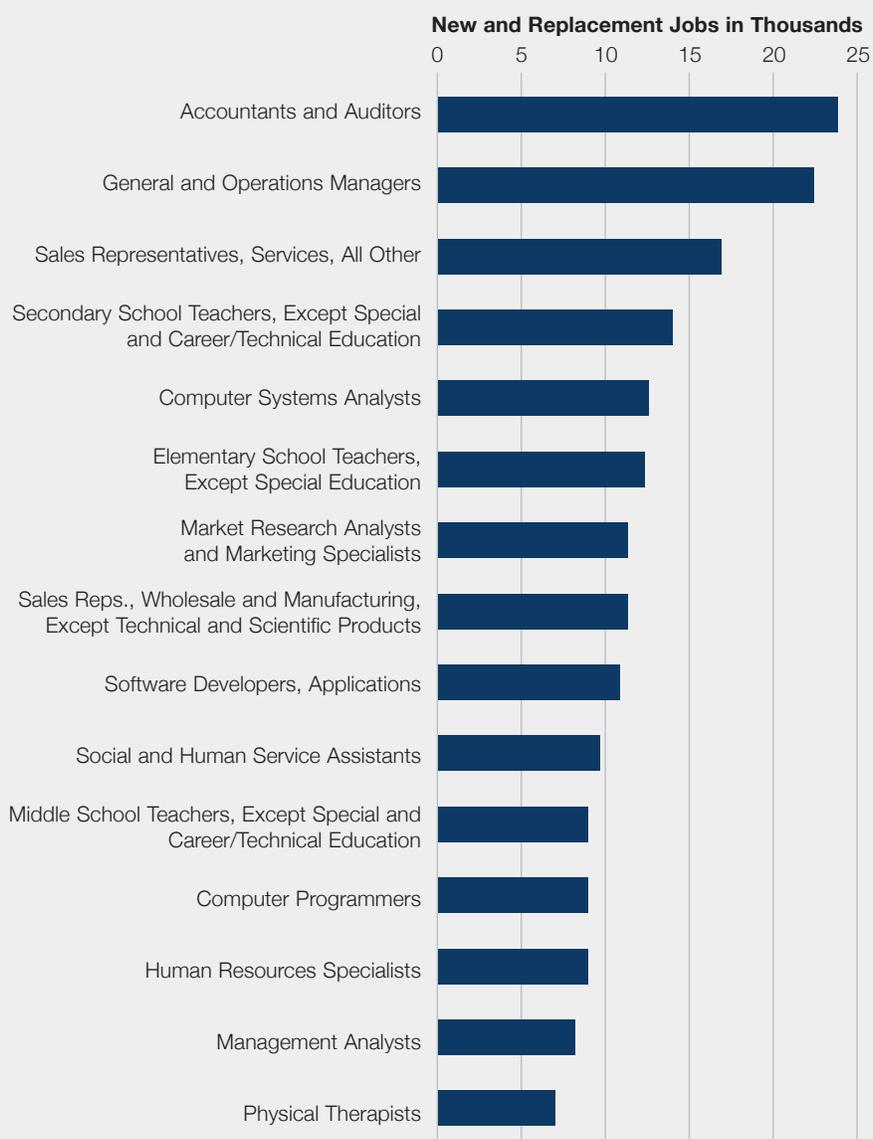
Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Top High Demand Occupations Aligning to Bachelor’s and Graduate Degrees⁷

The top high demand occupations are identified as having the largest projected new and replacement demand between 2014 and 2024. This section focuses on Job Zone Four and Five occupations that typically align to bachelor’s and graduate degrees. Top high demand occupations that align to bachelor’s and graduate degrees include: accountants and auditors, secondary school teachers, and sales representatives for wholesale and manufacturing. Fig. 8 and Fig. 9 highlight the top 15 high demand occupations that align to bachelor’s and graduate degrees in the state, 10-year job growth projections, and new and replacement jobs.

⁷ Occupations in O*Net Job Zones 4 and 5

Fig. 8: Pennsylvania's Top High Demand Occupations Aligning to Bachelor's and Graduate Degrees, 2014-2024



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Fig. 9: Pennsylvania Employment Projections for Top High Demand Occupations Aligning to Associate's Degrees, 2014-2024

Occupation Title	2014 Jobs	2024 Jobs	% Change 2014-2024	New and Replacement Jobs
Accountants and Auditors	54,384	59,962	10.3%	23,682
General and Operations Managers	65,499	76,216	16.4%	22,377
Sales Representatives, Services, All Other	30,180	38,249	26.7%	16,728
Secondary School Teachers, Except Special and Career/Technical Education	50,953	47,611	-6.6%	14,012
Computer Systems Analysts	23,193	31,622	36.3%	12,531
Elementary School Teachers, Except Special Education	55,324	53,736	-2.9%	12,330
Market Research Analysts and Marketing Specialists	23,315	30,907	32.6%	11,326
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	63,944	60,271	-5.7%	11,182
Software Developers, Applications	21,322	28,985	35.9%	10,702
Social and Human Service Assistants	22,576	25,478	12.9%	9,638
Middle School Teachers, Except Special and Career/Technical Education	24,071	26,935	11.9%	8,910
Computer Programmers	14,318	18,478	29.1%	8,849
Human Resources Specialists	19,642	24,278	23.6%	8,830
Management Analysts	21,463	26,143	21.8%	8,251
Physical Therapists	10,685	14,539	36.1%	6,878

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Skilled occupations typically require post-secondary education in order to meet the demands of employers. The next section provides a high-level overview of Pennsylvania's education program output by broad degree category.

EVALUATING EDUCATION SUPPLY

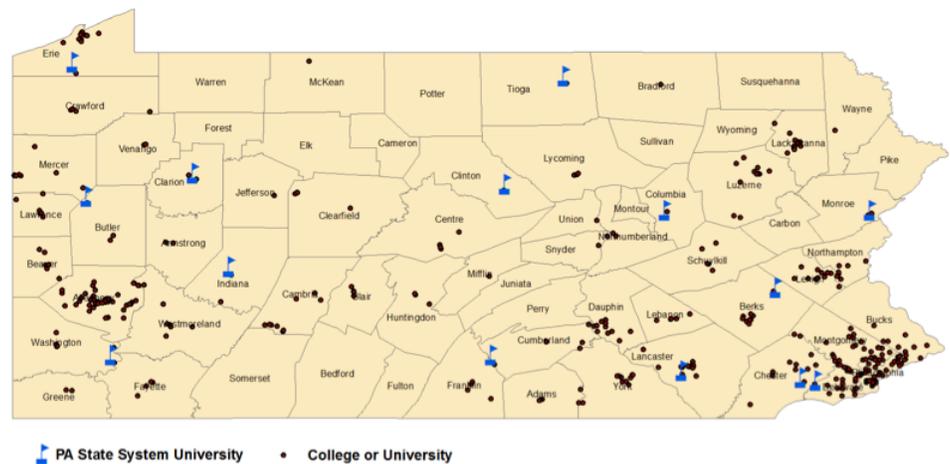
This section provides an analysis of completions of associate's, bachelor's and graduate degrees by major program in Pennsylvania. In this analysis, the education supply is derived from the National Center for Education Statistics (NCES) Integrated Post-Secondary Education Data System (IPEDS).

Education Profile of Pennsylvania

Pennsylvania is home to approximately 400 post-secondary institutions.⁸ These institutions have over 800,000 enrolled students and graduated on average over 166,000 students annually from 2011 to 2013 with an associate's degree or higher.⁹

Fig. 10 shows the geographic distribution of post-secondary institutions in Pennsylvania.

Fig. 10: Locations of Pennsylvania's Post-Secondary Institutions



8 This number includes the location of a physical campus/structure with learner enrolment as reported to NCES. Institutions with extension campuses that report enrollment at their main campus may not be captured within this list.

9 This number is the 3-year average completions in Pennsylvania from 2011 to 2013 as reported to NCES.

Pennsylvania's State System of Higher Education is a large contributor to the total number of degree completions. The State System produces approximately 21% of the total bachelor's degrees and above in the state.¹⁰ Furthermore, the State System enrolls approximately 18% of Pennsylvania's four-year institutions' learners, including bachelor's and master's degrees. This has remained steady for the past several academic years.

The following sections provide information on education production by degree level and area of study. This information is important to the State System's gap analysis project in order to analyze the education supply. The education production is synonymous to the 'supply' piece of the gap analysis. It considers the supply of post-secondary education degree output from post-secondary institutions reporting to IPEDS (as reflected in Fig. 10) not just the State System universities. This ultimately provides a more holistic view of education supply, which can then be compared to the demand for skilled occupations.

Associate's Degree Production

Over 100 different Pennsylvania institutions offer a range of associate's degree programs, as reported by the National Center for Education Statistics (NCES).¹¹ From 2011 to 2013, institutions in Pennsylvania awarded, on average, nearly 29,300 associate's degrees.

