MINNESOTA ECONOMIC

TRENDS

DISABILITY EMPLOYMENT STATISTICS

2018 UPDATE

DECEMBER 2019

EMPLOYMENT AND ECONOMIC DEVELOPMENT

Training Will Help Immensely

Last September's feature, Hiring Difficulties in Manufacturing, summarized the challenges faced by manufacturing employers when hiring skilled workers – and guides us to this issue's Most In-Demand Skills in Manufacturing. Employers will have to get creative about sustaining their partnerships with schools and technical education providers to bridge skills gaps, according to Alessia Leibert. General mechanical aptitude is acknowledged as the biggest gap. Some employers would hire people straight out of high school if their job candidates had mechanical aptitude.

As we've emphasized, it will take a multi-pronged approach to address the shortage of workers. Higher wages, specialized training programs, and policy responses to break down education and employment barriers will help. But we can do more.

In High Wage Workers in Minnesota, Nick Dobbins deploys DEED's Quarterly Employment Dynamics data to get a count of people who earned more than a million dollars in 2018 and 2003. What he finds isn't surprising: Most of the million-dollar employees are men, by a margin of 73 percent to 27 percent and most are concentrated in the metro area in a small number of industries.

Minnesota's strong economy, underpinned by October's 3.2 seasonally adjusted unemployment rate, has benefited workers of every demographic characteristic, writes Cameron Macht in Evaluating Unemployment Insurance Claims. However, the most detailed read on economic change is from Unemployment Insurance claims statistics, which are produced monthly and are directly tied to workers' employment status. If claims activity starts to rise, DEED can identify the age groups, gender, race, occupations, industries, or geographic locations affected and craft an effective response.

In the updated Disability Employment Statistics, Sanjukta Chaudhuri finds the unemployment rate of Minnesotans with disabilities declined more rapidly between 2014 and 2018, down by 2.2 percentage points, than for the total population, down 1.2 percentage points. But it's important to realize this segment of the workforce continues to face significant barriers to realizing their full economic potential.

Finally, Steve Hine, former Labor Market Information Office director, describes our effort to provide an annual count of occupational openings that will be available to new graduates after accounting for incumbent workers. This then provides an annual count, by occupation, of the number of new graduates required to fill these available openings.

If 'former' didn't register, be assured that after nearly 17 years of remarkable leadership, Steve is taking on a research and writing role in Commissioner Steve Grove's office – and you can expect to read his contributions regularly in Trends.

Carol Walsh

Carol Walsh
Editor

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Sanjukta Chaudhuri

Disability Employment Statistics: 2018 Update

In 2018, Minnesotans living with disabilities continue to face significant barriers to realizing their full economic potential.

DEED's mission is to empower the growth of the Minnesota economy, for everyone, by reducing employment disparities and promoting an equitable work environment. For the Labor Market Information Office, this means paying close attention to the specific labor market challenges faced by populations with barriers to employment. This article focuses on Minnesotans with a disability, comparing and contrasting their labor market statistics with the general population and Minnesotans with no disability.

As of 2018, more than 600,000 Minnesota residents reported having at least one disability, comprising 11 percent of the state's population (Table 1). This was up from 580,494 in 2014 (10.8 percent of the total population). A little over half of Minnesotans

Table 1. Percentage of Minnesotans with Disabilities and Percent Female

Year	Total Population*	With a Disability	Percent with a Disability	Percent Female Among Those With a Disability
2018	5,553,564	608,744	11.0%	49.2%
2017	5,519,199	615,846	11.2%	48.2%
2016	5,462,438	602,014	11.0%	49.8%
2015	5,431,894	593,675	10.9%	49.2%
2014	5,398,211	580,494	10.8%	49.0%

Source: American Community Survey, one year estimates 2014 through 2018

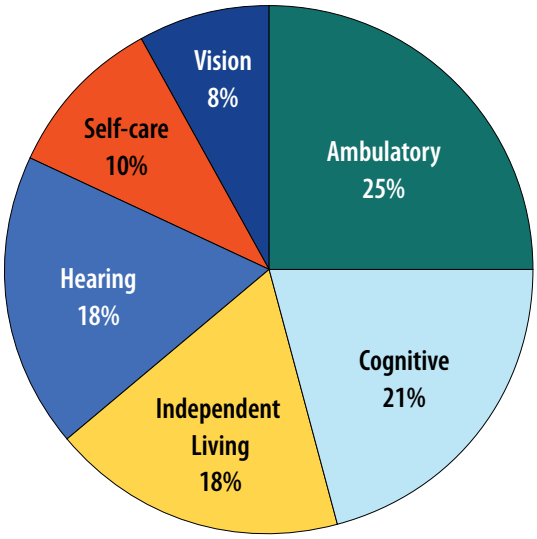
with a disability are male; the share of females increased marginally, from 49 percent in 2014 to 49.2 percent in 2018.

As Figure 1 shows, the most common disability reported was ambulatory (25 percent), followed by cognitive (21 percent), independent living (18 percent), hearing (18 percent), self-care (10 percent), and vision (8 percent).

By race and ethnicity, American Indian and Alaska Natives have the highest prevalence of disability at 15.6 percent (Figure 2). Native Hawaiians and other Pacific islanders have the second highest prevalence at 12.7 percent, followed by blacks or African Americans (12.3 percent), and whites (10.6 percent). Hispanics and Asians have the lowest prevalence rates, at 7.0 and 6.8 percent respectively.

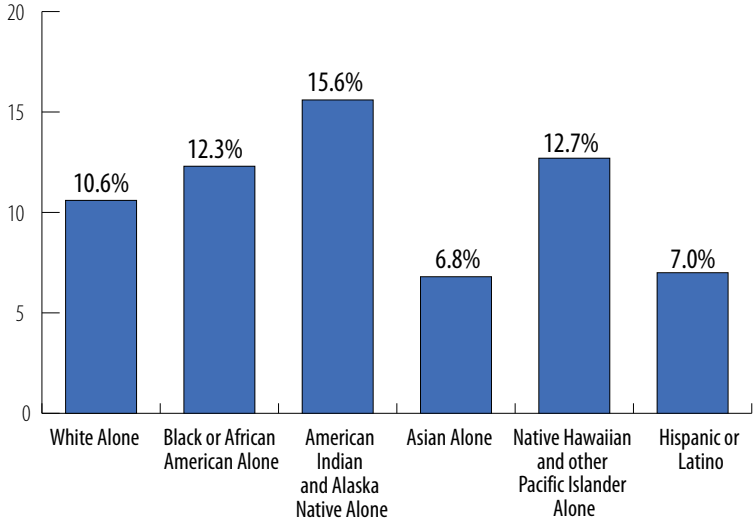
One of the best indicators of economic well-being and gaps in quality of life between sub-populations is poverty status. Living with a disability is associated with an alarmingly high poverty rate. In 2018, almost a quarter of the working-age population with one or more disabilities lived below the poverty line, compared to only 7.9 percent of those with no disability. Although poverty rates have fallen since 2014 for both those with disabilities and those

Figure 1. Breakdown of Minnesotans Living with Disabilities by Type of Disability, 2014-2018



Source: American Community Survey, one year estimates 2014 through 2018

Figure 2. Percentage of Minnesotans Living with Disabilities by Race and Ethnicity, Minnesota, 2013-2017



Source: American Community Survey, five year estimates 2013 through 2017

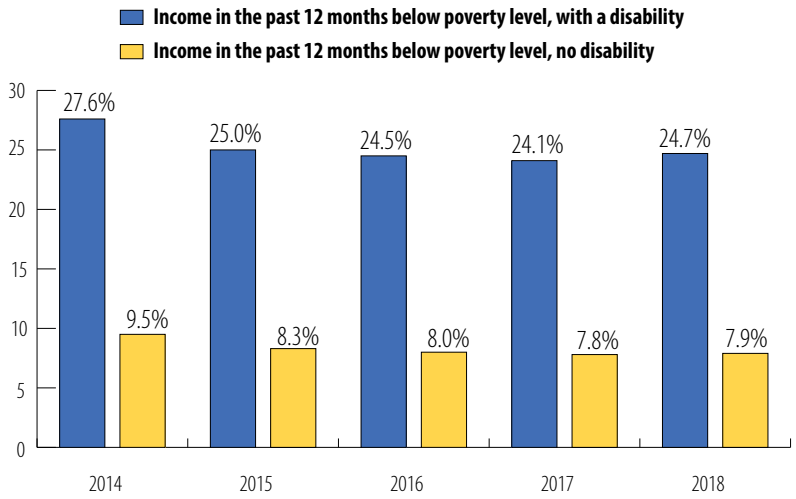
who are temporarily able-bodied, the gap has endured over the past five years.

Living with a disability can create barriers to education, which in turn can create barriers to employment. Having a disability is associated with lower levels of educational attainment (Table 2). While 32.9 percent of Minnesotans with no disability finish their education at the high school level or less, the percentage jumps above 60 percent for people living with self-care, independent living and cognitive disabilities.

