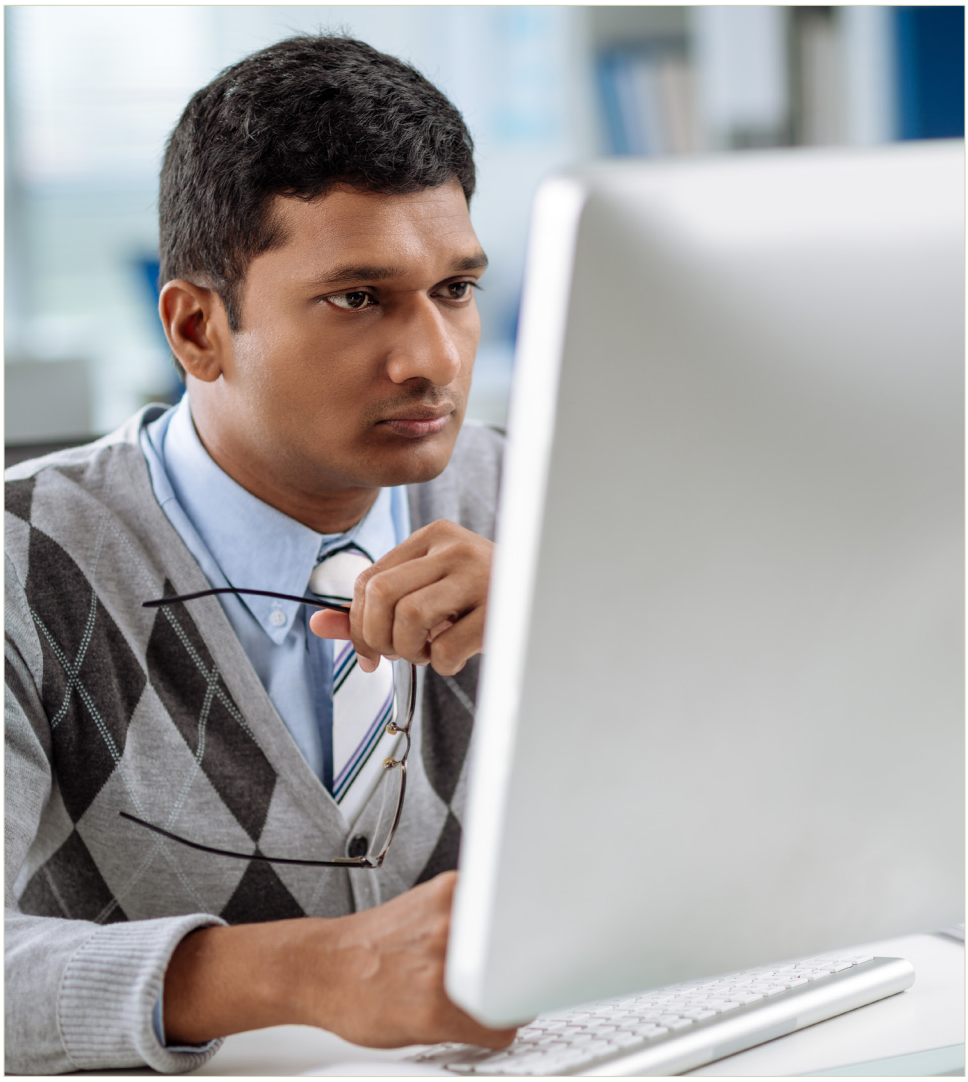
2016 EMPLOYMENT PROJECTIONS

Industries
Occupations
Growth Rates
Job Openings
Skill Projections
Occupations in Demand



Employment Security Department
WASHINGTON STATE

Labor Market and Performance Analysis

August 2016

2016 Employment Projections

Published August 2016

Washington State Employment Security Department
Dale Peinecke, *Commissioner*

Labor Market and Performance Analysis
Cynthia Forland, Ph.D., *Director*

Prepared by

Alex Roubinchtein, *Projections and Statistical Analysis Manager*
Bruce Nimmo, *Economic Analyst*

This workforce product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the recipient and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

For more information or to get this report in an alternative format, call the Employment Security Department Labor Market Information Center at 360-407-4541.

Contents

About the employment, industry and occupational projections 1
- Data sets used to develop projections 1
- Use of employment projections 2

Executive summary 3
- Key findings 3
  - Industry projections 3
  - Occupational projections 3

2016 industry projections results 5
- Historical and projected growth rates 6

2016 occupational projections results 9
- Major occupational groups 9
- Separations, replacement and growth openings 11
- Specific occupations 14

Appendices 17
- Appendix 1. Use and misuse of employment projections 17
- Appendix 2. Occupations in demand (OID) 19
- Appendix 3. Skill projections 23
- Appendix 4. Frequently asked questions 31
- Appendix 5. Glossary of terms 33

About the employment, industry and occupational projections

Employment projections provide a general outlook for industry and occupational employment in Washington state. They provide job seekers, policy makers and training providers an idea of how much an industry or occupation is projected to change over time and show the future demand for workers.

On an annual basis, the Employment Security Department produces industry employment projections for two, five and 10 years from a base period. The base period for the two-year (short-term) projections is second quarter 2015. The base period for the five-year (medium-term) and 10-year (long-term) projections is 2014.

Staffing patterns for each industry are used to convert industry projections into occupational projections.

Industry classifications are based on the North American Industry Classification System (NAICS). However, they have been modified to match the industry definitions used by the U.S. Bureau of Labor Statistics' (BLS) Occupational Employment Statistics (OES) program. These modified industry definitions are called Industry Control Totals (ICTs). The Standard Occupational Classification (SOC) system is used to group occupations. *Appendix 4* contains frequently asked questions relating to projections. *Appendix 5* provides a glossary of terms.

Data sets used to develop projections

The following data sets are used to produce projections:

1. Historical employment time series, in this case the U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW).
2. Employment not covered by the unemployment insurance system from the U.S. Bureau of Labor Statistics' Current Employment Statistics (CES) program.
3. Occupational employment by industries (staffing patterns) based on the OES survey.
4. National data for self-employed ratios, change factors, etc.
5. Independent variables (predictive indicators), which help to project the future direction of the economy, from IHS Global Insight's national forecast.

Use of employment projections

Employment projections are intended for career development over time, not as the basis for budget or revenue projections, or for immediate corrective actions within the labor market.

Employment projections are the basis of the Occupations in Demand (OID) list covering Washington's 12 workforce development areas (WDAs) and the state as a whole. This list is used to determine eligibility for a variety of training and support programs, but was created to support the unemployment insurance Training Benefits Program. *Appendix 2* contains a technical description of the OID list.

The full OID list is accessible through the "Learn about an occupation" tool located at: **https://fortress.wa.gov/esd/employmentdata/reports-publications/occupational-reports/occupations-in-demand**.

Executive summary

This report highlights findings on specific aspects of Washington's employment outlook. In the first section, industry projections results, we describe changes in employment by industry from 2014 through 2024. In the next section, occupational projections results, we look at:

- Major occupational groups
- Specific occupations

Detailed information on the projected demand for industry and occupational employment is available in the Employment Projections data files at: **https://esd.wa.gov/labormarketinfo/projections**.

In addition, detailed skill projections information is available in *Appendix 3* of this report.

The formal description of industry and occupational projection processes is presented in the *Employment Projections Technical Report*.