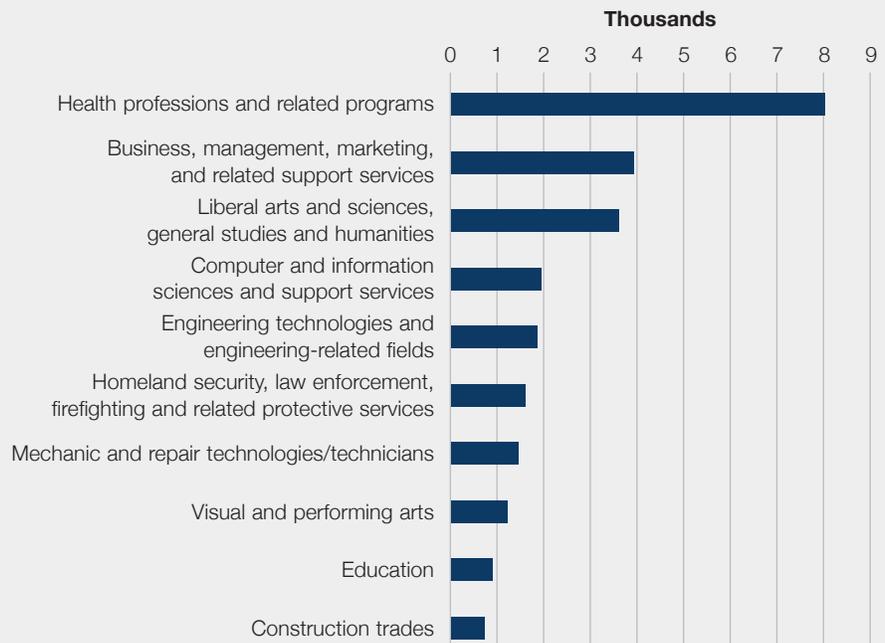
Health professions and related programs, business, management, marketing, and related support services, and liberal arts and sciences, general studies and humanities dominate the statewide associate's degree completions. Of the nearly 29,300 average annual completions of associate's degrees, these three program areas account for more than 53% of completions—representing an average of about 15,600 degree completions. Computer and information sciences and support services, engineering technologies and engineering-related fields, and homeland security, law enforcement, firefighting and related protective services also represent significant statewide associate's degree programs, totaling an average of about 5,400 degree completions.

Fig. 11 highlights the top 10 major categories based on the number of associate's degree completions within Pennsylvania.

10 Georgetown's Center on Education and the Workforce analysis of degree production in the Pennsylvania Baccalaureate Sector – October 2015.

11 This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

Fig. 11: Top 10 Average Annual Program Completions for Associate’s Degrees in Pennsylvania, 2011-2013



Source: National Center for Education Statistics (IPEDS), 2011-2013 Completions

State System Associate Degree Output

From 2011 to 2013, seven out of fourteen universities in the State System awarded associate degrees. On average, these institutions awarded 414 associate degrees annually. The top 3 schools accounted for 78% of all State System associate degree completions and include: Clarion University (161 annual average associate completions), Lock Haven University (93 annual average associate completions), and Edinboro University (68 annual average associate completions).

Fig. 12 displays the average annual associate degree completion by major categories within the State System. Three program areas dominate the State System associate's degree landscape:

- Health professions and related programs,
- Engineering technologies and engineering-related fields, and
- Homeland security, law enforcement, firefighting and related protective services.

Fig. 12: State System Average Annual Program Completions for Associate's Degrees, 2011-2013 Annual Average

Major Field of Study – Associate Degrees	2011-2013 3-year Average Completions	Share of Associate Degrees
Health professions and related programs	192	46.3%
Engineering technologies and engineering-related fields	50	12.1%
Homeland security, law enforcement, firefighting and related protective services	42	10.1%
Education	35	8.5%
Business, management, marketing, and related support services	29	7.0%
Liberal arts and sciences, general studies and humanities	29	7.0%
Legal professions and studies	10	2.5%
Public administration and social service professions	9	2.2%
Physical sciences	7	1.7%
English language and literature/letters	6	1.5%
Computer and information sciences and support services	3	0.8%
Science technologies/technicians	1	0.2%
Total	414	100.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Of the 414 average annual completions of associate degrees within State System universities, these three program areas account for 68% of State System associate degree completions—representing an annual average of over 280 completions.

Bachelor's Degree Production

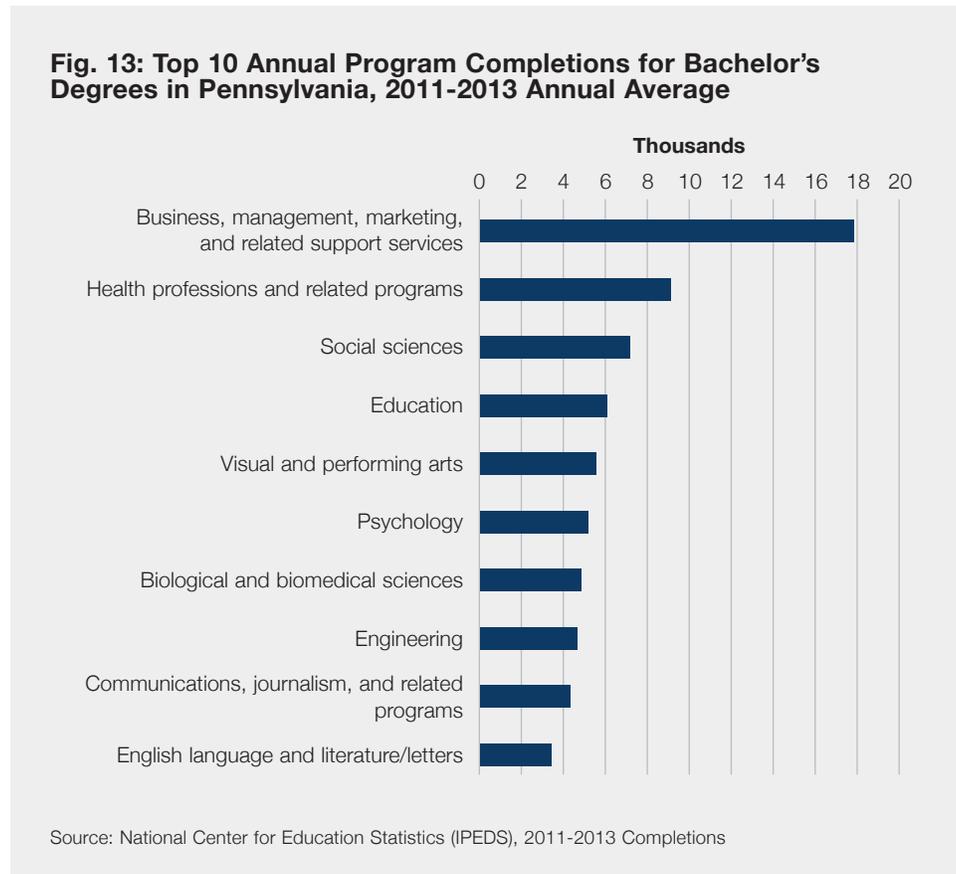
Over 150 different Pennsylvania institutions offer a range of bachelor's degree programs, as reported by the National Center for Education Statistics (NCES).¹² From 2011 to 2013, institutions in Pennsylvania awarded, on average, nearly 90,700 bachelor's degrees annually.

Business, management, marketing, and related support services, health professions and related programs, social sciences, education, and visual and performing arts dominate the statewide bachelor's degree completions. Of

¹² This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

the nearly 90,700 average annual completions of bachelor's degrees, these top five program areas account for almost 50% of completions—representing an average of 45,000 annual degree completions. Psychology, biological and biomedical sciences, and engineering also represent significant statewide bachelor's degree programs, totaling an annual average of almost 15,000 annual degree completions.

Fig. 13 highlights the top 10 major categories based on the number of bachelor's degree completions within Pennsylvania.



As is evident from both associate's degree completion and bachelor's degree completion, business and health professions programs dominate education supply. When compared to occupation demand (new and replacement jobs), for related business and health professions occupations, strong ties between associate degree completions, bachelor's degree completions and occupation demand (e.g. registered nurses, accountants and auditors, customer service representatives, etc.) are apparent.

State System Bachelor's Degree Output

From 2011 to 2013, all fourteen universities in the State System awarded bachelor's degrees. On average, these institutions awarded 19,200 bachelor degrees annually. The top 3 schools accounted for 35% of all State System bachelor degree completions and include: West Chester University (2,668 annual average bachelor completions), Indiana University (2,266 annual average bachelor completions), and Kutztown University (1,803 annual average bachelor completions).

Fig. 14 on the next page displays the average annual bachelor degree completion by major categories within the State System. The top 3 program areas for bachelor degrees in the State System include:

- Business, management, marketing, and related support services,
- Education, and
- Health professions and related programs.

Of the 19,200 average annual completions of bachelor degrees within the State System, these three program areas account for 39% of bachelor degree completions—representing an annual average of nearly 7,400 completions.

Graduate Degree Production

Over 100 different Pennsylvania institutions offer a range of graduate degree programs, as reported by the National Center for Education Statistics (NCES).¹³ From 2011 to 2013, institutions in Pennsylvania awarded, on average, more than 46,200 graduate degrees.