People living with disabilities also tend to achieve lower levels of higher education. For example, while the bachelor's degree completion rate is 22.5 percent for Minnesotans with no disabilities, it is drastically lower for those with disabilities (Table 2). Those living with self-care difficulties have the lowest rate of bachelor's degree completion at 8.4 percent.

Compared to the overall Minnesota workforce, Minnesotans with a disability typically have lower levels of labor market participation, lower employment-to-population ratios, and substantially higher unemployment rates (Table 3). In 2018, the annual unemployment rate for Minnesotans living with a

Figure 3. Disability, No Disability, and Poverty Status: Minnesota, Age 18-64



Source: American Community Survey, one year estimates 2014 through 2018

Table 2. Educational Attainment by Disability Status in Minnesota, 2013-2017

	Up to (and including) High School Diploma/GED	Some College, No Degree	Associate	Bachelor	Masters, Professional or Doctoral
With disability					
Vision	55.5%	20.2%	7.5%	10.5%	6.4%
Hearing	52.6%	20.8%	7.3%	12.2%	7.0%
Ambulatory	57.2%	21.1%	6.9%	9.9%	4.9%
Independent living	63.1%	18.5%	5.7%	8.5%	4.3%
Self-care	63.2%	18.1%	5.4%	8.4%	4.8%
Cognitive	60.7%	20.7%	6.4%	8.6%	3.6%
No disability	**32.9%**	**23.2%**	**10.7%**	**22.5%**	**10.7%**

Source: American Community Survey, one year estimates 2013-2017, and ipums.org online analyze data tool

disability was 9 percent, more than double that of the general population, which was 3.4 percent.

On the positive side, the unemployment rate of Minnesotans with disabilities declined more rapidly between 2014 and 2018, down by 2.2 percentage points, than for the total population over the same time period, down 1.2 percentage points. The annual labor force participation rate in 2018 was 84 percent for all Minnesotans, but only 54.1 percent for Minnesotans living with disabilities. However, the labor force participation rate for Minnesotans living with disabilities increased 4.1 percentage points over the five-year period, up from 50 percent in 2014, whereas the participation rate for all Minnesotans has remained stagnant over the same time period (Table 3).

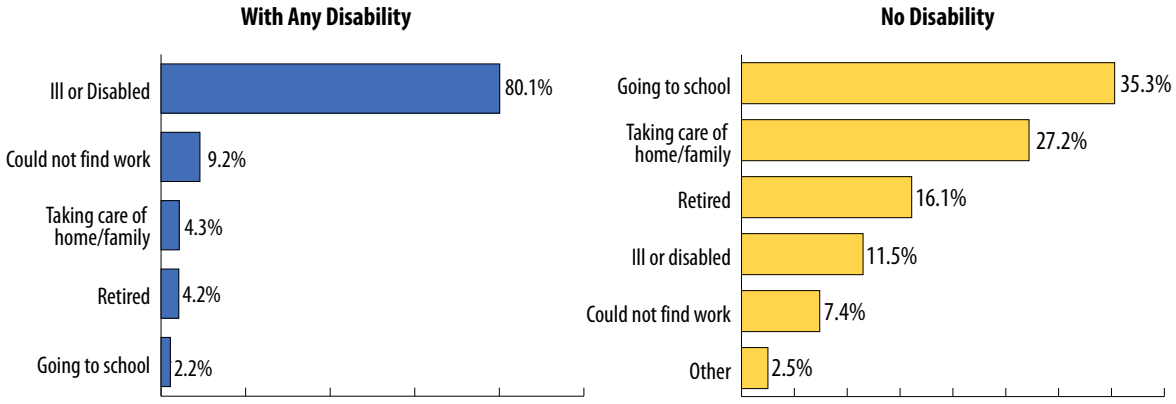
What employment barriers do people living with disabilities face? Figure 4 shows that among non-participants, 80 percent of disabled people cite ill health and disability as the reason for not working or looking for work compared to only 11.5 percent of those with no disability.

Table 3. Labor Force Indicators for Working Age Population, Age 18 to 64, Minnesota

	Labor Force Participation Rate		Employment to Population Ratio		Unemployment Rate	
Year	All	With Disability	All	With Disability	All	With Disability
2018	84.0%	54.1%	81.2%	49.1%	3.4%	9.0%
2017	83.9%	52.0%	81.0%	47.8%	3.6%	8.1%
2016	83.8%	52.3%	80.6%	48.0%	3.7%	8.2%
2015	83.9%	52.5%	80.6%	47.5%	4.0%	9.6%
2014	83.4%	50.0%	79.6%	44.4%	4.6%	11.2%

Source: American Community Survey, one year estimates 2014 through 2018

Figure 4. Main Reason Not Looking for Work During Last Four Weeks, Age 16 to 64, Minnesota, 2014-2018



Source: Current Population Surveys (CPS), Annual Social and Economic Supplements (ASEC), 2014-2018

Moreover, 9.2 percent of people living with disabilities were unable to find work compared with 7.4 percent of those with no disabilities. In contrast, non-participants without any disabilities are more likely to cite reasons such as going to school, family responsibilities, and retirement.

People living with a disability who are employed tend to work fewer hours and have lower earnings than those with no disability. Table 4 shows that 78.8 percent of employed people with no disability usually work full-time while only 52.7 percent of employed people living with a disability usually work full-time. In contrast, 47.3 percent of people living with a disability work part-time, compared to only 21.2 percent of those with no disability.

Having a disability is associated with substantially lower earnings (Table 5). Among all labor force participants with earnings in 2018, those with no disability earned $40,370 annually at the median, while those living with disabilities earned only $23,000. By gender, females with disabilities have the lowest median earnings at $19,305, compared to females with no disabilities at $33,795. Males with disabilities earn $26,257 at the median, compared to $46,548 for males with no disabilities.

People living with disabilities in Minnesota tend to have lower educational attainment, worse labor market outcomes, and higher poverty rates than those with no disabilities. The critical takeaway is that people living with disability continue to face significant barriers to realizing their full economic potential.

We embrace our role in helping people with disabilities break down barriers to full and equitable employment in Minnesota.

Table 4. Usual Hours of Work Last Year by Disability Status, Minnesota, 2014-2018

	With Any Disability (%)	With No Disability (%)
Usually full-time hours (35+ hours per week)	52.7%	78.8%
Usually part-time hours	47.3%	21.2%
Total	100%	100%

Source: Current Population Surveys (CPS) Annual Social and Economic Supplements (ASEC), 2014-2018

Table 5. Median Earnings in Past 12 Months (2018 Inflation-Adjusted Dollars) by Disability Status and Sex, Civilian Noninstitutionalized Population 16 Years and Over with Earnings, Minnesota

	With a Disability			No Disability		
Year	All	Male	Female	All	Male	Female
2018	$23,000	$26,257	$19,305	$40,370	$46,548	$33,795
2017	$20,957	$24,029	$18,329	$39,234	$45,514	$32,297
2016	$19,767	$21,914	$16,767	$37,142	$42,423	$31,378
2015	$19,681	$22,927	$15,860	$35,986	$41,757	$30,410
2014	$19,253	$23,632	$14,638	$35,184	$41,189	$29,732

Source: American Community Survey, one year estimates 2014 through 2018

Evaluating Unemployment Insurance Claims

UI claims activity is a barometer of economic change.

Evaluating Claims

Unemployment Insurance claims remain near historic lows in Minnesota, suggesting that demand for workers – and the strength of the state's economy – remains high. In fact, the average number of claims filed per month through the first three quarters of 2019 was the lowest reported in the past 20 years, just below the averages posted in 1999 and 2000 (Figure 1).

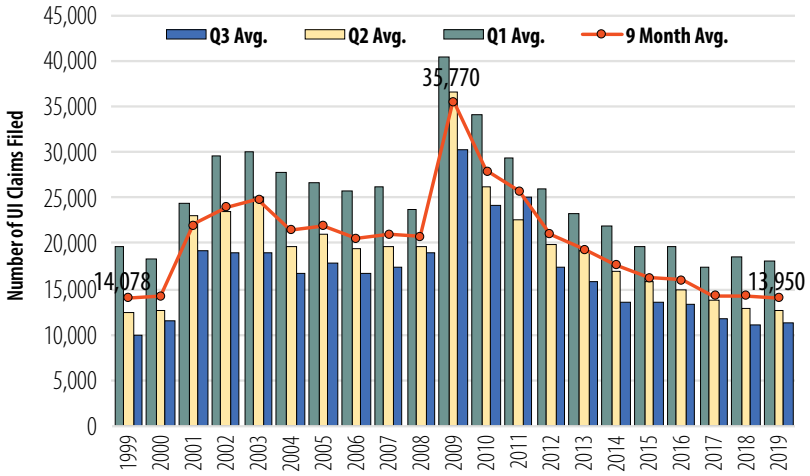
The Minnesota Unemployment Insurance (UI) Program provides short-term benefits through a temporary partial wage replacement to workers who have lost their jobs through no fault of their own. It is an economic stabilizer and stimulator in times of economic downturn and helps maintain an available skilled workforce for employers. The Department of Employment and Economic Development (DEED) supervises and administers the UI program, with benefits paid out from a fund that is supported by taxes on employers.[1]

Though not all laid-off workers file claims for benefits, and not all claims are filed by people permanently separated from their jobs, the number of initial claims being filed for unemployment benefits can be used as an indicator of labor market conditions since it provides a reliable and timely measure of layoff trends. To qualify for unemployment insurance benefits, applicants must:

- have earned sufficient wage credits at their job
- be unemployed through no fault of their own
- be available to work, and
- be actively seeking suitable employment.