Key findings

The 10-year average annual growth rate for total nonfarm employment for the 2014 through 2024 period is projected to be 1.55 percent. This is a decrease from the 1.79 percent average annual growth rate predicted last year for 2013 through 2023.[1]

Industry projections

- The largest increase by share of employment is projected for the professional and business services sector.
- The largest decreases by shares of employment are projected for manufacturing and government sectors.

Occupational projections

Major occupational groups

- The largest increases by shares of employment are projected for the computer and mathematical occupations.
- The largest decreases by shares of employment are projected for the production and office and administrative support occupations.

[1] See: "2015 Employment Projections," Washington State Employment Security Department, Labor Market and Performance Analysis, *Figure 2*, page 6. Also, please note that all tables contain values that are calculated and then rounded. As a result, details might not always add up to totals.

- The largest employment shares in 2024 are projected for the office and administrative support occupations, sales and related occupations and food preparation and serving-related occupations. However, the first two occupational groups are projected to have declining employment shares.

Specific occupations

This year two sets of projections results were created; a *separations* result and a *replacement* result. At the six-digit SOC level, total of average separations openings were approximately 4.67 times larger than total of average replacement openings. This is due to differences in how the separation and replacement methodologies treat workers who permanently exit the labor force. The separations (alternative.xlsx) and replacement (all-occupaitonal-projections.xlsx) results are available in the Occupational Projections data files: **https://esd.wa.gov/labormarketinfo/projections**.

The number of openings due to job growth did not exceed openings due to *separations* in any of the top 20 occupations. Four occupations had job growth that exceeded openings due to *replacement* needs: software developers, applications; janitors and cleaners, except maids and housekeeping cleaners; landscaping and groundskeeping workers; and personal care aides. The office and administrative support occupations are projected to have the largest number of average annual total openings irrespective of which method is applied.

2016 industry projections results

Figure 1 presents 2014 estimated employment, 2014 and 2024 employment shares, and changes in employment shares from 2014 through 2024 by industry for Washington state and the nation.

Through 2024, the three industry sectors with the largest increases in employment shares in Washington state are projected to be professional and business services, health services and social assistance and information.

For this same time period, the two industry sectors with the largest decreases in employment shares are projected to be manufacturing and state and local government (including education).

The changes in employment shares for the state and the nation are generally close. The two sectors with the largest increases in shares are identical for the state and the nation, but in different order. For the state, professional and business services has the largest increase, while for the nation it is the health services and social assistance sector. The third largest increase for the state is the information sector, while for the nation it is construction.

The largest decrease in shares for the state and nation are in the manufacturing sector. The second and third largest decreases for the state are in the state and local government and financial activities sectors. The second and third largest decreases for the nation are in the federal government and state and local government sectors.

Figure 1. Base and projected nonfarm industry employment
United States and Washington state, 2014 and 2024
Source: Employment Security Department/LMPA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

Industry sector[1]	WA state est. empl. 2014	WA state est. empl. shares 2014	WA state proj. empl. shares 2024	WA state percentage point change in empl. shares 2014-2024	National estimated empl. shares 2014	National projected empl. shares 2024	National percentage point change in empl. shares 2014-2024
Natural resources and mining[2]	2,300	0.07%	0.07%	0.00%	0.60%	0.62%	0.02%
Construction	160,400	5.22%	5.35%	0.13%	4.39%	4.65%	0.26%
Manufacturing	288,400	9.39%	8.11%	-1.28%	8.72%	7.63%	-1.09%
Wholesale trade	130,400	4.24%	4.23%	-0.01%	4.17%	4.12%	-0.05%
Retail trade	342,700	11.15%	11.01%	-0.14%	10.99%	10.82%	-0.17%
Utilities	4,800	0.16%	0.14%	-0.02%	0.40%	0.34%	-0.06%
Transportation and warehousing	92,700	3.02%	2.96%	-0.06%	3.32%	3.20%	-0.12%
Information	109,400	3.56%	3.87%	0.31%	1.96%	1.82%	-0.14%
Financial activities	152,900	4.98%	4.48%	-0.50%	5.71%	5.69%	-0.02%
Professional and business services	374,100	12.18%	13.79%	1.16%	13.66%	14.07%	0.41%
Education services	54,300	1.77%	1.91%	0.14%	2.44%	2.52%	0.08%
Health services and social assist.	397,400	12.93%	13.49%	0.56%	12.92%	14.65%	1.73%
Leisure and hospitality	298,000	9.70%	9.93%	0.23%	10.52%	10.49%	-0.03%
Other services	113,900	3.71%	3.62%	-0.09%	4.57%	4.47%	-0.10%
Federal government	71,300	2.32%	2.00%	-0.32%	1.95%	1.57%	-0.38%
State and local gov. (incl. educ.)	479,500	15.61%	15.05%	-0.56%	13.69%	13.34%	-0.35%

[1]The sectors presented in the table are based on CES definitions.

[2]Logging is not included in natural resources and mining to match national data.

The largest growth sectors for the state are projected for professional and business services, health services and social assistance, and information.

Historical and projected growth rates

Figure 2 shows the historical and projected growth rates for the state and Washington's 12 workforce development areas (WDAs).

The largest positive difference between historical growth rates and projected growth rates is in the Olympic Consortium WDA. For this area, the difference between the historical and projected rates is 0.97 percent. The Eastern Washington WDA came in second with a difference of 0.78 percent. Projected growth is less than the previous 10 years in the Snohomish County and Benton-Franklin WDAs.

Figure 2. Historical and projected total nonfarm employment growth
Washington state and workforce development areas, 1990 through 2024
Source: Employment Security Department/LMPA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

Workforce development area[1]	Historical growth[2] rate 2004-2014	Projected growth rate 2014-2024	Historical trend[3] growth 1990-2014
Statewide	**1.33%**	**1.55%**	**1.37%**
Olympic Consortium	0.27%	1.24%	1.13%
Pacific Mountain	0.76%	1.41%	1.26%
Northwest	0.96%	1.44%	1.79%
Snohomish County	2.55%	1.17%	2.05%
Seattle-King County	1.36%	1.68%	1.13%
Pierce County	1.29%	1.53%	1.65%
Southwest Washington	1.39%	1.77%	1.69%
North Central	1.33%	1.41%	1.29%
South Central	0.77%	1.41%	0.80%
Eastern Washington	0.63%	1.41%	0.97%
Benton-Franklin	2.04%	1.62%	2.17%
Spokane	0.83%	1.51%	1.26%

[1]Workforce development areas are regions within Washington state with economic and geographic similarities.
[2]Historical growth is based only on covered employment.
[3]Historical trend growth is defined as the growth rate of the linear trend line.

Projected growth is less than the previous 10 years' growth in the Snohomish County and Benton-Franklin WDAs.

2016 occupational projections results

The detailed state level occupational projections cover 815 occupations, 805 of which are publishable. This publication, however, provides only a summary of the top occupations. For a complete list of occupations and projected employment, see the 2016 Employment Projections data files available at: **https://esd.wa.gov/labormarketinfo/projections**.

Major occupational groups

Figure 3 shows occupational employment estimates and employment shares for Washington state.

At the state level, one occupational group stands out, with increases in employment shares from 2014 through 2024. Computer and mathematical occupations are projected to increase employment shares by 0.57 percentage points. The next highest increase in shares is projected for building and grounds cleaning and maintenance occupations with an increase of 0.26 percentage points.