Health professions and related programs, education, and business, management, marketing, and related support services dominate the statewide graduate degree completions. Of the more than 46,200 average annual completions of graduate degrees, these three program areas account for 60% of completions—representing an average of more than 27,500 degree completions. Engineering, legal professions and studies, and public administration and social service professions also represent significant statewide graduate programs, totaling an annual average of nearly 6,600 degree completions.

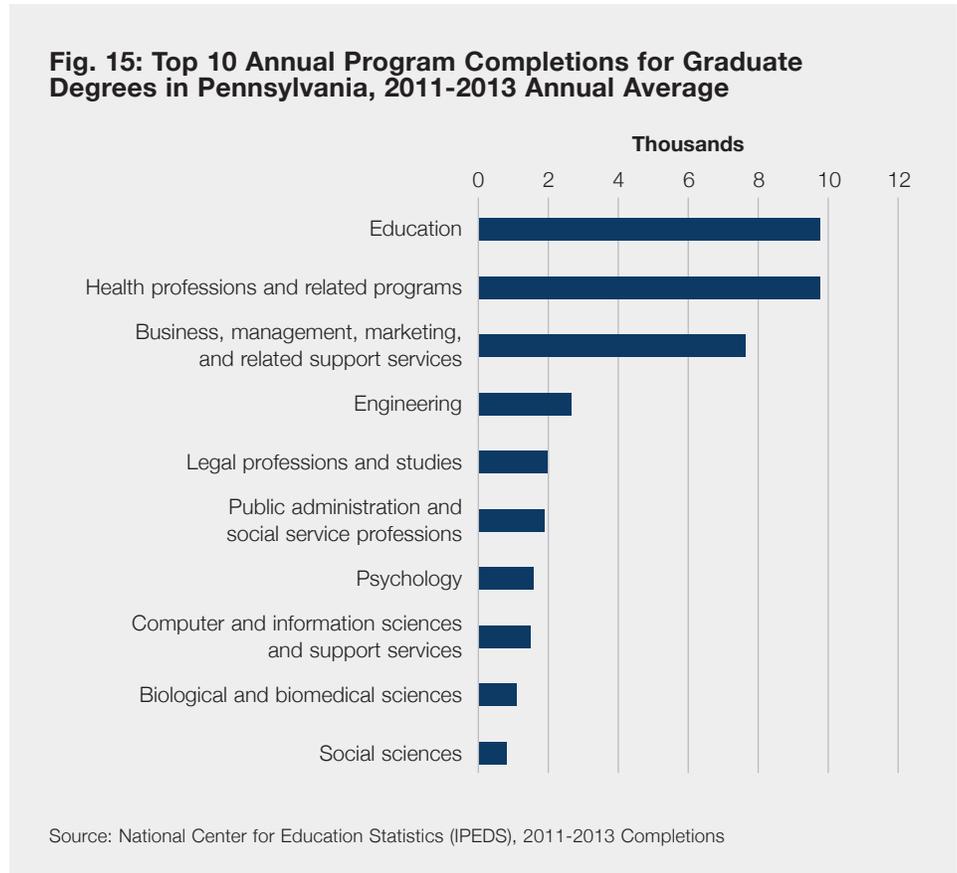
¹³ This number includes the location of a physical campus/structure as reported to NCES. Institutions with extension campuses that report to their main campus may not be captured within this list.

Fig. 14: State System Annual Program Completions for Bachelor's Degrees, 2011-2013 Annual Average

Major Field of Study – Bachelor Degrees	2011-2013 3-year Average Completions	Share of Bachelor Degrees
Business, management, marketing, and related support services	3,074	16.0%
Education	2,423	12.6%
Health professions and related programs	1,882	9.8%
Social sciences	1,521	7.9%
Psychology	1,170	6.1%
Parks, recreation, leisure, and fitness studies	1,148	6.0%
Visual and performing arts	1,114	5.8%
English language and literature/letters	930	4.8%
Communication, journalism, and related programs	858	4.5%
Homeland security, law enforcement, firefighting and related protective services	722	3.8%
Biological and biomedical sciences	663	3.5%
Liberal arts and sciences, general studies and humanities	559	2.9%
History	491	2.6%
Public administration and social service professions	440	2.3%
Physical sciences	434	2.3%
Computer and information sciences and support services	352	1.8%
Engineering technologies and engineering-related fields	324	1.7%
Mathematics and statistics	314	1.6%
Multi/interdisciplinary studies	187	1.0%
Foreign languages, literatures, and linguistics	184	1.0%
Family and consumer sciences/human sciences	136	0.7%
Natural resources and conservation	89	0.5%
Philosophy and religious studies	65	0.3%
Library science	30	0.2%
Area, ethnic, cultural, gender, and group studies	28	0.1%
Communications technologies/technicians and support services	26	0.1%
Engineering	8	0.04%
Architecture and related services	7	0.03%
Legal professions and studies	6	0.03%
Total	19,186	100.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Fig. 15 highlights the top 10 major categories based on the number of graduate degree completions within Pennsylvania.



State System Graduate Degree Output

From 2011 to 2013, all fourteen universities in the State System awarded graduate degrees. On average, these institutions awarded nearly 5,700 graduate degrees annually. The top 3 schools accounted for 43% of all State System graduate degree completions and include: California University (990 annual average graduate completions), Indiana University (788 annual average graduate completions), and West Chester University (674 annual average graduate completions).

Fig. 16 on the next page displays the average annual graduate degree completion by major categories within the State System. The top 3 program areas for graduate degrees in the State System include:

- Education,
- Health professions and related programs, and
- Parks, recreation, leisure, and fitness studies.

Fig. 16: State System Annual Program Completions for Graduate Degrees, 2011-2013 Annual Average

Major Field of Study – Graduate Degrees	2011-2013 3-year Average Completions	Share of Graduate Degrees
Education	2,195	38.6%
Health professions and related programs	661	11.6%
Parks, recreation, leisure, and fitness studies	618	10.9%
Business, management, marketing, and related support services	498	8.8%
Library science	292	5.1%
Public administration and social service professions	241	4.2%
Psychology	235	4.1%
English language and literature/letters	159	2.8%
Social sciences	106	1.9%
Visual and performing arts	90	1.6%
Mathematics and statistics	82	1.4%
Biological and biomedical sciences	73	1.3%
Homeland security, law enforcement, firefighting and related protective services	66	1.2%
Engineering technologies and engineering-related fields	65	1.2%
History	61	1.1%
Multi/interdisciplinary studies	45	0.8%
Legal professions and studies	45	0.8%
Communication, journalism, and related programs	44	0.8%
Computer and information sciences and support services	27	0.5%
Foreign languages, literatures, and linguistics	19	0.3%
Physical sciences	17	0.3%
Natural resources and conservation	13	0.2%
Liberal arts and sciences, general studies and humanities	10	0.2%
Philosophy and religious studies	10	0.2%
Family and consumer sciences/human sciences	8	0.1%
Total	5,681	100.0%

Source: National Center for Education Statistics (IPEDS) 2011-2013 Completions

Of the nearly 5,700 average annual completions of graduate degrees within the State System, these three program areas account for 61% of graduate degree completions—representing an annual average of nearly 3,500 completions.

With occupation demand established and education program completions compiled, comparisons between the two can be made. The following section evaluates the connection of completions by degree program (education supply) to the need for skilled labor by occupation (employer demand).

EVALUATING SUPPLY/DEMAND GAPS

A gap analysis comparing educational supply and occupational demand serves as a critical first step in efforts to align education programs with the workforce needs of Pennsylvania employers. It provides a data-driven perspective of employer demand (growing occupations across the state) and post-secondary education supply (degree production by program and level). This section focuses on the demand gaps and supply surpluses for skilled occupations in Pennsylvania (Job Zones 3, 4 and 5).

To make the connection between employer demand and education supply a crosswalk between the taxonomy of occupations (Standard Occupation Codes, or SOC) and major programs (Classification of Instructional Program or CIP) is required. The State System's gap analysis project conducted original research to enhance the traditional taxonomy of major program to occupation crosswalk¹⁴ using American Community Survey data that demonstrate a broader spectrum of connections between education programs and occupations. This hybrid crosswalk connected the CIP and SOC using both the NCES and Pennsylvania standard crosswalks and the additional real-world connections using the American Community Survey.

An additional consideration when viewing the gap analysis results includes the regional workforces that comprise different pools of supply—specifically: employed workers, skilled unemployed workers, skilled underemployed workers, and graduating learners (new entrants). Recent graduates will likely compete against one or more of the above supply pools. When evaluating gaps and surpluses, the analysis focuses on net openings, as opposed to replacement jobs.¹⁵ This helps to mitigate some of the issues involving the employed workforce.