As noted, not every unemployed worker applies for unemployment insurance benefits, meaning the UI statistics capture only one

Figure 1. Number of Unemployment Insurance Claims Filed in Minnesota, 1999-2019



Source: DEED Unemployment Insurance Claims Statistics

[1]"About Unemployment Insurance." Minnesota Department of Employment and Economic Development. Retrieved from: www.uimn.org/about-ui.jsp

segment of all unemployed workers and labor market churn. Likewise, they capture only one-half of the net job change equation, with new hires also impacting labor market performance. Still, data from DEED's Unemployment Insurance statistics can be used to help better understand current economic conditions. In general, when claims are low and falling, the economy is doing well; whereas when claims are high and rising, the economy is not.

With less than 200,000 total claims filed in each of the past two years (2017 and 2018) and even lower numbers posted through the first three quarters of 2019, unemployment insurance activity is down more than 10 percent compared to the previous low in 2016, and down more than 56 percent from the peak UI heights reported during the Great Recession in 2009. In sum, Minnesota is experiencing new record high levels of workers, jobs, and job vacancies, and historic lows in unemployment rates and UI claims (Figure 1).

Demographic Details

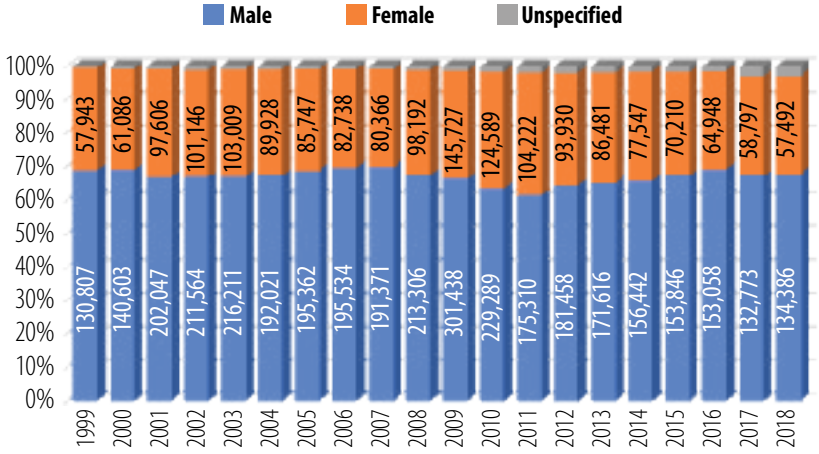
In addition to analyzing total claims activity, UI statistics also provide demographic details on the occupation, industry, education level, race, origin, gender, and geographic location of claimants. This information provides insight into who and what the claims activity is affecting the most.

Just over two-thirds of UI claimants are male, a ratio that has stayed relatively consistent over time, ranging from a low of 61.4 percent of claims in 2011 to a high of 69.7 percent in 2007. Interestingly, while the number of claims filed was spiking during 2008, 2009, and 2010, the percentage of claims filed by men was actually declining (Figure 2).

One of the main reasons for the gender imbalance in UI claims filed is the industry of employment, with construction and manufacturing being two of the main sources of UI claims activity, accounting for just over 43 percent of total claims in 2018. According to DEED's Quarterly Employment Demographics program, more than 70 percent of the manufacturing workforce and almost 90 percent of construction workers are male.

The seasonal nature of construction employment in Minnesota makes it the largest contributor to UI activity each year, accounting for almost one-third of total claims in 2018. Claims filed by construction workers are always highest from November through January, compared to low levels from June to August. Manufacturing also

Figure 2. Number of Unemployment Insurance Claims Filed in Minnesota by Gender, 1999-2018



Source: DEED Unemployment Insurance Claims Statistics

has minor seasonal spikes in the winter and dips in the summer, but the annual counts actually see more variation. During the Great Recession, manufacturing comprised 22 percent of total claims filed in 2009, but dropped to just 11 percent of total claims in 2018.

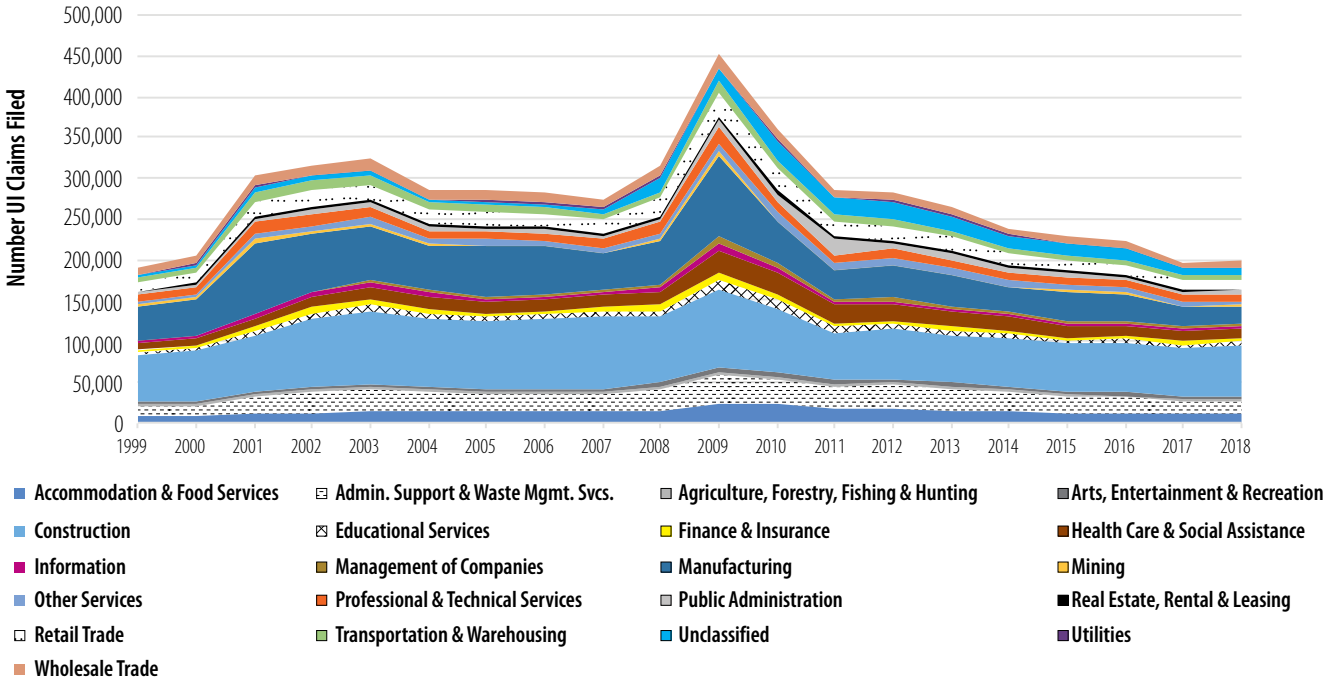
Other industries that produce a lot of UI claims each year include administrative support and waste management services, health care and social assistance, retail trade, and accommodation and food services. Encouragingly, 19 of Minnesota's 20 industry sectors saw a decline in the number of UI claims filed over the past five years, with manufacturing seeing a particularly notable decrease to a record low of just 21,735 claims in 2018 (Figure 3).

The only exception was the construction industry, which saw an increase in claims over the past five years. However, the buildup in construction UI claims might actually be good news as well, since it relates to the fact that construction employment overall has been rising steadily. According to data from DEED's Quarterly Census of Employment and Wages program, construction firms have built up their payrolls by more than 10 percent over the past five years, and more workers means more seasonal layoffs.

Educational Attainment

Perhaps not surprisingly, the largest number of UI claims are filed by workers with a high school diploma, followed closely by people with some college or an associate degree. Combined,

Figure 3. Number of Unemployment Insurance Claims Filed in Minnesota by Industry, 1999-2018



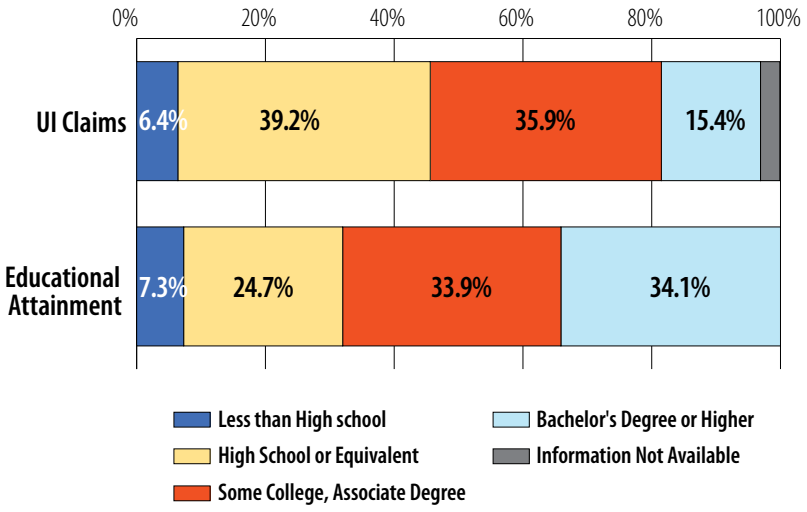
Source: DEED Unemployment Insurance Claims Statistics

those two groups accounted for just over 75 percent of total claims filed in 2018, while just 15 percent were filed by people with a bachelor's degree or higher. That matches closely the educational attainment of the state's working age population – according to the Census Bureau, about 59 percent of people aged 18 and over had a high school diploma, some college, or an associate degree, while 34 percent had a bachelor's degree or higher in 2018 (Figure 4).