The largest decreases in employment shares at the state level are in production occupations, with a projected decrease of 0.48 percentage points, and in office and administrative support occupations, with a projected decrease of 0.33 percentage points.

At the national level the largest increases in employment shares are in healthcare practitioners and technical, 0.51 percentage points, and healthcare support, 0.44 percentage points. The nation's largest decreases are in office and administrative support, 0.63 percentage points, and production, 0.55 percentage points.

By 2024, the top three state occupational groups for shares of employment are projected to be:

1. Office and administrative support occupations (12.26 percent)
2. Sales and related occupations (9.82 percent)
3. Food preparation and serving related occupations (7.82 percent)

By 2024 combined, these three major groups are projected to represent nearly 30 percent of total employment shares for the state.

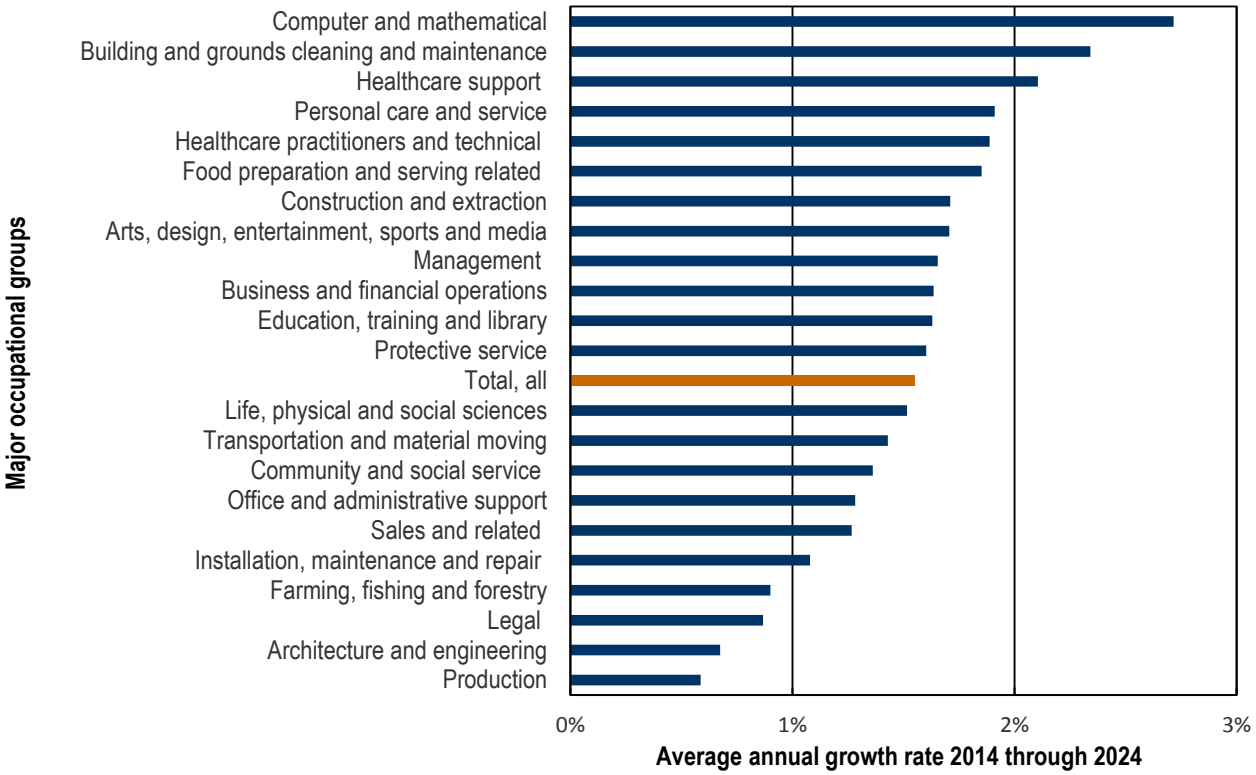
Figure 3. Estimated and projected occupational employment
Washington state, 2014 through 2024
Source: Employment Security Department/LMPA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics

2-digit SOC	Major occupational group	WA state est. empl. 2014	WA state est. empl. shares 2014	WA state proj. empl. shares 2024	Nat'l est. empl. shares 2014	Nat'l proj. empl. shares 2024	WA state percentage point change in empl. shares 2014 -2024	Nat'l percentage point change in empl. shares 2014 -2024
11-0000	Management	189,887	5.42%	5.48%	6.08%	6.03%	0.06%	-0.06%
13-0000	Business and financial operations	204,536	5.84%	5.89%	5.03%	5.11%	0.05%	0.09%
15-0000	Computer and mathematical	163,875	4.68%	5.24%	2.70%	2.87%	0.57%	0.17%
17-0000	Architecture and engineering	85,364	2.44%	2.23%	1.68%	1.62%	-0.20%	-0.06%
19-0000	Life, physical and social sciences	37,122	1.06%	1.06%	0.87%	0.88%	0.00%	0.01%
21-0000	Community and social services	59,769	1.71%	1.67%	1.64%	1.70%	-0.03%	0.06%
23-0000	Legal	28,568	0.82%	0.76%	0.84%	0.83%	-0.05%	-0.01%
25-0000	Education, training and library	205,610	5.87%	5.92%	6.12%	6.18%	0.05%	0.06%
27-0000	Arts, design, entertain., sports and media	74,290	2.12%	2.15%	1.74%	1.70%	0.03%	-0.04%
29-0000	Healthcare practitioners and tech.	160,508	4.58%	4.74%	5.47%	5.98%	0.15%	0.51%
31-0000	Healthcare support	87,675	2.50%	2.64%	2.82%	3.25%	0.14%	0.44%
33-0000	Protective service	63,295	1.81%	1.82%	2.29%	2.24%	0.01%	-0.04%
35-0000	Food prep. and serving related	266,079	7.60%	7.82%	8.28%	8.28%	0.23%	0.00%
37-0000	Bldg. and grounds cleaning and maint.	113,923	3.25%	3.51%	3.73%	3.72%	0.26%	-0.01%
39-0000	Personal care and service	151,535	4.33%	4.48%	3.99%	4.24%	0.16%	0.25%
41-0000	Sales and related	353,880	10.10%	9.82%	10.25%	10.10%	-0.28%	-0.14%
43-0000	Office and administrative support	441,080	12.59%	12.26%	15.12%	14.49%	-0.33%	-0.63%
45-0000	Farming, fishing and forestry	90,587	2.59%	2.43%	0.65%	0.57%	-0.16%	-0.08%
47-0000	Construction and extraction	186,865	5.33%	5.42%	4.32%	4.47%	0.08%	0.15%
49-0000	Installation, maintenance and repair	128,093	3.66%	3.49%	3.77%	3.77%	-0.17%	0.00%
51-0000	Production	185,402	5.29%	4.81%	6.13%	5.58%	-0.48%	-0.55%
53-0000	Transportation and material moving	225,266	6.43%	6.35%	6.48%	6.37%	-0.08%	-0.10%

Over the 2014-through-2024 period, the largest increases in employment shares are expected for computer and building maintenance occupations.