14 The existing crosswalks available include a national NCES crosswalk and a state crosswalk specific to Pennsylvania. Additional connections were made using data available in the ACS. The benefits of ACS approach include: A better capture of demand for college majors within an occupation classification, a reality-driven process to connect liberal arts degrees to occupations, a reality-driven reflection of educational attainment distribution by degree level demonstrating that a range of skill levels exist within occupation classification, and a regionalized crosswalk that better reflects the competition for jobs in Pennsylvania and the surrounding region.

15 Replacement jobs include retirements, deaths, and other workers who permanently leave an occupation.

The findings compare employer demand and education supply and are presented in two categories in this Briefing Paper:

- Occupations at the statewide level that demonstrate excess employer demand.
- Occupations at the statewide level that demonstrate supply surpluses.

Excess demand gaps should be considered on a case-by-case basis and additional research should be undertaken to better understand the market conditions that result in the excess demand gap. To assist in initially identifying excess demand gaps, this analysis contains 2 pieces of data: an average annual gap number (volume) and a ratio of annual program completions (supply) to annual occupation demand. For example, an occupation with a demand of 100 and a supply of 60 would indicate an excess demand gap of 40 and a supply/demand ratio of 0.6 because 60% of employer demand is being supplied by Pennsylvania postsecondary institutions.

Similar to excess demand gaps, supply surplus gaps should be reviewed on a case-by-case basis. Supply surpluses are also measured in total supply surplus numbers (volume) and ratios of program completions to occupation demand (supply/demand ratio). For example, an occupation with a demand of 100 and a supply of 350 would indicate a supply surplus of 250 and a ratio of 3.5 because 350% of employer demand is being supplied by Pennsylvania postsecondary institutions.

Category 1: Excess Demand in Pennsylvania's Skilled Occupations

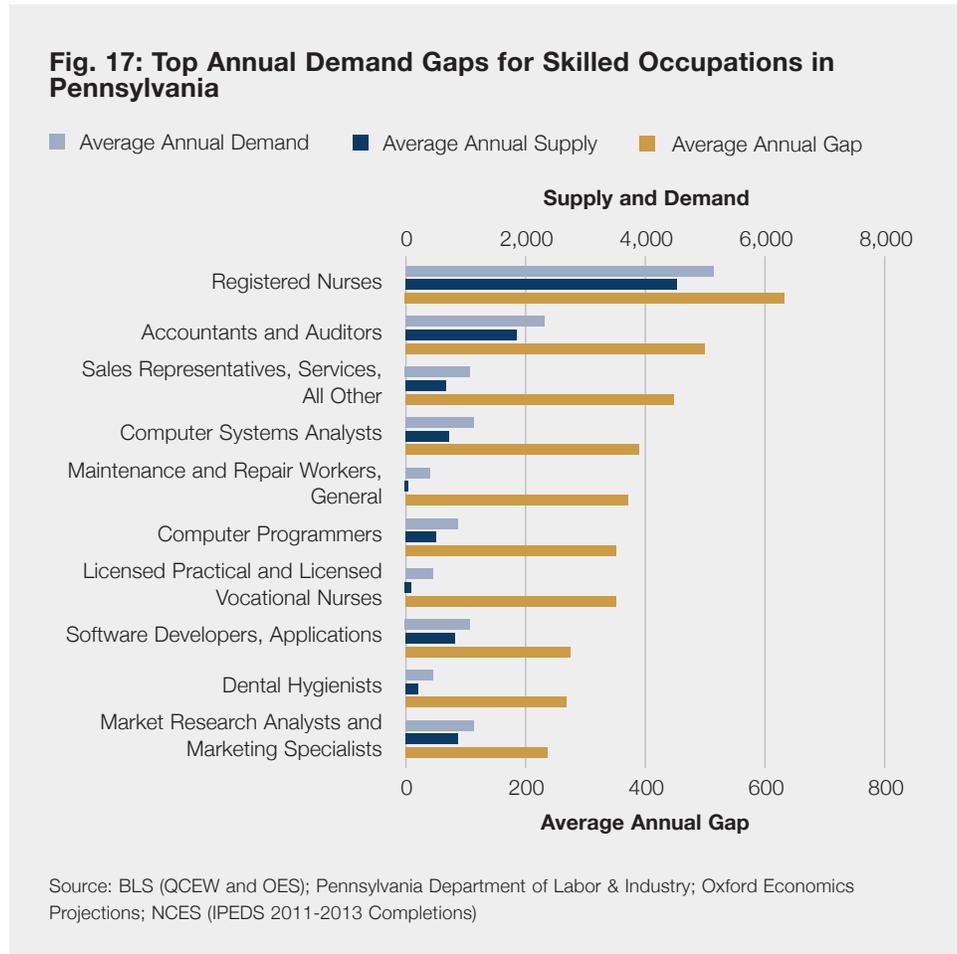
The gap analysis results provide overarching data and information between employer demand and education supply. When considering program expansion or development in degree areas related to occupations displaying excess demand, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.

The findings from that compare employer demand and education supply are presented in two categories highlighting excess employer demand and areas of supply surplus. Along with relevant analysis, for each highlighted occupation, the following information is included:

- Projected employer demand for the occupation,
- Education supply for the occupation, and
- Ratio of supply to demand (S/D Ratio).

Category 1-A: Excess Demand for Skilled Occupations in Pennsylvania

As illustrated by Fig. 17, excess demand gaps are evident in Pennsylvania for skilled occupations such as registered nurses, accountants and auditors, sales representatives for services, computer systems analysts, maintenance and repair workers, and computer programmers.



A notable demand gap exists for registered nurses. The number of projected annual new and replacement job openings for registered nurses is 5,211. The number of annual program completions allocated to satisfy demand is 4,587, leaving an annual demand gap of nearly 625—an excess demand gap ratio of 0.88.

Another interesting demand gap finding is computer systems analysts, where the projected annual demand is approximately 1,130 and the annual program supply allocated to meet that demand is approximately 747, resulting in an annual demand gap of 385. This occupation has a low ratio of supply relative to

demand, with Pennsylvania institutions providing a supply that meets about two thirds (66%) of the statewide demand.

Of the top ten excess demand gaps, four of the occupations align to the key skilled high demand occupations evaluated in Pennsylvania's Workforce Characteristics Report. These key skilled high demand occupations are: registered nurses, accountants and auditors, computer systems analysts and market research analysts & marketing specialists.

Fig. 18 provides more detail about occupation gaps, including annual projected demand, the annual supply of program completions allocated to meet the occupation demand, the demand gap, and the ratio of supply to demand.

Fig. 18: Top 20 Annual Demand Gaps for Skilled Occupations in Pennsylvania with Detailed Information

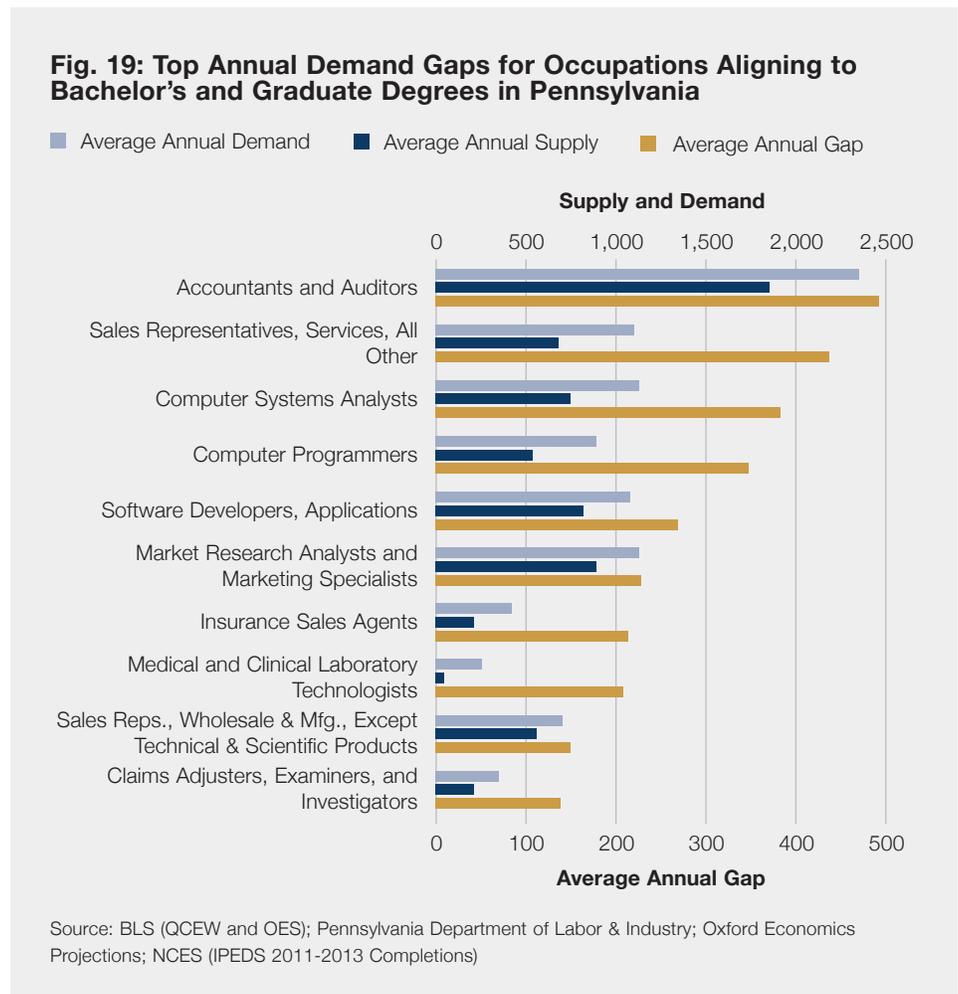
Occupation Title	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Registered Nurses	5,211	4,587	624	0.88
Accountants and Auditors	2,350	1,856	494	0.79
Sales Representatives, Services, All Other	1,110	671	439	0.60
Computer Systems Analysts	1,132	747	385	0.66
Maintenance and Repair Workers, General	392	28	364	0.07
Computer Programmers	891	543	348	0.61
Licensed Practical and Licensed Vocational Nurses	450	104	346	0.23
Software Developers, Applications	1,081	811	270	0.75
Dental Hygienists	455	191	264	0.42
Market Research Analysts and Marketing Specialists	1,127	896	231	0.80
Insurance Sales Agents	431	216	215	0.50
Medical and Clinical Laboratory Technologists	261	52	209	0.20
Hairdressers, Hairstylists, and Cosmetologists	184	29	155	0.16
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	706	557	149	0.79
Industrial Machinery Mechanics	161	18	143	0.11
Claims Adjusters, Examiners, and Investigators	361	220	141	0.61
Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	1,378	1,237	141	0.90
First-Line Supervisors of Mechanics, Installers, and Repairers	274	138	136	0.50
Cost Estimators	324	193	131	0.60
Personal Financial Advisors	494	371	123	0.75