Even though the number of claims filed in 2009 was more than double the number filed in 2018, the percentage of claims filed by workers in each educational attainment category was nearly identical – 76 percent had a high school diploma, some college, or an associate degree; and 15 percent had a bachelor's degree or higher.

Charts displaying unemployment rates by educational attainment clearly show that post-secondary training provides some insulation from recessionary periods and creates a stronger attachment to the labor force. However, DEED data also show that in the year leading up to the recessions in both 2001 and 2009, the number of UI claims filed by workers with post-secondary education increased much faster than for workers with a high school diploma or less. From 2000 to 2001, the number of claims filed by workers with post-secondary education jumped nearly 70 percent, compared to a 37 percent increase for workers with a high school diploma or less. Similarly, the number of claims filed by workers with post-secondary education climbed 55 percent from 2008 to 2009, compared to a 33 percent increase for workers with a high school diploma or less. This reflects the spread of layoffs and UI claims into industries that employ more workers with higher educational attainment, and also provides a stark reminder than no one is immune to the effects of a recession.

Figure 4. Percent of Unemployment Insurance Claims Filed in Minnesota by Educational Attainment, 2018



Source: DEED Unemployment Insurance Claims Statistics, U.S. Census Bureau 2018 American Community Survey

Age

As the state's population continues growing older, the age of workers filing UI claims has also skewed upward over time. The percentage of claims filed by workers aged 50 and over has climbed more than five percentage points over the past decade, while the percentage of claims filed by workers under 30 years of age fell by five percent. In simpler terms, younger workers accounted for one in every five claims filed in 2018, compared to one in every four claims 10 years earlier. In contrast, older workers now comprise 32 percent of total claims, a share that has been steadily swelling each year. The oldest workers have seen the biggest increases (Table 1).

Race and Origin

UI Claims statistics started providing data on race and origin in 2001, adding another dimension to the available demographic characteristics. In 2018, just over 78 percent of all UI claimants in Minnesota were white, with 6.7 percent filed by black or African Americans, and 4.6 percent of claimants reporting Hispanic or Latino ethnicity.

Fortunately, claims activity has dropped significantly for every race group over the past 10 years. In fact, the 13,167 claims reported for black or African American workers and the 3,785 claims filed by Asian workers in 2018 was the lowest number reported since data became available in 2001, while the 2,588 claims posted for American Indians was the second lowest ever. The 9,042 claims filed by Hispanic or Latino workers was the fourth lowest since 2001. However, it is interesting to note that the drop in the number of claims was slower for all other race groups other than white, with the exception of a 68 percent decline for Asian workers (Table 2).

Making Sense of It All

Historically low levels of unemployment insurance activity suggest that Minnesota's economy is strong and Minnesota's labor force continues to be in high demand. In the buildup to the 2001 and 2009 recessions, UI claims increased significantly in all nine months compared to the prior year, whereas claims filed were up year-over-year in only three of the first nine months of 2019, and in numbers that were barely perceptible (Figure 5).

Thankfully, the need for unemployment insurance is low across the board regardless

Table 1. Percent of UI Claims Filed in Minnesota by Age, 2009-2018

	2009	2018
Under age 22	4.3%	3.0%
Age 22 to 29	21.1%	17.4%
Age 30 to 39	22.5%	24.6%
Age 40 to 49	23.8%	19.9%
Age 50 to 59	20.4%	21.6%
Age 60 to 64	4.5%	7.1%
Age 65 & over	1.7%	3.1%
Info. Not Available	1.7%	3.4%

Source: DEED Unemployment Insurance Claims Statistics

Table 2. Number of UI Claims Filed in Minnesota by Race and Origin, 2009-2018

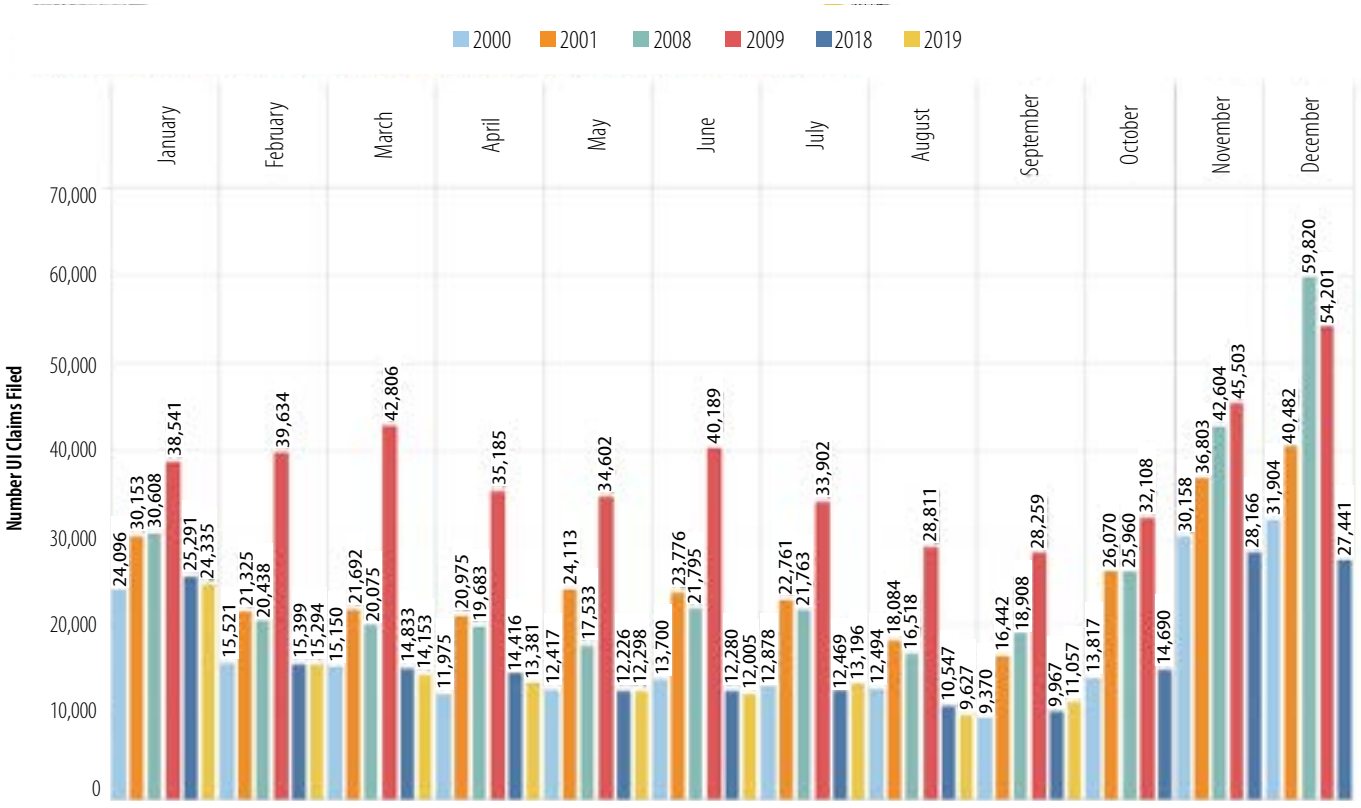
	2009		2018		2009-2018
	Claims	Percent	Claims	Percent	Change
White	376,117	82.9%	154,502	78.1%	-58.9%
Black or African American	25,312	5.6%	13,167	6.7%	-48.0%
American Indian or Alaska Native	4,563	1.0%	2,588	1.3%	-43.3%
Asian	11,917	2.6%	3,785	1.9%	-68.2%
Native Hawaiian/Pacific Islander	847	0.2%	400	0.2%	-52.8%
Race Unknown	34,982	7.7%	23,281	11.8%	-33.4%
Total Claims	**453,738**	**100.0%**	**197,723**	**100.0%**	**-56.4%**
Hispanic or Latino	14,775	3.3%	9,042	4.6%	-38.8%
Not Hispanic or Latino	387,357	85.4%	165,090	83.5%	-57.4%
Ethnicity Unknown	51,609	11.4%	23,593	11.9%	-54.3%

Source: DEED Unemployment Insurance Claims Statistics

of industry or demographic characteristic. Data show historically low levels of claims activity for whites, black or African Americans, American Indians, and Asians. Both young and old workers have benefited from the strong economy, though the percentage of claims filed by older workers is increasing as the state's population ages. Likewise, workers of all educational levels have seen lower layoff levels over the past 10 years.