The projected average annual growth rates for the major occupational groups in Washington state are presented in *Figure 4*. Computer and mathematical occupations (2.72 percent), building and grounds cleaning and maintenance occupations (2.34 percent) and healthcare support occupations (2.10 percent) are projected to grow faster than other occupational groups from 2014 through 2024. In the long term, four occupational groups are projected to fall below a 1 percent average annual growth rate: production (0.59 percent), architecture and engineering (0.67 percent), legal (0.87 percent) and farming, fishing and forestry (0.90 percent).

Figure 4. Projected average annual growth rates for major occupational groups
Washington state, 2014 through 2024
Source: Employment Security Department/LMPA ; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics



Computer and mathematical, building and grounds cleaning and maintenance, and healthcare support occupations are projected to experience the largest growth rates through 2024 (2.72, 2.34 and 2.10 percent, respectively).

Separations, replacement and growth openings

The Bureau of Labor Statistics (BLS) concluded that the current replacement methodology undercounts occupational openings. As a result, they created a new separations methodology. BLS created replacement and separation results for the 2012 to 2022 and 2014 to 2024 projections. They will not completely omit the replacement methodology until the 2016 to 2026 projections. This gives states time to convert their projections software over to the separations methodology.

More detailed information about the separation and replacement approaches can be found at: http://www.bls.gov/emp/ep_separations_methods.htm and http://www.bls.gov/emp/ep_replacements.htm, respectively.

The separations and replacement methods measure workers who leave their occupation and need to be replaced by new entrants into the occupation. The separations method is different in how it estimates workers who leave permanently from the replacement methodology used in previous years.

In the replacement methodology, workers who leave an occupation and are replaced by workers from different age cohorts are considered to have permanently left and are identified as generating replacement openings. Workers replaced by workers from the same age cohort are not identified as generating replacement openings. The inability to track openings generated by replacement workers of the same age cohort causes a significant undercount of openings.

In the separations methodology, workers who exit the labor force for at least four consecutive months or transfer to an occupation with a different Standard Occupational Classification (SOC) are identified as generating separations openings.

On average, for all occupations, separations openings are approximately 4.67 times greater than replacement openings at the detailed occupational level (six-digit SOC). Also, the total number of average annual openings for all occupations due to separations is more than seven times greater than the number of openings due to growth. Average total replacement openings are 1.5 times greater than growth openings.

In addition to tracking more openings, the separations methodology has the notable effect of reversing a projections trend for average annual total openings. At the state level, under the replacement methodology, the first five years (2014-2019) of average annual total openings are higher (151,433) than the second five years (2019-2024) of openings (140,091). This has been a typical replacement rate trend over time. Under the separations methodology, though, the reverse is true. The first five years (2014-2019) of average annual openings are lower (459,933) than the second five years (2019-2024) of openings (473,732).

Using either the separations or replacement methodology, average annual openings due to growth are calculated by subtracting base year values from projected year values and then dividing by the number of years used for the calculation period.

Comparison of replacement and separations methodologies

Figure 5 presents a comparison between the separations and replacement methodologies. Average annual total openings are compared at the two-digit SOC level. On average, separation openings are three times larger than replacement openings.

Figure 5. Comparison of replacement and separations methodologies on total openings
Washington state, 2014 through 2024
Source: Employment Security Department/LMPA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages

2-digit SOC title	Estimated employment 2014	Estimated employment shares 2024	Replacement average annual total openings 2014-2024	Separations average annual total openings 2014-2024	Ratio separations to replacement
Architecture and engineering	85,364	91,298	2,780	6,404	2.30
Arts, design, entertainment, sports and media	74,290	87,983	3,394	9,638	2.84
Building and grounds cleaning and maintenance	113,923	143,581	5,546	18,989	3.42
Business and financial operations	204,536	240,557	7,978	22,490	2.82
Community and social service	59,769	68,422	2,250	7,403	3.29
Computer and mathematical	163,875	214,228	7,902	16,801	2.13
Construction and extraction	186,865	221,380	6,562	23,225	3.54
Education, training and library	205,610	241,676	8,438	23,567	2.79
Farming, fishing and forestry	90,587	99,084	3,352	15,196	4.53
Food preparation and serving related	266,079	319,624	16,147	56,155	3.48
Healthcare practitioners and technical	160,508	193,511	7,139	12,164	1.70
Healthcare support	87,675	107,976	4,056	13,123	3.24
Installation, maintenance and repair	128,093	142,602	4,623	13,835	2.99
Legal	28,568	31,143	769	1,875	2.44
Life, physical and social science	37,122	43,149	1,755	4,279	2.44
Management	189,887	223,721	8,069	18,778	2.33
Office and administrative support	441,080	500,972	15,686	57,508	3.67
Personal care and service	151,535	183,111	6,401	27,062	4.23
Production	185,402	196,545	5,473	22,475	4.11
Protective service	63,295	74,199	2,699	8,428	3.12
Sales and related	353,880	401,303	15,362	54,664	3.56
Transportation and material moving	225,266	259,617	9,386	32,777	3.49

On average, separation openings are three times larger than replacement openings.

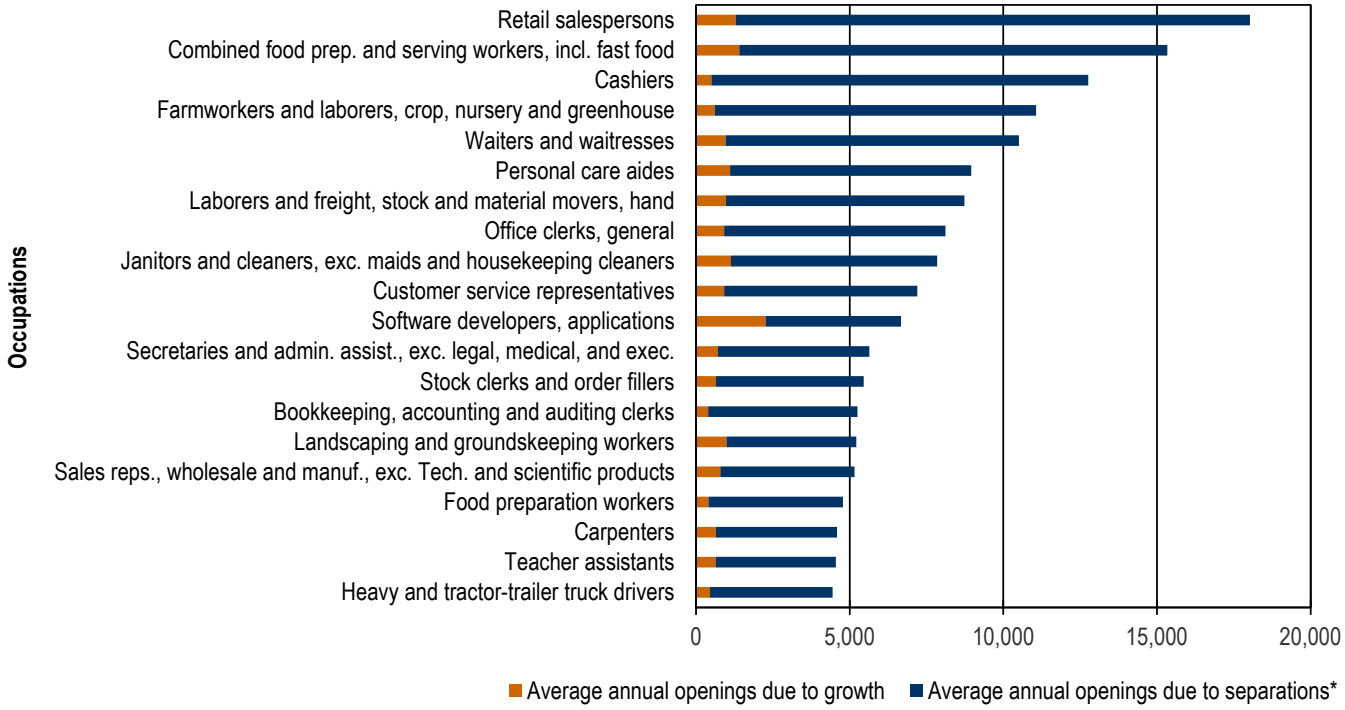
Specific occupations

Figure 6 shows the top 20 specific occupations by total openings based on the BLS separations methodology. *Figure 7* shows the top 20 specific occupations by total openings based on the BLS replacement methodology.