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

While this section focused on occupations with an overall excess demand, the next section has a more narrow focus on the demand for workers with bachelor's degrees or graduate degrees.

Category 1-B: Excess Demand Gaps for Bachelor's and Graduate Degrees in Pennsylvania

This section isolates occupation demand at the bachelor's degree level. As illustrated by Fig. 19, gaps are evident in skilled occupations that align to bachelor's and graduate degrees such as accountants and auditors; computer systems analysts; computer programmers; software developers, applications; market research analysts & marketing specialists; and medical and clinical laboratory technologists. Of the top five excess demand gaps, three occupations are found in computer science/information technology.



The combined excess demand gaps for computer systems analysts, computer programmers and software developers, applications exceed 1,000.

Additional notable demand gaps exist for financial analysts, civil engineers, veterinarians, healthcare social workers and human resource specialists.

Another interesting demand gap finding exists for medical and clinical laboratory technologists, where the projected annual demand exceeds 260 and the annual program supply allocated to meet that demand is less than 60—an annual demand gap exceeding 200. This occupation has a low ratio of supply relative to demand, with Pennsylvania institutions supplying only 20% of the needed program completions to meet projected annual demand.

Fig. 20: Top 20 Annual Bachelor's Demand Gaps for Skilled Occupations in Pennsylvania with Detailed Information

Occupation Title	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Accountants and Auditors	2,350	1,856	494	0.79
Sales Representatives, Services, All Other	1,110	671	439	0.60
Computer Systems Analysts	1,132	747	385	0.66
Computer Programmers	891	543	348	0.61
Software Developers, Applications	1,081	811	270	0.75
Market Research Analysts and Marketing Specialists	1,127	896	231	0.80
Insurance Sales Agents	431	216	215	0.50
Medical and Clinical Laboratory Technologists	261	52	209	0.20
Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	706	557	149	0.79
Claims Adjusters, Examiners, and Investigators	361	220	141	0.61
Cost Estimators	324	193	131	0.60
Personal Financial Advisors	494	371	123	0.75
Compliance Officers	330	218	112	0.66
Financial Analysts	554	455	99	0.82
Securities, Commodities, and Financial Services Sales Agents	350	264	86	0.75
Purchasing Agents, Except Wholesale, Retail, and Farm Products	243	160	83	0.66
Civil Engineers	544	466	78	0.86
Insurance Underwriters	206	132	74	0.64
Veterinarians	191	118	73	0.62
Healthcare Social Workers	368	296	72	0.80

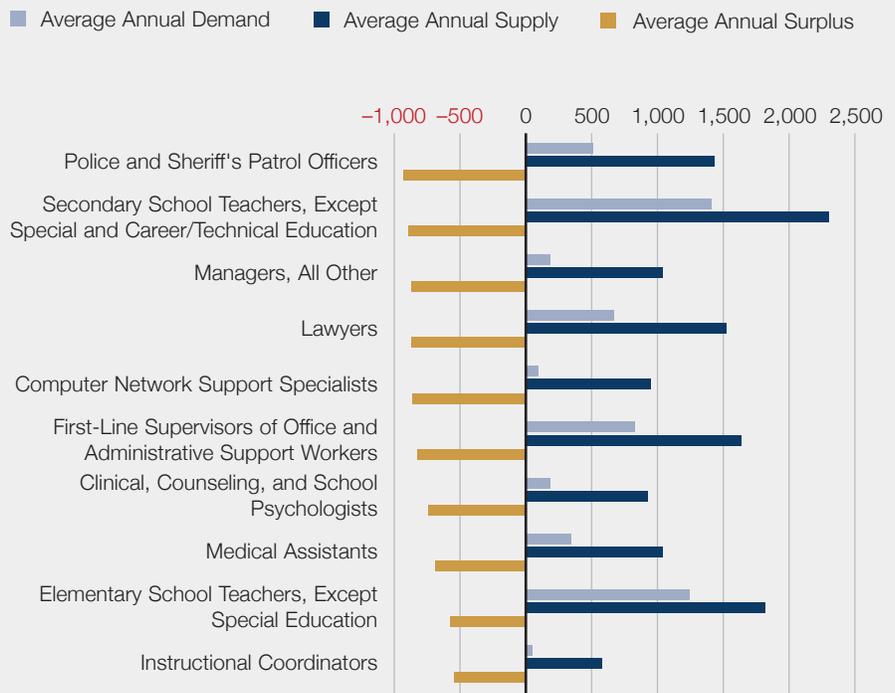
Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Fig. 20 provides more detail about occupation gaps, projected demand (for bachelor's degrees), the supply of bachelor's degrees allocated to meet the occupation demand, the bachelor's demand gap, and the ratio of bachelor supply to bachelor demand (S/D Bachelor Ratio).

Category 2: Supply Surplus in Pennsylvania's Skilled Occupations

Top supply surpluses within Pennsylvania cover a broad range of both technical and non-technical occupations. The gap analysis results provide overarching data and information between employer demand and education supply. When considering program changes in degree areas related to occupations displaying supply surplus, further research should be considered to confirm the extent of alignment needed to arrive at equilibrium with the labor market.

Fig. 21: Top Annual Supply Surpluses for Skilled Occupations in Pennsylvania



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

As illustrated by Fig. 21, supply surpluses are evident in skilled occupations such as police and sheriff's patrol officers; secondary school teachers; managers, all other; lawyers; and computer network support specialists.

A notable supply surplus exists for instructional coordinators. The number of projected annual new and replacement job openings for instructional coordinators is approximately 50. However, the number of relevant annual program completions allocated to satisfy demand amounts to 585, creating a supply surplus of almost 540—a ratio of more than 12 annual program completions per 1 projected annual job opening.

Fig. 22: Top 20 Annual Supply Surpluses for Skilled Occupations in Pennsylvania with Detailed Information

Occupation Title	Average Annual Demand	Average Annual Supply	Average Annual Gap	S/D Ratio
Police and Sheriff's Patrol Officers	501	1,424	-923	2.84
Secondary School Teachers, Except Special and Career/Technical Education	1,412	2,296	-884	1.63
Managers, All Other	174	1,038	-864	5.97
Lawyers	665	1,527	-862	2.30
Computer Network Support Specialists	91	948	-857	10.42
First-Line Supervisors of Office and Administrative Support Workers	819	1,638	-819	2.00
Clinical, Counseling, and School Psychologists	186	921	-735	4.95
Medical Assistants	356	1,036	-680	2.91
Elementary School Teachers, Except Special Education	1,245	1,811	-566	1.45
Instructional Coordinators	48	585	-537	12.19
Postsecondary Teachers, All Other	160	692	-532	4.33
Management Analysts	724	1,250	-526	1.73
Graphic Designers	294	817	-523	2.78
Education Administrators, Elementary and Secondary School	198	704	-506	3.56
Nursing Instructors and Teachers, Postsecondary	55	524	-469	9.53
Middle School Teachers, Except Special and Career/Technical Education	897	1,356	-459	1.51
Librarians	133	579	-446	4.35
Producers and Directors	140	567	-427	4.05
Pharmacists	429	833	-404	1.94
Chefs and Head Cooks	44	437	-393	9.93

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections; NCES (IPEDS 2011-2013 Completions)

Another interesting supply surplus finding exists for computer network support specialists, where the projected annual demand is just over 90 and the annual program supply allocated to meet that demand is almost 950—a supply surplus of approximately 860 and a supply/demand ratio exceeding 10 completions per 1 job opening.