Because they are produced monthly and are directly tied to the employment status of workers, UI claims statistics provide an immediate indicator of economic changes. If claims activity starts to rise, DEED can use this information to identify what age groups, gender, race, occupations, industries, or geographic locations are getting hit the hardest. Understanding UI is a benefit to us all.

Figure 5. Number of Unemployment Insurance Claims Filed in Minnesota by Month



Source: DEED Unemployment Insurance Claims Statistics

Nick Dobbins

High Wage Workers in Minnesota

Million-dollar employees in Minnesota make over 3 percent of all wages.

In 2018, 2,343 people in Minnesota were paid $1 million dollars or more in wages. While these million-dollar workers represented just 0.08 percent of the total jobs in the state, they accounted for 3.32 percent of all wages paid. Using DEED's Quarterly Employment Demographics data, this article will look at those Minnesotans who were paid over a million dollars, exploring who they are, where they work, and how their cohort has changed in the past 15 years.

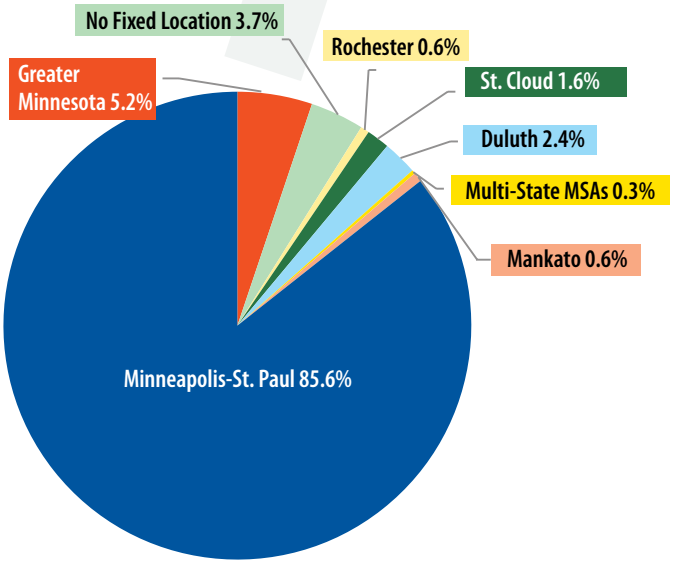
Who They Are

Demographically, most of the million-dollar employees in Minnesota are men, by a margin of 73 percent to 27 percent. While large, this represents a significant closing of the overall gender gap, as the 2003 margin was an even wider 86 percent to 14 percent. The cohort has also gotten older over the past 15 years, as the average age has moved from 49.2 to 52.9 years old.

Geographically, labor in general is concentrated in the metro area. Sixty-five percent of all jobs are in the 11 Minnesota counties of the Minneapolis-St. Paul metropolitan statistical area. As Figure 1 shows, this effect is even more pronounced at the highest wage levels. Nearly 86 percent of million-dollar jobs are in the Twin Cities metro. That number jumps to over 89 percent when we include jobs in the 'no fixed location' classification, most of which are in either Wholesale Trade or Consulting Services and take place at a variety of locations but are likely primarily located in the metro.

While just 2,343 Minnesotans were paid over a million

Figure 1. Million-Dollar Employees by Geographic Location of Employment, 2018



Source: DEED Quarterly Employment Demographics

dollars in 2018, this represents significant growth over previous years. In 2003, only 878 people made the cut, and they collected 1.9 percent of the total wages paid. The number of people and the proportion of all wages, in this employment cohort, have been on a relatively consistent upward trajectory for the past 15 years, save for a dip surrounding the 2009-10 recession.

These well-paid employees also tend to be distributed even higher on the wage curve than the relatively arbitrary cutoff might suggest. While we refer to them as 'million-dollar employees' here, their average wage was over $2.37 million, with a median wage of $1.47 million. Moving even higher up the distribution, 59 Minnesotans were paid more than $10 million. Their combined pay represented 0.6 percent of all wages paid in the state in 2018.

What They Do

Million-dollar jobs are concentrated in a small number of industries. As Figure 2 shows, over half could be found in one of three groups: Finance and Insurance (23.2 percent), Management of Companies (17.5 percent), and Professional, Scientific, and Technical Services (13.2 percent).

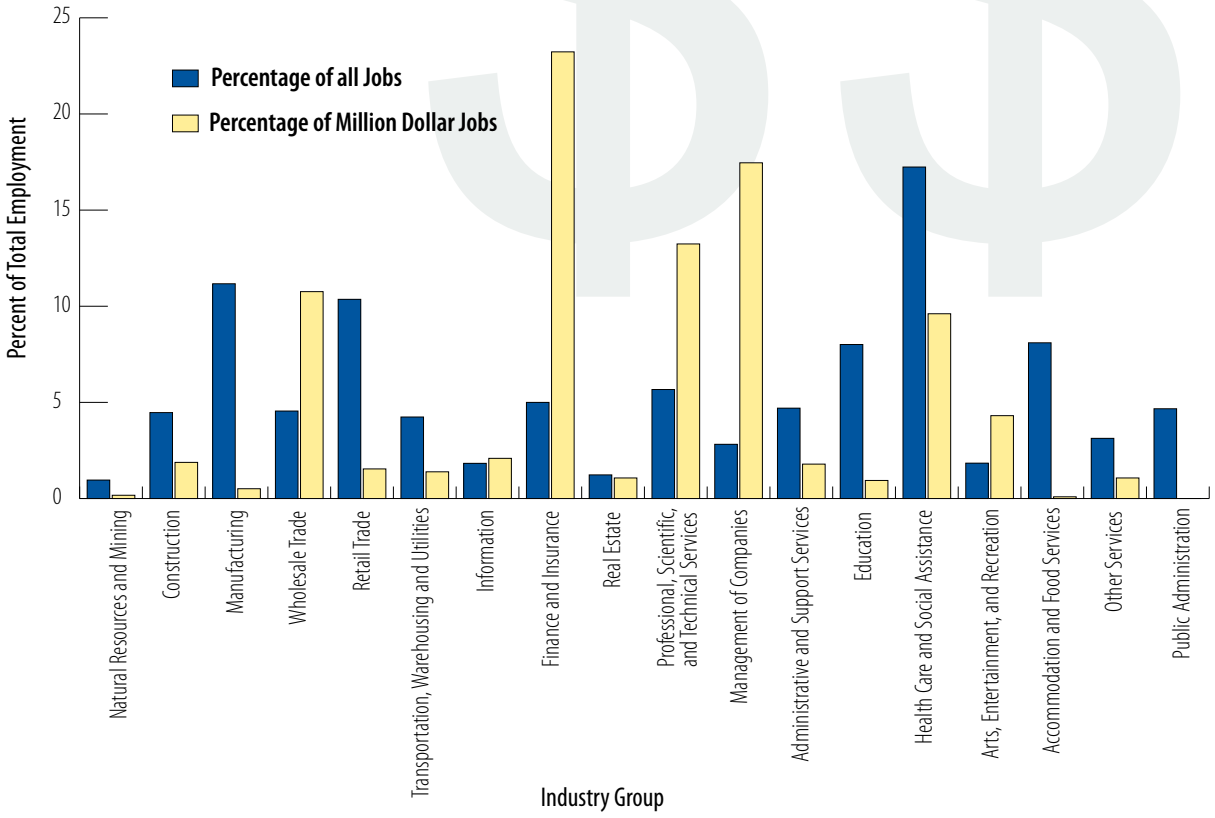
The source of the largesse in two of these is clear. The Finance and Insurance industry group includes banks, investment and brokerage firms, and other organizations that manage large sums of money for clients, and they are evidently highly compensated for it. Management of Companies clearly involves firms primarily engaged in managing companies, which includes corporate headquarters. Minnesota is home to the headquarters of several large corporations, including 19 members of the 2018 Fortune 500. It's likely you would find several c-suite employees from those firms among the million-dollar employees.

The source of high-wage jobs in Professional, Scientific, and Technical Services, is less obvious. While the industry group is home to engineering, law, architectural, and accounting firms, none of those industries contributed greatly to this cohort. The plurality of people on our list from the Professional, Scientific, and Technical Services group is found in the relatively small Management Consulting Services industry. While the industry has rapidly expanded in the past 15 years, more than doubling its employment in that time, it still accounts for less than one percent of all jobs, but 5.7 percent of million-dollar jobs.

Of the 18 industry groups included here, 12 contributed proportionally fewer million-dollar jobs than total jobs. Some of the largest disparities came in the largest industry groups. Manufacturing, Retail Trade, and Accommodation and Food Services accounted for 11.2, 10.4, and 8.1 percent of all jobs in the state, respectively. The same three industry groups contributed just 0.5, 1.5, and 0.09 percent of million-dollar jobs, respectively.