The number of openings due to job growth did not exceed openings due to separations in any of top 20 occupations. Four occupations had job growth that exceeded openings due to replacement needs; software developers, applications; janitors and cleaners, except maids and housekeeping cleaners; landscaping and groundskeeping workers; and personal care aides.

For both methodologies, the retail salespersons occupation is projected to have the largest number of total openings. Fifteen of the top 20 specific occupations are the same in both methods.

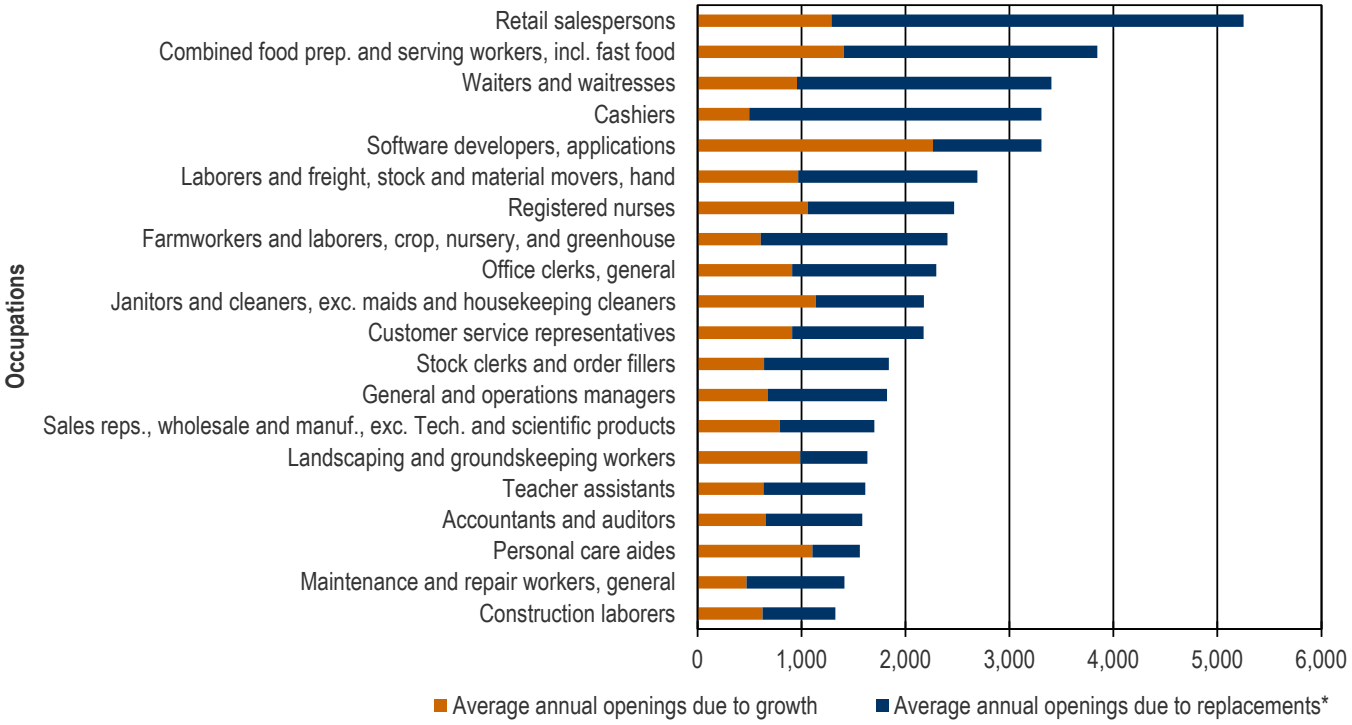
Figure 6. Top 20 specific occupations by average annual total openings, separations methodology
Washington state, 2014 through 2024
Source: Employment Security Department/LMPA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics



*The separations rate methodology tracks when workers leave occupations entirely and when workers leave the labor force entirely.

In the new separations methodology, the number of openings due to job growth did not exceed openings due to separations in any occupations.

Figure 7. Top 20 specific occupations by average annual total openings, replacement methodology
Washington state, 2014 through 2024
Source: Employment Security Department/LMPA; U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Occupational Employment Statistics



*The replacement rate methodology tracks when workers leave occupations entirely.

Job growth exceeded replacement needs in four occupations: software developers, applications; janitors and cleaners, except maids and housekeeping cleaners; landscaping and groundskeeping workers and personal care aides.

Appendices

Appendix 1. Use and misuse of employment projections

Employment projections provide a general outlook for industries and occupations in Washington state. Occupational projections show how many job openings are projected due to occupational employment growth and replacement needs.[2]

Replacement includes openings created by retirements and occupational separations. It does not include normal turnover as workers go from one employer to another or from one area to another without changing their occupations. Total openings from occupational projections do not represent the total demand, but can be used as an indicator of demand.

Occupational details for employment (with at least 10 jobs) are presented for the state and all workforce development areas in our Employment Projections data files available online at: https://esd.wa.gov/labormarketinfo/projections.

Observed and predicted extremes in employment growth and other indicators, such as fastest-growing occupations and shortage of skills, can be used for placement and short-term training decisions. However, these should be limited for use when developing long-term education programs. There are two main reasons for this limitation:

1. First, with more education targeting occupations with skill shortages, there is a higher probability that this will cause an oversupply in those occupations and skill sets.[3]

2. Second, the general development of transferable skills is much more productive than trying to catch up with a skills shortage.

The U.S. Bureau of Labor Statistics cautions: "The 2010 SOC was designed solely for statistical purposes. Although it is likely that the 2010 SOC also will be used for various non-statistical purposes (e.g., for administrative, regulatory or taxation functions), the requirements of government agencies or private users that choose to use the 2010 SOC for non-statistical purposes have played no role in its development, nor will the Office of Management and Budget (OMB) modify the classification to meet the requirements of any non-statistical program.

---

[2] This is discussed in the Employment Projections Technical Report. Due to the non-additive formula for calculating total openings, in this round of projections we calculated total openings for aggregated occupations as a total for detailed occupations. As a result, the aggregated level of total openings might not equal the total of growth plus replacement.

[3] Occupational projections are the basis of the Occupations in Demand list (also referred to as the Training Benefits list). See https://fortress.wa.gov/esd/employment-data/reports-publications/occupational-reports/occupations-in-demand.

Consequently, the 2010 SOC is not to be used in any administrative, regulatory, or tax program unless the head of the agency administering that program has first determined that the use of such occupational definitions is appropriate to the implementation of the program's objectives."[4]

Different programs use different SOC coding systems. Combining the employment projections with other data sources generally requires a case-by-case analysis; an understanding of the differences of each program should be clearly explained and properly handled.