Fig. 22 provides more detail about supply surpluses, including the projected demand (for associate's degrees and higher), the supply of associate's degrees and higher allocated to meet the occupation demand, and the total gap, and the ratio of supply to demand (S/D Ratio). The S/D ratio provides a relative measure of supply surplus.

CONCLUSION

These findings are further described in the Supply/Demand Gap Analysis Technical Report. The report provides a data-driven foundation for program planning and alignment in order to drive economic value and career success within the Commonwealth. The analysis itself is not the solution, but can lend credible insight to guide decision making at the strategic level. The content is designed to be a starting point and resource for program evaluation and planning.

It is important to remember that the results for the gaps are largely driven by industry employment growth. As market conditions change, the resulting demand for skilled workers will also change. Therefore, results of this analysis should be taken into context of changing industry sector employment and occupational demand.

Additionally, areas of future research should be considered when considering program evaluation and planning. These areas include (but are not limited to):

- Strong vs. weak occupation to education alignment
- Wage trend research and supply/demand effects on wages
- Career pathways, outcomes, and lifetime earnings
- Issues of mal-employment¹⁶ and underemployment¹⁷
- Program alignment best practices

As more insights into the connections between education programs and labor market outcomes are gained, students, universities, workers, and employers will all benefit significantly.

16 Mal-employment is a specific type of underemployment that exists in the labor market. This occurs when college-educated workers choose to work in occupations that do not utilize the skills and abilities gained in college. An example of this would include a person who has a bachelor's degree in political science but works as bartender. For more on mal-employment see Harrington and Fogg (2011) "Rising Mal-Employment and the Great Recession: The Growing Disconnection between Recent College Graduates and the College Labor Market."

17 Underemployment occurs in the labor market when workers' skills, experience, and willingness to work are not fully utilized. An example of this would include a person who is employed part-time but wants to work full-time.

ABOUT THE STATE SYSTEM'S GAP ANALYSIS PROJECT

The gap analysis methodology and report was produced through a multi-organization collaboration that consisted of Pennsylvania's State System of Higher Education Office of the Chancellor and Oxford Economics USA Inc. — the team. Throughout the project and research process, the team sought feedback and insight from senior administration and representatives from each of the 14 State System Universities. The team also drew on insight and feedback from subject matter experts involved in labor market intelligence and education program alignment.

The modeling and results presented here are based on information provided by third parties, upon which Oxford Economics has relied in producing its report and forecasts in good faith. Any subsequent revision or update of those data will affect the assessments and projections shown.

Oxford Economics is a key adviser to corporate, financial, government and education decision-makers and thought leaders. Oxford Economics' worldwide client base now comprises over 1000 international organizations, including leading multinational companies and financial institutions; key government bodies and trade associations; and top universities, consultancies, and think tanks.

This report is confidential to stakeholders of Pennsylvania's State System of Higher Education and may not be published or distributed without their prior written permission. Contact information for such request is provided below:

Dr. Sue Mukherjee

Executive Director for Program Alignment and Policy Development

Phone: (717) 720-4201

Email: SMukherjee@passhe.edu

APPENDIX 1: REGIONAL EDUCATION SUPPLY/DEMAND GAP ANALYSIS

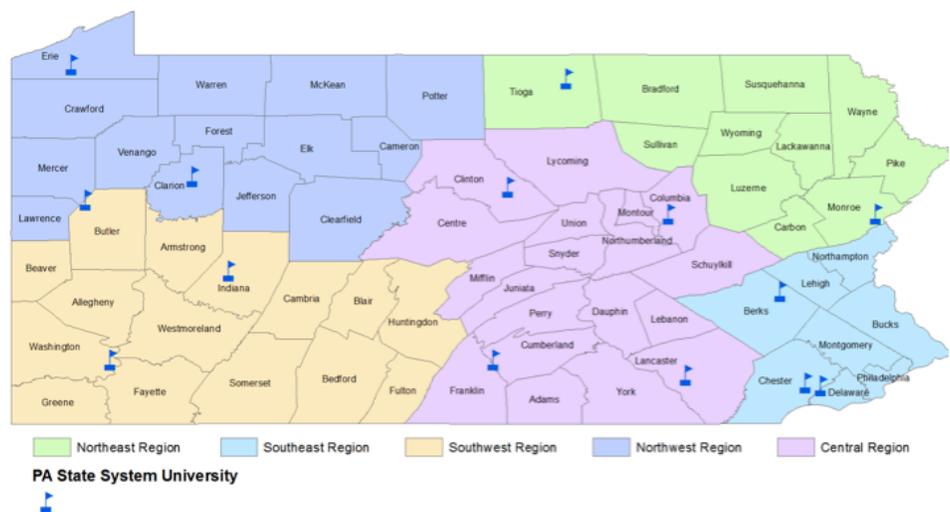
Pennsylvania’s economically diverse geography supports the need for a more regionalized perspective of economic and workforce characteristics. The State System conducted original research to identify five broad sub-regions as well as fourteen university-specific workforce regions. It is important to note that these five regions align with Pennsylvania’s Partnerships for Regional Economic Performance (PREP). The PREP regions are Pennsylvania’s network of businesses as defined by the Department of Community and Economic Development (DCED). Aligning the State System’s five regions to the PREP reflects a broader goal of the State System to connect higher education with economic development in the commonwealth.

The only exception to the PREP region boundary is Schuylkill County, which was put within the Central sub-region. This allocation better balances enrollment between regions, given that learners from Schuylkill were nearly evenly dispersed between the Central, Northeast and Southeast sub-regions.

Fig. A.1 illustrates the geographic areas for the sub-regions as well as the locations of the State System Universities.

For PREP geographic boundaries please see Appendix A in the technical report.

Fig. A.1: Pennsylvania State System Sub-Regions



Source: Oxford Economics mapping

This section provides the findings on the supply-demand gaps for the five sub-regions of Pennsylvania in the following two categories:

- Occupations that demonstrate excess employer demand.
- Occupations that demonstrate supply surplus.

Detailed reports are available for each region.

Highlights of Skilled Job Growth, Demand Gaps and Supply Surpluses

The growth of skilled jobs across Pennsylvania will drive further demand for specific skilled occupations. However, growth of skilled jobs varies across each region. The following sections highlight the growth of skilled jobs (Job Zone 3, 4 and 5) compared to low-skilled jobs (Job Zone 1 and 2).

From the increase in demand for skilled occupations, a number of gaps and surpluses are apparent at the sub-region level. The following appendix also highlights the top demand gaps and top supply surpluses for each region. Each region is presented separately.

SOUTHEAST REGION

Projected Job Growth in Southeast Pennsylvania by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
Southeast Total	2,344,298	2,590,963	10.5%	100%	100%
Job Zones 1-2 (Low Skilled)	1,130,321	1,231,141	8.9%	48%	48%
Job Zones 3-5 (Skilled)	1,213,977	1,359,822	12.0%	52%	52%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; O*NET; Oxford Economics Projections

Demand Gap



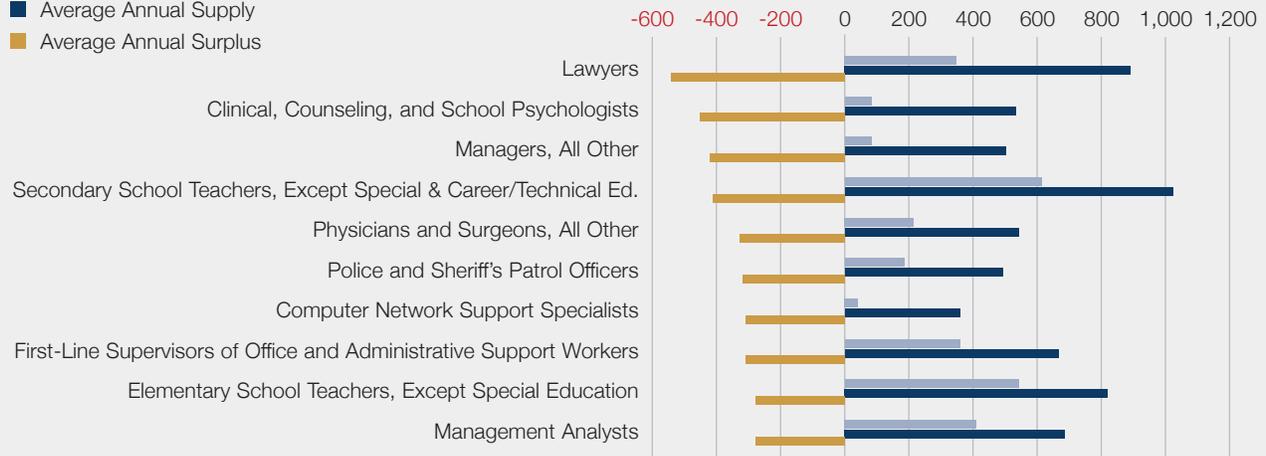
Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
29-1141	Registered Nurses	Health Care and Social Assistance
15-1132	Software Developers, Applications	Professional, Scientific, and Technical Services
15-1121	Computer Systems Analysts	Professional, Scientific, and Technical Services
15-1131	Computer Programmers	Professional, Scientific, and Technical Services
41-3099	Sales Representatives, Services, All Other	Professional, Scientific, and Technical Services
13-2011	Accountants and Auditors	Professional, Scientific, and Technical Services
15-1151	Computer User Support Specialists	Professional, Scientific, and Technical Services
29-2061	Licensed Practical and Licensed Vocational Nurses	Health Care and Social Assistance
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	Educational Services
29-2021	Dental Hygienists	Health Care and Social Assistance