While the public sector accounts for over 13 percent of all jobs in the state (or 384,615 jobs), only eight government employees qualified for this list. None were found in the Public Administration industry group, making it the only one in the state without representation on this list.

Figure 2. All Employment and Million-Dollar Employment by Industry Group, Minnesota, 2018



Source: DEED Quarterly Employment Demographics and Quarterly Census of Employment and Wages

Alessia Leibert

Most In-Demand Skills in Manufacturing

Lack of general mechanical aptitude – sometimes the basic ability to use hand tools – leaves manufacturers in a quandary.

In the 2019 Minnesota Hiring Difficulties Survey, manufacturing employers attributed one out of three hard-to-fill vacancies (34 percent) to skills gaps, a lack of skills in applicants. Hard-to-fill occupations, due to skills gaps, were Quality Technicians, Machinists, and CNC Machinists/Machine Tool Programmers (Table 1). These occupations have become more skilled and specialized as a result of automated technologies, but workforce skills haven't kept up. In contrast, Machinery Maintenance Workers, Industrial Machinery Mechanics, and CNC Machine Operators had a low incidence of skills gaps because they are becoming less skilled – and less in demand – as more complex tasks are being performed by machines. Table 1 also shows that most of these occupations require on-the-job training, either medium-term (more than one month and up to 12 months) or long-term (more than 12 months).

Which Skills are Hardest to Find?

By far the biggest gap identified in job applicants is general mechanical aptitude, sometimes as basic as the ability to use hand tools such as a drill or a screwdriver. Some employers would be willing to hire people straight out of high school if they had mechanical aptitude. Respondents characterized this gap as generational: Younger generations have not grown up tinkering and fixing things as a hobby like previous generations. Another hard-to-find skill set is math, especially trigonometry, algebra, and geometry. The disappearance of vocational and technical training from high school also contributed to youths' lack of exposure to the use of tools, measuring equipment, machine shop math, and hands-on problem solving.

Mechanical skills, in particular, are integral to new manufacturing technologies. They are required to understand what is happening under the automation, such as setting up the automation, repairing and maintaining the machines, and understanding the properties of materials.

These responses illustrate the mix of skills that employers report as hardest to find:

"It would be helpful if more applicants had a hobby with cars or fixing things."

"Some of the applicants don't even know what a drill is. In this position, it is a skill set."

"The younger generation is not as mechanically inclined, so they require extra training when they are hired."

"The work requires someone very mechanically inclined. It's a lot of math and problem solving. Finding somebody that has that tenacity to work through it is tough. Our products are not standardized. New issues emerge that require problem solving."

"A lot of applicants are just operators, they push the button and the machine goes. With set-up there may be some programming involved, editing, or understanding the entire process of using the machine to check the part and reading/understanding the data related to setting up the part."

The survey also asked employers if skilled production staff have any gaps in skills or knowledge that would benefit from additional training. The skills most in need of improvement are developed through work experience, while a minority are deemed well suited for classroom delivery. Among the latter, English as a Second Language was mentioned by employers who hire from the immigrant community.

Here are some examples:

"Our newest employees would benefit from going through our own on-the-job training and learning our specialized attachments."

"We would need more robotics training through train the trainer, not needing to go back to school for. We would have somebody from our site go and learn the skill and then come back and train the staff."

"I cross-train them in-house. A person is used to operating a lathe but doesn't operate a mill, so I will put them through running a mill so they learn that, too."

"Some of our employees have not gone to school to be a welder or machinist. We've thought about getting them some blueprint reading/training, some math classes that the machinists would need."

Table 1. Role of Skills Gaps in Hiring Difficulties by Occupation

Occupation	Percent in which skills gaps are the biggest problem when hiring (1)	Most common training required (2)	Most typical on-the-job training needed for competency (2)
Quality Technicians/Inspectors (SOC 519061)	88%	High school diploma or equivalent	Moderate-term on-the-job training
Tool and Die Makers (SOC 514111)	78%	Vocational certificate	Long-term on-the-job training
Machinists and CNC Machinists/Machine Tool Programmers (SOC 514012 and 514041)	60%	Vocational certificate	Long-term on-the-job training
Welders (SOC 514122)	36%	High school diploma or equivalent	Moderate-term on-the-job training
Miscellaneous Engineering Technicians (SOC 173013, 173023, and 173024)	31%	Associate degree	None
Machinery Maintenance Workers and Industrial Machinery Mechanics (SOC 499041 and 499043)	22%	High school diploma or equivalent	Moderate-term on-the-job training
CNC Machine Operators (SOC 514011)	15%	High school diploma or equivalent	Moderate-term on-the-job training

(1) 2019 Minnesota Hiring Difficulties Survey.
(2) On-the-job training includes employer-sponsored training programs. Source: Bureau of Labor Statistics Education and Training measures www.bls.gov/emp/tables/education-and-training-by-occupation.htm

Study Design: This study leverages spring 2018 Minnesota Job Vacancy Survey results. A subset of reported vacancies was selected for further study based on occupation and industry. For all selected vacancies, the research team made follow-up phone calls to employers to ask about their experiences filling these vacancies. In total, 146 establishments out of the 217 sampled responded to the follow-up telephone survey, representing a 67 percent response rate.[1] Survey findings are summarized in this Trends article mn.gov/deed/newscenter/publications/trends/september-2019/mfg-hiring-difficulties.jsp.

[1]Results and detailed methodology from previous rounds of the survey are available on DEED's website at mn.gov/deed/data/lmi-reports/hiring-difficulties-mn/ Comprehensive information about the JVS methodology is available at mn.gov/deed/data/data-tools/job-vacancy/jvs-methodology.jsp.

"The staff would benefit from English as a Second Language training. That is the biggest obstacle we have."

"Machinists could use skilled training on learning things like programming and keeping up-to-date with newer machines. We bring in a new machine every year to be more up with what we have in our machine shop. We offer training on how to program the new machines."

Table 2 summarizes the skills most frequently lacking in candidates or in current workers in skilled production.

As low-skilled manufacturing jobs (such as assemblers and operators) are replaced with higher-skilled jobs, mechanical and math skills will continue to be the foundation upon which emerging skill sets are built, such as machine learning and robotics. We won't be able to upskill the workforce or train new workers in emerging job roles if we fail to develop math and mechanical skills from an early age.

Whose Job is it to Fill Skills Gaps?

How can the skills (Table 2) be developed? According to survey results, expanding manufacturing-related vocational and associate degree programs, especially in Greater Minnesota[2] would help mitigate workforce shortages in occupations listed in Table 1 as requiring post-secondary training. However, employers also made it very clear that increasing post-secondary training is not enough. As the following responses indicate, lack of experience could still be a barrier to hiring even if candidates have good educational credentials:

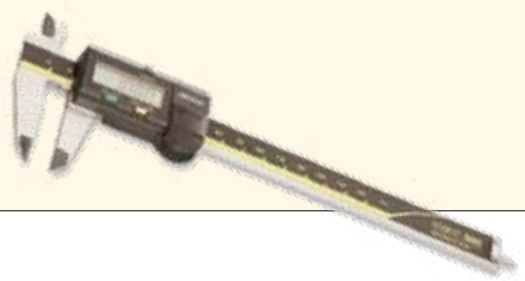
"Experience is lacking, not post-secondary training. Each brand of machine does a little bit different style of offset. People who are applying seemed like they had only seen a CNC Machine but never had a whole lot of experience with one."

"The quality control inspector job requires specialized experience more than any type of degree. The specialized experience is developed here as an operator."

"We have trouble finding candidates with previous experience working on a Swiss machine. Those machines are not very common, so finding someone who has worked on that machine before is tough."

[2]DEED's Occupations In Demand tool shows that only two schools offer a program in Tool and Die Making in the entire state (https://apps.deed.state.mn.us/lmi/oid/CIP_SchoolDetail.aspx?id=514111&geog=2701000000) and no program for CNC Machining exists in Northwest Minnesota (see https://apps.deed.state.mn.us/lmi/oid/CIP_SchoolDetail.aspx?id=514012&geog=2701000000)

Table 2: Skills/Knowledge/Experience Shortage Areas

Lacking in applicants	Lacking in workforce
Degrees or Certifications: Machining and CNC Machining Vocational degree, Machine Tool Technology Vocational degree; any degree in Mechatronics and Robotics; boiler operator license; welding certificate **Knowledge:** Manufacturing math, especially trigonometry and algebra; blueprint reading; hydraulics, pneumatics, and electronics (logic controls); special machine language codes (especially G and M code)	**Most Commonly Cited Training Needed:** 6G welding certification; CWI (Certified Welding Inspector) certification; Computer-Aided Design classes; machine shop courses to keep up-to-date with newer machines; general math, algebra training; English as a Second Language; computer programming
Skills best developed on the job: • Mechanical training, including use of hand tools and power tools (i.e., drills, press, etc.) • Read and understand proper use of measuring equipment (microscopes, micrometer, gauges, calipers) • Geometric Dimensioning and Tolerancing (GD&T) experience • Welding, both general and precision welding • Operate Computer-Aided Design (CAD) software and convert designs into computer-aided manufacturing (CAM) programs • Experience with industrial manufacturing equipment such as motors and controls, including ability to assess, diagnose, and repair machinery such as CNC machines, industrial robotics components, electrical equipment, pneumatic and hydraulic equipment • Experience building fixtures (devices that hold metal while it is bored, stamped, or drilled) • Robotics and mechatronics skills (mechanical and electronics) • Experience building and repairing tools from blueprints • Experience running or programming a CMM (Coordinate Measuring Machine) to inspect parts • Experience with multi-axis milling and lathe	**Skills best developed on the job:** • General mechanical knowledge and abilities • Blueprint reading • Tool and safety training • Use of inspection equipment/tools such as calipers, drop indicators, micrometers and pin gauges; experience measuring and interpreting quality metrics • Soldering and welding • Robotics • Experience with Programmable Logic Controls • Able to adapt to different coding language platforms • Able to adapt to a variety of machines, such as lathe and mill machines • LEAN or continuous improvement 