Occupations in Demand list

The methodology for determining whether an occupation is "in demand," "not in demand" or "balanced" is based on industry and occupational projections. Specific levels of job growth and job openings are used to designate an occupation as "in demand," "not in demand" or "balanced." For more details and methodology, see the *Employment Projections Technical Report* in the "Projections methodology" section at: **https://esd.wa.gov/labormarketinfo/projections**.

[4] See: **www.bls.gov/soc/soc_2010_user_guide.pdf**, pages xxv-xxvi.

Appendix 2. Occupations in Demand (OID)

Employment Projections are intended for career development over time, not as the basis for budget or revenue projections, or for immediate corrective actions within the labor market.

Employment projections are the basis of the Occupations in Demand (OID) list covering Washington's 12 workforce development areas (WDAs) and the state as a whole. This list is used to determine eligibility for a variety of training and support programs, but was created to support the unemployment insurance Training Benefits Program.

The full OID list is accessible through the "Learn about an occupation" tool located at: **https://esd.wa.gov/labormarketinfo.**

All occupations in the list have demand indication definitions. The definitions come in three forms; "in demand," "not in demand" or "balanced." These definitions indicate the probability of a job seeker gaining employment in a given occupation. The term "in demand" indicates a greater probability of gaining employment. The term "not in demand" indicates a lesser probability and "balanced" indicates an uncertain probability between success and failure in gaining employment. The definitions are created through a four-step process as follows:

The data sources for the OID list:

The 2016 list is based on projections:

- Five-year projections for 2014 through 2019, using average annual growth rates and total job openings.
- Ten-year projections for 2014 through 2024, using average annual growth rates and total job openings.
- A combination of two-year (second quarter 2015 through second quarter 2017) and ten-year (2014 through 2024) projections, using average annual growth rates and total job openings.

All of these time frames use unsuppressed occupations with employment in a base year (2014), consisting of 50 or more employees, for the state and WDAs.

In addition to projections, the OID list is created using supply and demand data:

- **Supply data**: average annual counts of WorkSource registered job seekers and unemployment claimants for WDAs, May 2015 through April 2016.
- **Demand data**: average annual counts of job announcements from Help Wanted OnLine (HWOL) mid-monthly time series, May 2015 through April 2016.

Step one: Identify initial "in demand" and "not in demand" categories for each period.

- For each time frame, occupations with average annual growth rates of at least 90 percent of their respective geographic areas (statewide or WDA) total average annual growth rates *and* a share of total openings of at least .08 percent are defined as "in demand."
- Occupations with average annual growth rates less than 70 percent of their respective geographic areas total growth rates *and* a share of total openings of less than 1 percent are defined as "not in demand."

Step two: Identify provisional occupational categories.

- If within any of the three projection time frames (five-year, 10-year and two-/10-years combined), an occupation is categorized as being "in demand," it receives the first provisional identification as "in demand."
- If within any of the three projection time frames, an occupation is categorized as "not in demand," it receives a second provisional identification of "not in demand."

Step three: Create final projections definitions.

- If an occupation has only one provisional definition, it equals the final projections definition.
- If an occupation has two provisional definitions of "in demand" and "not in demand," it gets identified as "balanced."
- All other occupations, without provisional definitions (i.e., not meeting the thresholds from step one), are identified as "balanced."

Step four: Create final adjustment definitions.

The projections definitions are now put through an adjustment process, using current labor market supply/demand data, which compares online job postings to information on unemployment claimants and WorkSource job seekers. An adjustment is applied when current supply/demand data significantly contradicts the model-based projections definitions. Only data for occupations with new annual job announcements of at least 100 are used in further calculations.

The adjustment methodology

- If the projections definition is "in demand" or "balanced" but the ratio of supply to demand is more than 2, then the adjusted definition is "not in demand."
- If the projections definition is "in demand" and the ratio of supply to demand is not larger than 2, but more than 1.5, then the adjusted definition is "balanced."
- If the projections definition is "not in demand" or "balanced," but the ratio of supply to demand is less than 0.5, then the adjusted definition is "in demand."
- If the projections definition is "not in demand" and the ratio is at least 0.5, but less than 0.75, then the adjusted definition is "balanced."
- If the number of new job announcements for a current month is at least 10 and supply data are not available, the adjusted definition is "in demand."

The final list: Local adjustments

The Employment Security Department's Labor Market and Performance Analysis division uses the methodology outlined above to prepare the initial lists for the state as a whole and by WDA. Those lists are then given to local workforce development councils to review, adjust and approve on the basis of their local, on-the-ground experience.

Appendix 3. Skill projections

This is the second year we have processed skill projections. This new process attempts to convert occupational projections into skill projections. We rely on the content of employers' job postings rather than the predefined, general O*NET skills. While the results of this attempt should be considered as preliminary, we believe that the attempt to use employer identified skills from job postings deserves some attention.

Data sources

The main source for this analysis was a download of the top 100 hard skills for each detailed (six-digit SOC) occupation for Washington state from WANTED Analytics. The downloaded files represent the extracted hard skills from online job announcements posted in the last three years (from May 2013 through April 2016).[5] Each skill is displayed with the number of job announcements from which it was extracted. This skill-announcement(s) pairing permits every occupation to display the relative importance of each skill. Theoretically, each occupation could contain a vector of up to 100 components with announcement numbers indicating the relative importance of each skill. A vector is a single entity (i.e., a column) consisting of an ordered collection of numbers. A skill drawn from a greater number of job announcements is realatively more important. The number of job announcements is summed for each occupation. Only vectors with a summation value of at least five and not less than 1 percent of base year employment were used. Some occupations contain very limited (if any) numbers of skill components.

Vectors were normalized (i.e., scaled) to totals of one. With this type of normalization, we created skill–to-occupation matrices. These matrices were used to convert occupational estimations and projections into comparable numbers expressed as hard skills.

The skill matrices are similar in structure and function to normalized matrices used for occupational-industrial staffing patterns. The skill matrices were based on statewide data and were used to convert occupational projections for the state and all areas into skill projections.[6]

After conversion, we deleted all records where estimated or projected employment numbers were below five. We consider estimations below five as unreliable. As a result of filtering out missing skill/occupation vectors and removing results below five, only a portion of the occupational employment estimates were converted into skills.

---

[5] In last year's projections report we used the only data available; a three month sample.

[6] WANTED Analytics data includes duplicated job announcements. Normalization of the matrices eliminates these inflated totals, but bias is still possible.

The conversion size (occupational employment to skills), calculated on base year employment, varies between about 84.5 percent for Seattle-King County WDA, 60 percent for the state, Snohomish County and Spokane WDAs, to a low of 63 percent for the North Central Washington WDA. The conversions are around 80 percent for the majority of the areas and approximately 20 percentage points larger than the numbers in last year's report. The main reason for this increase was the larger sample size this year.

Some results

The skills to occupational matrices have different dimensions for the state's areas based on data availability. As a result, the largest number of detailed skills were 3,016 for Washington state, followed by King County at 2,594. These numbers are between 1.5 to 2.35 times larger than last year's limited sample results.

The top three detailed hard skills, based on projected numbers of openings (for both net replacement and separations methodologies) as well as available number of jobs were: "Food preparation," "Bilingual" and "Quality assurance." They are the same top three skills as were in last year's limited sample projections. It is no surprise these three skills are the same for all areas since the same statewide matrix was used for all areas.