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Supply Surplus

- Average Annual Demand
- Average Annual Supply
- Average Annual Surplus



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
23-1011	Lawyers	Professional, Scientific, and Technical Services
19-3031	Clinical, Counseling, and School Psychologists	Educational Services
11-9199	Managers, All Other	Public Administration
25-2031	Secondary School Teachers, Except Special and Career/Technical Education	Educational Services
29-1069	Physicians and Surgeons, All Other	Health Care and Social Assistance
33-3051	Police and Sheriff's Patrol Officers	Public Administration
15-1152	Computer Network Support Specialists	Professional, Scientific, and Technical Services
43-1011	First-Line Supervisors of Office and Administrative Support Workers	Finance and Insurance
25-2021	Elementary School Teachers, Except Special Education	Educational Services
13-1111	Management Analysts	Professional, Scientific, and Technical Services

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

SOUTHWEST REGION

Projected Job Growth in Southwest Pennsylvania by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
Southwest Total	1,347,867	1,450,485	7.6%	100%	100%
Job Zones 1-2 (Low Skilled)	676,169	712,774	5.4%	50%	49%
Job Zones 3-5 (Skilled)	671,698	737,711	9.8%	50%	51%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; O*NET; Oxford Economics Projections

Demand Gap

- Average Annual Demand
- Average Annual Supply
- Average Annual Gap



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
13-2011	Accountants and Auditors	Professional, Scientific, and Technical Services
13-1161	Market Research Analysts and Marketing Specialists	Professional, Scientific, and Technical Services
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	Educational Services
41-3099	Sales Representatives, Services, All Other	Professional, Scientific, and Technical Services
29-2021	Dental Hygienists	Health Care and Social Assistance
29-1069	Physicians and Surgeons, All Other	Health Care and Social Assistance
13-2051	Financial Analysts	Finance and Insurance
41-3021	Insurance Sales Agents	Finance and Insurance
13-1041	Compliance Officers	Public Administration
17-2051	Civil Engineers	Professional, Scientific, and Technical Services

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Supply Surplus

- Average Annual Demand
- Average Annual Supply
- Average Annual Surplus



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
15-1152	Computer Network Support Specialists	Professional, Scientific, and Technical Services
27-2022	Coaches and Scouts	Educational Services
31-9092	Medical Assistants	Health Care and Social Assistance
25-1072	Nursing Instructors and Teachers, Postsecondary	Educational Services
11-9199	Managers, All Other	Public Administration
33-3051	Police and Sheriff's Patrol Officers	Public Administration
43-1011	First-Line Supervisors of Office and Administrative Support Workers	Finance and Insurance
23-1011	Lawyers	Professional, Scientific, and Technical Services
25-2031	Secondary School Teachers, Except Special and Career/Technical Education	Educational Services
13-1111	Management Analysts	Professional, Scientific, and Technical Services

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

CENTRAL REGION

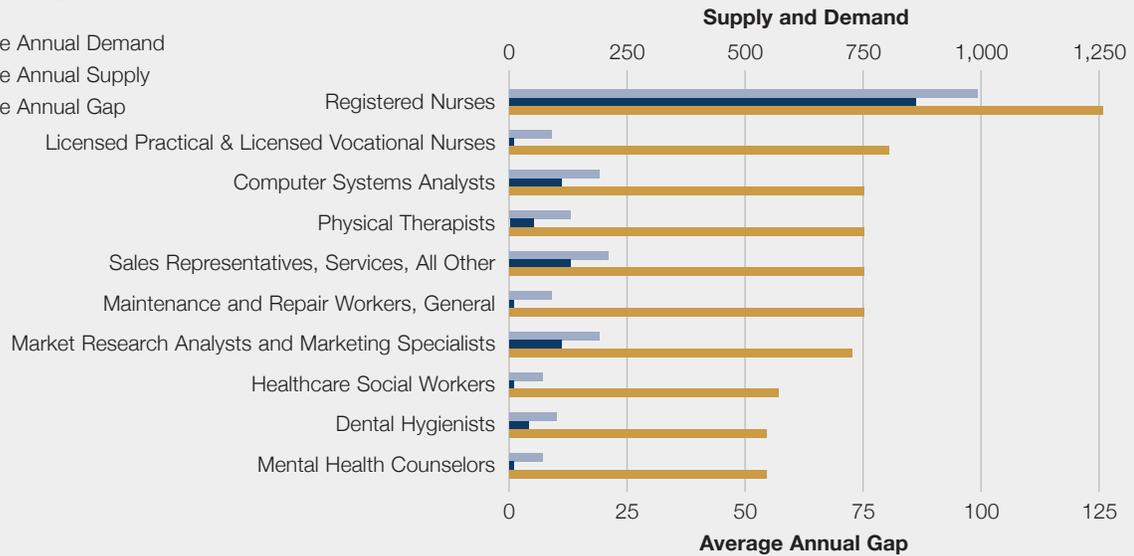
Projected Job Growth in Central Pennsylvania by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
Central Total	1,179,500	1,298,075	10.1%	100%	100%
Job Zones 1-2 (Low Skilled)	640,076	699,894	9.3%	54%	54%
Job Zones 3-5 (Skilled)	539,424	598,181	10.9%	46%	46%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; O*NET; Oxford Economics Projections

Demand Gap

- Average Annual Demand
- Average Annual Supply
- Average Annual Gap



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
29-1141	Registered Nurses	Health Care and Social Assistance
29-2061	Licensed Practical and Licensed Vocational Nurses	Health Care and Social Assistance
15-1121	Computer Systems Analysts	Professional, Scientific, and Technical Services
29-1123	Physical Therapists	Health Care and Social Assistance
41-3099	Sales Representatives, Services, All Other	Professional, Scientific, and Technical Services
49-9071	Maintenance and Repair Workers, General	Real Estate and Rental and Leasing
13-1161	Market Research Analysts and Marketing Specialists	Professional, Scientific, and Technical Services
21-1022	Healthcare Social Workers	Health Care and Social Assistance
29-2021	Dental Hygienists	Health Care and Social Assistance
21-1014	Mental Health Counselors	Health Care and Social Assistance

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Supply Surplus

- Average Annual Demand
- Average Annual Supply
- Average Annual Surplus



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
31-9092	Medical Assistants	Health Care and Social Assistance
33-3051	Police and Sheriff's Patrol Officers	Public Administration
25-9031	Instructional Coordinators	Educational Services
43-1011	First-Line Supervisors of Office and Administrative Support Workers	Finance and Insurance
15-1152	Computer Network Support Specialists	Professional, Scientific, and Technical Services
23-1011	Lawyers	Professional, Scientific, and Technical Services
11-9199	Managers, All Other	Public Administration
23-2011	Paralegals and Legal Assistants	Professional, Scientific, and Technical Services
27-3031	Public Relations Specialists	Professional, Scientific, and Technical Services
35-1011	Chefs and Head Cooks	Accommodation and Food Services

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

NORTHEAST REGION

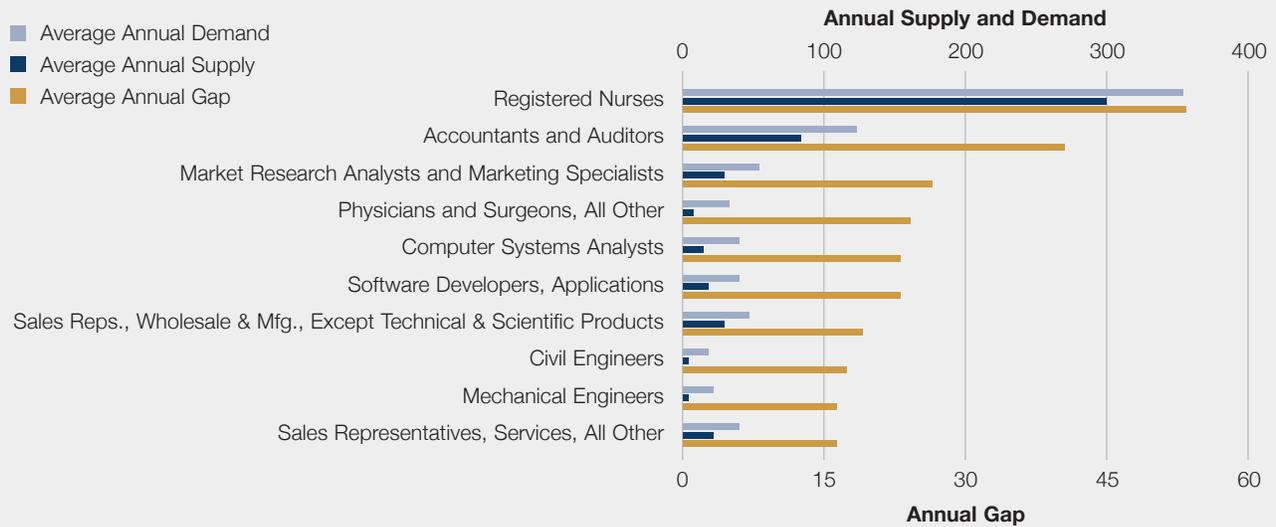
Projected Job Growth in Northeast Pennsylvania by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
Northeast Total	399,586	439,344	9.9%	100%	100%
Job Zones 1-2 (Low Skilled)	219,288	239,471	9.2%	55%	55%
Job Zones 3-5 (Skilled)	180,298	199,873	10.9%	45%	45%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; O*NET; Oxford Economics Projections