Identifying skills needs and determining the best training delivery methods are daunting tasks in today's manufacturing firms. Skill requirements are becoming more STEM-like and multi-disciplinary, not only because IT skills have been added to the daily work, but also because of changing technologies. Many job postings reviewed in this study require a mix of skill sets traditionally acquired through separate educational tracks, making it harder for employers to find post-secondary programs that meet all of their needs. A machinist today might be expected to perform manual machining as well as computer-aided machining, work on a variety of machines, do preventive maintenance, inspect and monitor quality, and participate in product design decisions alongside engineers. CNC programmers are expected to learn more about the machining side of the work. Manufacturing technicians and quality inspectors are often required to know how to operate and program CNC machines to inspect quality. The ideal training would teach programming, knowledge of mechanical and electrical principles, knowledge of quality measurement and reading data for process improvement purposes, problem-solving, and occasionally project management.

Rapidly changing technologies make it very hard for employers to accurately identify and draw the talent they need. Since every market is impacted differently, employers are on their own when it comes to determining which skills can be taught internally and which are best taught in post-secondary school. For example, when hiring a machinist, some employers only want a high school diploma while others require a degree. And, of those who require only a high school diploma, some complain about not finding candidates with formal post-secondary credentials.

The absence of an industry-recognized standard to certify competency levels in machining-related occupations compounds the problem. One of the few existing industry-recognized credentials, the National Institute for Metalworking Skills (NIMS) Credentialing program, is considered inadequate by some employers because it only measures foundational knowledge, and the exams contain errors and obsolete practices. Therefore, efforts should not be limited to designing high-quality certification standards that employers can agree upon but should include frequent updates to ensure their relevance.

While employers understand the importance of their relationship with local colleges and high schools, working out the terms of partnerships takes time and effort. The following

response illustrates how hard and time-consuming it can be for employers to identify competencies and educational requirements for a CNC machinist:

> "We tried to implement a part-time apprenticeship program that lasted three years and was a hybrid between on-the-job training and getting the full degree. However, at the end of the program we determined that it was not the best way to develop the skills we need. We realized that a full CNC machinist has to have the two-year degree. Our interns that go through the formal Machine Tool two-year degree program receive better quality instruction. Therefore, we are now offering tuition reimbursement to people willing to actually get the two-year Machine Tool degree or Mechatronics degree."

Unless employers can clearly identify their skills needs and types of training to acquire them, they will struggle to communicate their needs not only to job seekers but to vocational training institutions.

Filling Skills Gaps: Best Practices

The survey asked employers what they've done in response to hiring difficulties. The most effective strategies address the disincentives employers face in delivering on-the-job training. Here are some steps Minnesota manufacturers are taking to bridge skills shortages before they turn into full-blown hiring difficulties:

- Promote high school summer internships to encourage young people to pursue careers and training in manufacturing. This helps employers by creating a pool of experienced candidates;
- Partner with local technical schools by offering internships and work-based learning opportunities for students early in the program. Developing a relationship with post-secondary institutions could lead to collaboration on updating the curriculum with industry-approved competency standards, which is essential to improving alignment between school offerings and employer needs;
- Improve internal training by assessing skills needs, training the trainers, and investing in equipment – such as welding and machining laboratories – to simulate the work environment and prepare new hires;
- Improve employee retention through enhanced training for new hires, offering career ladder opportunities, and linking skills mastery to pay raises;
- Make use of state-funded programs, especially the Minnesota Apprenticeship Initiative[3] (MAI), which offers grants to assist with the costs of developing apprenticeship programs, and the Pipeline Training program[4], which supports work-based training combined with classroom training through a partner college.

[3]This program, funded by the Minnesota Department of Employment and Economic Development and the Minnesota Department of Labor and Industry, offers grants to assist employers with costs associated with developing apprenticeship programs. The goal is to get 100 companies to hire 1,000 apprentices by the end of 2020. www.dli.mn.gov/mai

[4]This program, funded by the Minnesota Department of Labor and Industry, supports employers in delivering work-based training together with classroom training through a partner college. Employers can hire students enrolled in trades-related post-secondary programs and provide them with OJT that relates to what they are studying. Employers also reimburse the cost of their tuition, with part of this funding coming from the state via a grant. The company agrees to offer participants a full-time position upon completion of their degree. In return, the students agree to work for the company for two years. The program also provides technical assistance to help employers identify internal skill needs and design delivery methods. www.dli.mn.gov/pipeline

Conclusions

Manufacturing offers well-paying jobs that require only a high school diploma or short-term post-secondary training. With the rising cost of college, more should be done to connect high school students to excellent opportunities in manufacturing, including access to an affordable college education, technical skills acquisition and the potential for career advancement.

But despite these advantages, the talent pipeline is shrinking faster than the system's ability to build it. A coordinated response is needed at three levels: middle and high school, two-year post-secondary and trade schools, and businesses. Here are actions that could be effective at each level:

1. High schools can equip students with foundational skills, such as mechanical and math skills, computer coding, and problem solving. Since these competencies are essential in many industries and careers, school counselors and parents should be persuaded of their value.

More investments are needed to make Career and Technical Education more academically rigorous and to expand opportunities to combine classroom and workplace experience.

2. Post-secondary schools can design more inter-disciplinary curricula aligned with emerging skill requirements. Schools could coordinate with employers to offer students opportunities to work while they are in school. The guarantee of a full-time job at the end of the program is a powerful incentive for prospective students.

3. Employers are in the best position to identify and teach specific skills. Making employer-sponsored training more effective can improve retention, enabling firms to promote from within.

Without greater investment and collaboration, employers will have more difficulty and face more costs meeting their skill needs, especially in industry sectors and regions where retirements hit the hardest. A concerted effort must be undertaken to grow the talent needed to keep Minnesota manufacturing at the cutting edge of technology.

Steve Hine

Measuring Alignment Between Post-secondary Graduates and Employment Opportunities

The key to understanding causes and magnitudes of education and employment imbalances.

Introduction

A question of vital importance is whether post-secondary graduates are coming out of school with credentials that position them for employment success. From the students' perspective, this is an important concern when tuition levels and student debt burdens are rising, but many find their employment opportunities limited by having majored in something employers aren't searching for.

On the other side of that coin, employers are stymied in their hiring and expansion efforts when the available pool of candidates don't have the educational background they seek. Program planners at post-secondary institutions trying to calibrate instructional offerings in the face of tightening budgets need to know where to put their school's resources. And from a public policy perspective where educational spending is significant and where it is important that tax dollars yield the best return, instructional offerings should align with employment opportunities available to graduates. Obviously, it's important that we get this right.

Measuring alignment between the post-secondary credentials held by a given cohort of students and the employment opportunities available to them requires that we develop measures of demand for these newly credentialed individuals. Thus far, common practice has been to use some measure of future occupational employment as proxy for the demand for newly minted graduates. In a 2017 survey of state workforce agencies, 35 of 51 states (including the District of Columbia) use projected net occupational growth rates, and 41 states used projected job openings generated by net growth and permanent exits as at least part of the measurement of post-secondary credential demand.

Neither of these measures, however, can filter out only those openings that are available to new graduates. Net job growth takes no account of the much larger set of openings created as incumbent workers retire or transition into other occupations, and total exits overstate opportunities of new graduates to the extent that experienced incumbent workers are available to fill these openings.

Here we describe our effort to develop an annual count of occupational openings that will be available to new graduates after accounting for inter-occupational transfers of incumbent workers that have

a competitive advantage over new graduates due to their work experience. This then provides an annual count, by occupation, of the number of new graduates required to fill these available openings.

On the supply side, we use annual counts of graduates from Minnesota post-secondary institutions by major and award level from the Integrated Postsecondary Education Data System (IPEDS)[1]. This presents another challenge since our demand side measure, the number of employment opportunities, is in the Standard Occupational Classification (SOC) taxonomy while students' majors on the supply side are reported by Classification of Instructional Programs (CIP) codes. To overcome this, we augment the standard CIP-SOC crosswalk[2] and then allocate CIP graduates across their available SOC openings in proportion to the number of openings available. The result is an annual count by SOC of both openings available to new graduates and the new graduates themselves available to fill them. By reversal of the application of the CIP-SOC crosswalk, we also produce annual counts by CIP major and the number of openings available to graduates of each CIP major.