The top detailed hard skills were not the same when we increased the number to the top five. This is due to differences in occupational employment structure by area. However, last year's and this year's numbers remained close. For the state and major areas, the next two top skills are "Quality control" and "Forklifts." The numbers of total annual projected openings from 2014 through 2024 associated with the top five skills for Washington state are 19,925 (replacement) and 65,259 (separation). Combined, they represent 16.7 percent of total openings for net replacement and 17.8 percent for separation calculations.

It is interesting to note that the replacement projected openings, for the years 2019 through 2024 are lower than the same numbers for 2014 through 2019. The results are inverse for the separations methodology. Projected separations openings for 2019 through 2024 are larger than 2014 through 2019. These results seem logical since the separations methodology tracks workers leaving the labor force, while the net replacement methodology does not. However, skills with the largest number of openings are not on top of the separations list based on growth rates.

The fastest growth is projected for skills related to information technology (IT). The IT skills are very specific, vary from area to area and the majority, individually, are not large in terms of employment and job openings. The largest annual average growth rates between 2014 and 2024 for skills with separations openings of at least 50 are expected to be: "Asynchronous JavaScript" and "XML," "Spring" (Spring framework), "Simple Object Access Protocol," "Object-oriented design" and "Representational state transfer." However, the

combined totals for these top detailed occupations represented an insignificant share, just 0.12 percent of total openings represented in the skill projections.

The top 20 detailed skills for Washington state based on a combined rank of annual average openings and growth for 2014 through 2024 are presented in *Appendix figure A3-1*.

Appendix figure A3-1. Top 20 skills ranked by combined growth and openings
Washington state, 2014 through 2024
Source: Employment Security Department/LMPA; WANTED Analytics

Combined rank	Hard skill titles	Estimated hard skill employment numbers 2014	Projected hard skill employment numbers	Average annual growth rate 2014-2024	Total average annual openings
1	JavaScript	3,665	4,876	2.90%	414
2	Lawn care	7,884	10,129	2.50%	1,238
3	Java	8,815	11,383	2.60%	1,011
4	C-sharp	6,284	8,165	2.70%	674
5	Cascading Style Sheets	2,328	3,104	2.90%	274
6	C/C++	3,816	4,993	2.70%	397
7	Hypertext markup language	3,715	4,806	2.60%	440
8	Microsoft SQL Server	3,916	5,060	2.60%	418
9	Systems Development Life Cycle	3,355	4,374	2.70%	342
10	Distributed system	2,317	3,068	2.80%	255
11	Microsoft .NET Framework	2,813	3,679	2.70%	291
12	Linux	5,634	7,154	2.40%	578
13	Graphical User Interface design	2,947	3,792	2.60%	336
14	Extensible markup language	2,114	2,777	2.80%	232
15	Amazon Web Services	2,063	2,720	2.80%	220
16	Statistical Analysis System	2,368	3,026	2.50%	294
17	Object-oriented design	1,349	1,830	3.10%	146
18	Practical Extraction and Reporting Language	3,228	4,106	2.40%	340
19	Medical software	1,722	2,186	2.40%	344
20	Machine learning techniques	2,185	2,806	2.50%	253

Nineteen of the top 20 skills are related to information technology.

With one noticeable exemption, "Lawn care," 19 of the top 20 skills are related to information technology (IT). The top 20 occupations only represent about one percent of total openings in the skills forecast.

In the entire list of skills, some skills are quite general and represent a significant share of total numbers and openings. Examples are the top three skills based on openings: "Food preparation," "Bilingual" and "Quality assurance." The majority of skills, especially related

to information technology (IT) and high-tech, are very specific and their numbers are dispersed among all occupations. As a result, such detailed skills normally do not represent a significant share of total numbers. However, in spite of the significant change in sample size, the top 20 skills this year have a lot in common with last year's report. Among the 19 IT related skills in this year's report, 14 were the same as last year's report.

Results change significantly if we group all detailed skills together, based on primary fields. This type of grouping is quite challenging since a significant number of skills are a combination of specific fields and IT skills. A good example of this is the grouping of CAD software with the field of architectural drawing.

In the skills forecast, by far the largest group of skills are IT related. They represent more than one-fourth of estimated skill numbers and openings for replacement and 23.2 percent for separations. Among 20 groups with large skill numbers (more than 10,000), the IT group is projected to be the fastest growing with an annual average growth rate of 1.78 percent. The second and third largest groups of skills are related to production and healthcare, which accounts for almost 11.2 and 8.2 percent of all openings in the separation methodology. Healthcare also has the third largest projected growth rate of 1.74 percent among the twenty groups with large numbers.

It is interesting to note that out of a total of 562 occupations, IT skills are present in 530 occupations. For 257 of these occupations, IT skills comprise more than one-quarter of total numbers and for 104 they comprise more than one-half of total numbers.

The IT skills naturally dominated shares in computer related occupations, but also have a very high share in occupations whose primary occupational focus is not computers. The top 15 occupations with high computer skill requirements, based on IT shares (with IT skill numbers more than 100) are presented in *Appendix figure A3-2*.

Appendix figure A3-2. Occupations, not primarily computer related, with the largest shares of computer skill requirements
Washington state, 2015 second quarter occupational estimations (June 2013 to May 2016 sample, skills/occupations matrices)
Source: Employment Security Department/LMPA; WANTED Analytics

SOC	Occupation	Share of skills that are IT
492095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	0.973
271025	Interior Designers	0.938
171011	Architects, Except Landscape and Naval	0.901
171012	Landscape Architects	0.878
271022	Fashion Designers	0.842
173011	Architectural and Civil Drafters	0.823
271014	Multimedia Artists and Animators	0.813
193011	Economists	0.791
191029	Biological Scientists, All Other	0.788
271024	Graphic Designers	0.779
439111	Statistical Assistants	0.766
271021	Commercial and Industrial Designers	0.764
131161	Market Research Analysts and Marketing Specialists	0.750
413041	Travel Agents	0.738
152031	Operations Research Analysts	0.737

Nine of the current occupations are the same as in last year's report, which was produced with a limited sample.

Skill based related occupations

Skills–to-occupations matrices allowed us to create a tool for defining related occupations, based on common skills. To achieve this, we calculated a matrix of correlations based on skills between occupations. The results are presented in the macro-enabled file, **reloccup_skills_2016.xlsm**. The matrix in the file's "main" tab is symmetric around the main diagonal. The main diagonal has all 1s in it. There are two ways of using the file's data when opened with the enabled-macros feature:

1. You can select an occupational title of interest, from a column heading, in the "main" tab and then sort the numbers below the title of interest from largest to smallest. Starting from row 3 in column B you would see the sorted list of related occupations (row 2 will be the same occupation as selected). To restore the original sort-configuration, sort the key-column (column A) from smallest to largest.

2. You can select an occupation of interest, from a column heading, in the "main" tab and then click the "**Ctrl**" and "**A**" keys simultaneously. This will execute a macro. The macro opens a table in a "table" tab. In the table you will find a list of the top 15 occupations related to your occupation of interest.

An example of a list for computer programmers is in *Appendix figure A3-3*.