Demand Gap

- Average Annual Demand
- Average Annual Supply
- Average Annual Gap



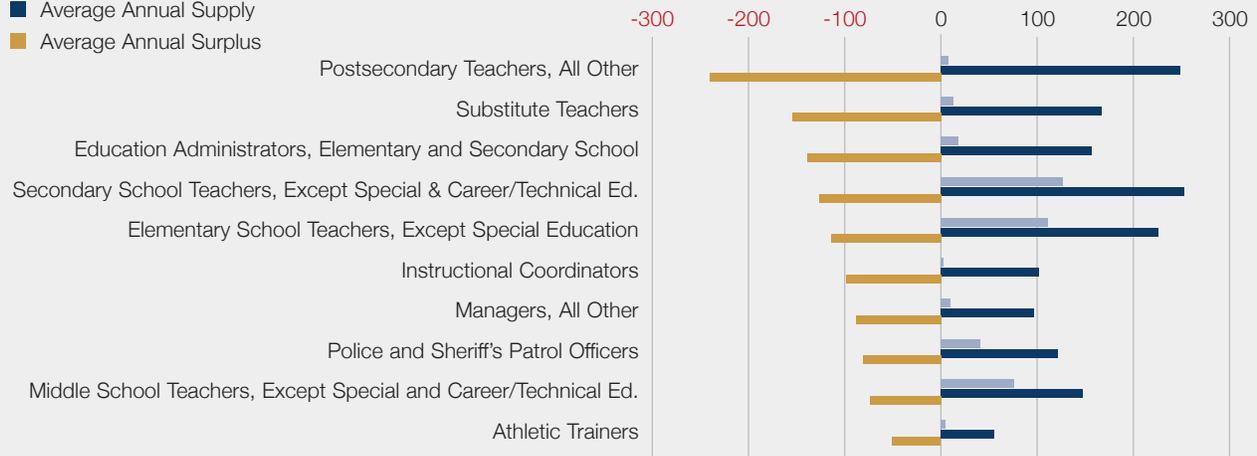
Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
29-1141	Registered Nurses	Health Care and Social Assistance
13-2011	Accountants and Auditors	Professional, Scientific, and Technical Services
13-1161	Market Research Analysts and Marketing Specialists	Professional, Scientific, and Technical Services
29-1069	Physicians and Surgeons, All Other	Health Care and Social Assistance
15-1121	Computer Systems Analysts	Professional, Scientific, and Technical Services
15-1132	Software Developers, Applications	Professional, Scientific, and Technical Services
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	Wholesale Trade
17-2051	Civil Engineers	Professional, Scientific, and Technical Services
17-2141	Mechanical Engineers	Manufacturing
41-3099	Sales Representatives, Services, All Other	Professional, Scientific, and Technical Services

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Supply Surplus

- Average Annual Demand
- Average Annual Supply
- Average Annual Surplus



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
25-1199	Postsecondary Teachers, All Other	Educational Services
25-3098	Substitute Teachers	Educational Services
11-9032	Education Administrators, Elementary and Secondary School	Educational Services
25-2031	Secondary School Teachers, Except Special and Career/Technical Education	Educational Services
25-2021	Elementary School Teachers, Except Special Education	Educational Services
25-9031	Instructional Coordinators	Educational Services
11-9199	Managers, All Other	Public Administration
33-3051	Police and Sheriff's Patrol Officers	Public Administration
25-2022	Middle School Teachers, Except Special and Career/Technical Education	Educational Services
29-9091	Athletic Trainers	Health Care and Social Assistance

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

NORTHWEST REGION

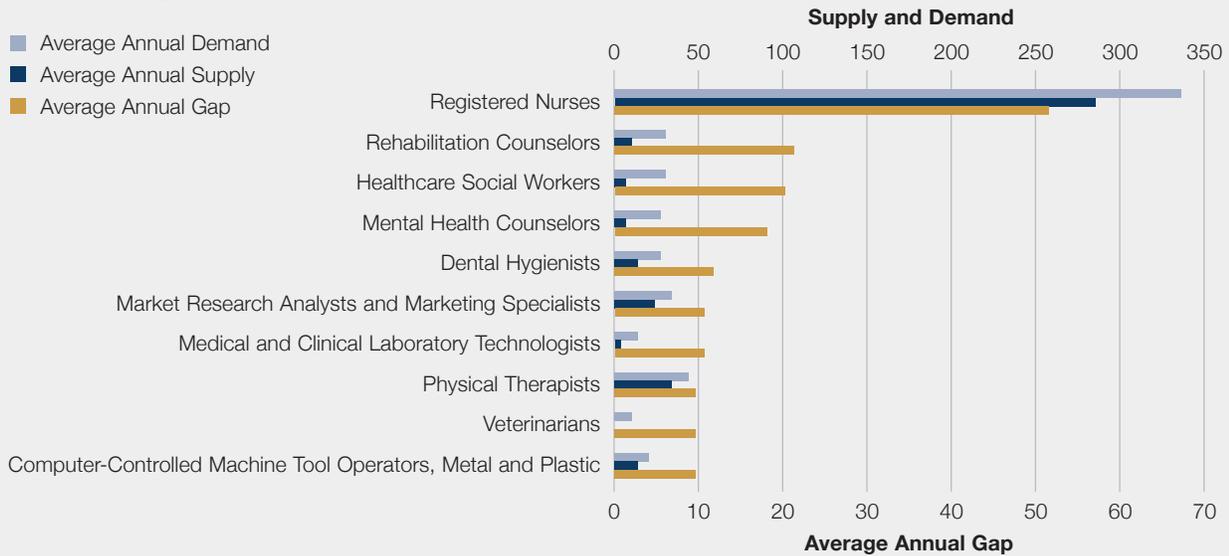
Projected Job Growth in Northwest Pennsylvania by Job Zone, 2014-2024

	2014	2024	% Change 2014-2024	Share 2014	Share 2024
Northwest Total	372,427	401,023	7.7%	100%	100%
Job Zones 1-2 (Low Skilled)	201,135	216,115	7.4%	54%	54%
Job Zones 3-5 (Skilled)	171,292	184,908	7.9%	46%	46%

Source: BLS (QCEW); Pennsylvania Department of Labor & Industry; O*NET; Oxford Economics Projections

Demand Gap

- Average Annual Demand
- Average Annual Supply
- Average Annual Gap



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
29-1141	Registered Nurses	Health Care and Social Assistance
21-1015	Rehabilitation Counselors	Health Care and Social Assistance
21-1022	Healthcare Social Workers	Health Care and Social Assistance
21-1014	Mental Health Counselors	Health Care and Social Assistance
29-2021	Dental Hygienists	Health Care and Social Assistance
13-1161	Market Research Analysts and Marketing Specialists	Professional, Scientific, and Technical Services
29-2011	Medical and Clinical Laboratory Technologists	Health Care and Social Assistance
29-1123	Physical Therapists	Health Care and Social Assistance
29-1131	Veterinarians	Professional, Scientific, and Technical Services
51-4011	Computer-Controlled Machine Tool Operators, Metal and Plastic	Manufacturing

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Supply Surplus

- Average Annual Demand
- Average Annual Supply
- Average Annual Surplus



Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections

Occupation Code	Occupation Title	Top Employing Industry in Pennsylvania
29-1069	Physicians and Surgeons, All Other	Health Care and Social Assistance
25-4021	Librarians	Educational Services
29-1051	Pharmacists	Retail Trade
11-9199	Managers, All Other	Public Administration
29-1062	Family and General Practitioners	Health Care and Social Assistance
25-2031	Secondary School Teachers, Except Special and Career/Technical Education	Educational Services
47-2111	Electricians	Construction
33-3051	Police and Sheriff's Patrol Officers	Public Administration
25-2021	Elementary School Teachers, Except Special Education	Educational Services
43-1011	First-Line Supervisors of Office and Administrative Support Workers	Finance and Insurance

Source: BLS (QCEW and OES); Pennsylvania Department of Labor & Industry; Oxford Economics Projections