Appendix figure A3-3. Top 15 occupations related to computer programmers
Washington state,
Source: Employment Security Department/LMPA; WANTED Analytics

SOC	Occupation	Share of skills that are IT
151132	Software Developers, Applications	0.802
151121	Computer Systems Analysts	0.74
151134	Web Developers	0.64
151199	Computer Occupations, All Other	0.639
151141	Database Administrators	0.63
152031	Operations Research Analysts	0.509
151111	Computer and Information Research Scientists	0.422
131161	Market Research Analysts and Marketing Specialists	0.404
131111	Management Analysts	0.402
151133	Software Developers, Systems Software	0.391
113021	Computer and Information Systems Managers	0.39
111021	General and Operations Managers	0.378
151142	Network and Computer Systems Administrators	0.351
132099	Financial Specialists, All Other	0.345
251191	Graduate Teaching Assistants	0.331

Numbers in the table represent coefficients of correlations for normalized vectors of skill shares.

The related occupations tool could be useful for job seekers. The results are specific for Washington state since the skills come from job announcements in this state.

Conclusions

Some significant data limitations were encountered when converting occupational data from job announcements into skills. In spite of these limitations, useful results were produced. It is our conclusion that it is more important to connect education and training programs with real world skill requirements than with generic occupational skill definitions.

Some skills with large projected numbers of openings are well defined and can be linked to different levels of training. Examples of skills with the largest numbers of projected openings are: "Food preparation," "Bilingual" (with a separate skill in bilingual Spanish), "Customer relationship management," "Pediatrics," "Behavioral health," etc.

A second significant group of skills which for the most part are well defined in terms of primary activities, but which require significant secondary skills related to information technology are: "quality control," "risk assessment," "lean" and different engineering skills. These types of skills are much more dispersed than the first group. Relating this second skill group to training is more complicated. While primary fields are relatively stable and well defined, IT skill sets are ever changing. IT skills are concentrated mainly in software, algorithms, some hardware and in web applications. Since required IT skill sets change frequently, specific software applications should be given a secondary emphasis in training.

Though IT skills are a very large group, they are highly dispersed amongst detailed skills and are subject to frequent changes. Some specific skills, like those in *Figure 6*, are important and help graduates enter the labor market or move to higher paid jobs. However, in the long run, it might be worth giving priority to foundational academic subjects like math and formal logic, multidimensional design and foundational concepts in object oriented programing. In other words, foundational abilities to learn, develop and implement new knowledge and technology in the long run should take priority for career preparation.

Future possibilities

Our skills forecasting process used three years of sample files, which was a longer timeframe than last year's three month sample. In the future, we hope to be able to use an even longer timeframe. It will also be important to establish a direct connection between specific skills required by employers and education and training programs.

Appendix 4. Frequently asked questions

Q: **What are the steps in industry projections?**

A: There are two major steps to industry projections. The first step is developing aggregated statewide industry projections using the Global Insight model. The second step produces detailed industry projections. The principal data source for industry projections is a detailed covered employment time series of four-digit NAICS data for all Washington counties, specifically, the U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW).

Q: **Why are the detailed industry projections not comparable with U.S. Bureau of Labor Statistics, Current Employment Statistics (CES) definitions?**

A: Industry projections are disaggregated according to U.S. Bureau of Labor Statistics, Occupational Employment Statistics (OES) definitions, which are somewhat different from CES.

Q: **What is the source for occupational/industry ratios?**

A: The primary source for occupational/industry ratios is the OES survey. However, this survey uses different area designations than the state's workforce development areas (WDAs) and has limited industry coverage (agriculture, non-covered employment, private households and self-employment are excluded) necessitating the use of other staffing patterns as well.

Q: **Why can the ratio for industry and occupational projections differ from the OES survey outputs?**

A: We use raw sample and limited numbers of imputations while standard OES processing uses significant share of imputations. We also use some extra samples (from previous surveys). In cases when a sample is weak or missing we use a substituted area (state staffing patterns) or combined areas (King and Snohomish counties).

Q: **Why can occupational/industry ratios differ between the base year and projected years?**

A: This is due to the use of change factors, which predict changes in the occupational shares for each industry over time.

Q: **Why can't projections be benchmarked or verified?**

A: There are no administrative records for employment by occupation; therefore, the data cannot be reliably benchmarked or verified by non-survey means.

Q: **How are occupational projections used?**

A: Occupational projections are the only data source for the statewide and WDA-specific occupational outlook. Projections are also the foundation for developing the Occupations in Demand list, which is used to determine eligibility for a variety of training and support programs, but was created to support the unemployment insurance Training Benefits Program.

Q: **How are industry projections used?**

A: Industry projections can be used by policy makers, job seekers, job counselors and economic analysts. For any policy decisions, the projections should be supplemented with other available data sources (e.g., unemployment insurance claims, educational data, job announcements, etc.).

Q: **Which occupational codes are used?**

A: The 2010 Standard Occupational Classification (SOC) system was used for this round of projections.

Q: **Can the SOC be used for administrative purposes?**

A: According to BLS, the 2010 SOC was designed solely for statistical purposes. To use SOC for administrative programs, the head of an agency considering using SOC must first determine if the use of SOC definitions is appropriate for a program's objectives.

Q: **Why don't the occupational totals by WDA equal the state total?**

A: The totals are not additive due to the use of local staffing patterns for projections by WDA, which differ from the statewide staffing pattern.

Q: **What is the difference between the Bureau of Labor Statistics replacement and separations rate methodologies?**

A: The new separations and the old replacement methodologies both estimate the numbers of workers leaving occupations (leavers). In the new methodology, leavers are distinguished by those who leave an occupation and those who leave the workforce entirely. In the old methodology, only workers leaving occupations were estimated. The new methodology estimates leavers directly and the old method estimates leavers indirectly. The new methodology uses a regression model with multiple demographic characteristics. The old methodology extrapolates one demographic trend (age) from historical data.

Appendix 5. Glossary of terms

Industries

A classification of business establishments based on their specific economic activity.

Job openings due to growth and net replacement

Job openings due to growth and net replacement (calculated on a compound basis) represent the total projected number of openings available for new entrances into the occupation. This does not include openings that result when workers change jobs but stay in the same occupation.

Net replacement (net separation)

The new separations and the old replacement methodologies both estimate the numbers of workers leaving occupations (leavers). In the new methodology, leavers are distinguished by those who leave an occupation and those who leave the workforce entirely. In the old methodology, only workers leaving occupations were estimated. The new methodology estimates leavers directly and the old method estimates leavers indirectly. The new methodology uses a regression model with multiple demographic characteristics. The old methodology extrapolates one demographic trend (age) from historical data.

North American Industry Classification System (NAICS)

North American Industry Classification System (NAICS) is the system used by federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing and publishing statistical data related to the U.S. business economy. NAICS was developed under the authority of the U.S. Office of Management and Budget.

Occupation

A job or profession, a category of jobs that are similar with respect to the work performed and the skills possessed by the workers.

Occupational projections

Industry projections converted to occupations, based on occupational/industry ratios.

Standard Occupational Codes (SOC)

Standard Occupational Classification (SOC) is the system used by federal statistical agencies in classifying workers into occupational categories for the purpose of collecting, calculating or disseminating data. All workers are classified into one of 840 detailed occupations according to their occupational definition. SOC was developed under the authority of the U.S. Office of Management and Budget.

Total occupational estimations and projections

Total occupational estimations and projections are calculated to describe employment in the base year and future time periods.