Challenges inherent in this crosswalk between majors by award level and occupations create some notable qualifications to the set of results available. At the vocational certificate and associate of arts award levels, many CIPs have a clear vocational focus and therefore an obvious and limited set of SOCs to which they are related. At the bachelor's degree level, many majors have more ambiguous relationships to the occupations that degree holders may be qualified to enter. Work on improvements to the CIP-SOC crosswalk at this award level will continue, but at present the sub-baccalaureate relationships are clearly more reliable. We also disregard graduate level awards in our analysis as holders of these degrees are often entering national-level labor markets rather than statewide, and employers seeking candidates with advanced degrees are more likely to search nationally.

Another important aspect of this alignment is the treatment of award level. We recently published our classification of SOC occupations by educational requirements[3] based on 10 rounds of our bi-annual job vacancy survey. We use this classification and the award level provided by IPEDS to limit the allocation of graduates to occupations that have the

[1]See https://nces.ed.gov/ipeds/use-the-data/download-access-database for data downloads.
[2]Available at https://nces.ed.gov/ipeds/cipcode/resources.aspx?y=55.
[3]mn.gov/deed/data/data-tools/educational-requirements-occupations/

required educational level.

We note too that many students graduate with degrees in their major that exceed the award level 'required' by occupations that they may pursue. As an example, CIP 51.3901, "Licensed Practical/Vocational Nurse Training" prepares students to be an LPN (SOC 29-2061) which is an occupation requiring a vocational certificate as an adequate degree. And while 2,164 of the 2,295 of the graduates of this program did indeed receive vocational certificates, the other 134 were awarded associate degrees. While this 'extra' education may provide a competitive advantage to the recipient, for our purposes we consider this a misalignment and limit our attention to that between an occupation and the program and award level combination required of the occupation. By doing so, we can better align the public and private resources committed to education and the credentials required of those pursuing their education.

There are a number of occupations, currently 52 of the 685 in Minnesota's economy, that we combine into a catch-all 'small occupations' group, either because they are too small to provide reliable employment and growth estimates, or because they simply don't appear in the ASEC-based transition matrix. We also exclude 41 'All Other' SOC codes (e.g. SOC 31-9099, Healthcare Support Workers, All Other) that capture related employment not fitting clearly into any single detailed occupation, and thus not having any obvious or single educational requirement. As a result, not all occupational opportunities are tabulated – some small occupations and some newly emerging occupations that have not yet been classified as their own detailed occupation will not necessarily be found in these results.

We point out lastly that these occupational opportunities and educational outcomes are aggregated to the statewide level, even though we realize that many decisions are made at a more local level. This leaves open the likelihood that in some localities, a shortage of available graduates with certain credentials may exist even when there exists a surplus at the statewide level.

While our intention is to measure alignment between educational outcomes and employment opportunities, educational decisions are based on various other considerations besides just the job prospects upon completion (although that's likely to be near the top in most peoples' calculus). However, given the resource considerations mentioned above, and the relative scarcity of workers that is likely to persist for the next decade or more, it is beneficial to understand the causes and magnitudes of imbalances between education and employment.

Estimating Inter-Occupational Transfers and Demand for New Graduates

Every March, the monthly Current Population Survey includes an Annual Social and Economic Supplement (ASEC)[4] that asks, among other things, about the respondents' occupation of employment in both the current and previous year. We use seven years (2013-2019) of responses to these questions to estimate national transition rates between occupations, as well as between occupations and into and out of the labor force, including those that report being outside the labor market and in school in the previous year before entering their occupation of employment in the current year.

[4]See www.census.gov/programs-surveys/saipe/guidance/model-input-data/cpsasec.html. Public use microdata from ASEC is accessed through the University of Minnesota's IPUMS site at https://cps.ipums.org/cps/.

Applying these inter-occupational transition rates to current occupational employment estimates for Minnesota then yields estimates of the number of our workers flowing from one occupation to another. One-year-ahead occupational employment projections are then applied, and proportional iterative ranking procedures are used to estimate flows of workers that are consistent with Minnesota's occupational employment distribution and annual growth, with each cell *XY* being the number of individuals leaving occupation *X* in period t for occupation *Y* in period *t+1*.

As an example, consider the various estimated flows for Database Administrators (SOC 15-1141). There were 2,460 DBAs employed in 2018, and of these, 2,035 remained employed as DBAs in 2019. Over the year, 11 DBAs left the workforce, 414 transitioned into other jobs, and there was a projected growth of 14 additional DBA jobs, thus creating a total of 439 openings for DBAs during the year.

Of these, 301 openings were filled by transitions in from other occupations that require the same or higher level of education (or from 'All Other' categories for which education is undefined), and 44 openings were filled by individuals entering or returning to the workforce after having reported that they did not work the previous year.

Another 88 DBA openings were filled by people transitioning from occupations requiring less education. Although the ASEC does not ask about schooling activities of those that are employed, we assume that in order to make such a transition, these individuals were among post-secondary attendees that work simultaneously.

Thus, these 88 openings are among those available to new graduates of programs that prepare students for this occupation. An additional six previous non-participants entered DBA jobs after reporting school attendance the previous year. These, therefore, are also considered opportunities available to new graduates, as are the additional 14 growth openings, for a total of 108 opportunities available to post-secondary completers during the year.

On the CIP-based supply side of the market for DBAs, our augmented CIP-SOC crosswalk identifies eight CIP majors producing 1,466 bachelor's degree graduates that provide the educational background required to be a DBA. However, these CIPs also provide the background needed to qualify for other IT-related occupations.

We distribute each CIP's graduates across their related occupations in proportion to the number of openings available in these occupations, essentially assuming that all candidates with appropriate training have equal chances of filling an opening. By summing across all CIPs that 'feed' each SOC, we estimate that 89 new graduates of appropriate CIPs are available to fill the 108 DBA openings available to them.

Conducting this exercise for each occupation for which there are adequate data, we can compile a ranking of occupations by the shortage or surplus of new post-secondary completers relative to the opportunities available to them.

Interpreting Results

Table 1 provides information on 30 of the 37 occupations classified as requiring a vocational certificate[5], while Table 2 covers 28 of the 38 AA-requiring occupations[6]. Nearly half of the occupations, 13 of the 30, in Table 1 are installation, maintenance and repair occupations, but nearly half (47.4 percent) of the demand for new graduates are for those in the health care practitioner or health care support occupations. Another 12 of the 28 AA occupations are health care-related, and these account for two-thirds of the demand for

Table 1. Occupations Requiring Vocational Certificate

	Annual Demand	Annual Supply	Shortage/ Surplus(-)
Nursing Assistants	5,365	3,460	1,905
Machinists	1,642	138	1,504
Automotive Service Technicians and Mechanics	1,354	447	907
Hairdressers, Hairstylists, and Cosmetologists	2,014	1,280	734
Industrial Machinery Mechanics	694	90	604
Mobile Heavy Equipment Mechanics, Except Engines	473	75	398
Manicurists and Pedicurists	435	56	379
Electricians	574	222	352
Medical Records and Health Information Technicians	334	8	326
Dental Assistants	682	382	300
Farm Equipment Mechanics and Service Technicians	200	32	168
Aircraft Mechanics and Service Technicians	220	59	161
Tool and Die Makers	157	-	157
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	529	392	137
Forest and Conservation Technicians	126	-	126
Emergency Medical Technicians and Paramedics	452	374	78
Outdoor Power Equipment and Other Small Engine Mechanics	125	79	46
Electric Motor, Power Tool, and Related Repairers	95	60	35
Wind Turbine Service Technicians	38	19	18
Electronic Equipment Installers and Repairers, Motor Vehicles	20	9	11
Motorcycle Mechanics	29	18	11
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	3	2	2
Camera and Photographic Equipment Repairers	3	2	1
Electrical and Electronics Repairers, Commercial and Industrial Equipment	33	37	(4)
Massage Therapists	336	350	(14)
Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	308	329	(21)
Court Reporters	69	186	(117)
Skincare Specialists	222	544	(322)
Medical Transcriptionists	151	544	(392)
Licensed Practical and Licensed Vocational Nurses	1,117	2,164	(1,047)

Source: Author's calculations

[5]Those missing are barbers, ship engineers, embalmers, commercial divers, avionic technicians, auto damage insurance appraisers, and transportation equipment electrical and electronics installers and repairers.
[6]Missing are geological and petroleum technicians, nuclear technicians, air traffic controllers, aerospace engineering technicians, radio and cellular tower equipment installers, agricultural inspectors, transit police, fish and game wardens, nuclear medicine technologists, and mechanical engineering technologists.

Table 2. Occupations Requiring Associate Degree

	Annual Demand	Annual Supply	Shortage/ Surplus(-)
Veterinary Technologists and Technicians	676	115	561
Dental Hygienists	574	131	443
Radiologic Technologists	573	132	441
Paralegals and Legal Assistants	571	139	432
Surgical Technologists	510	114	396
Medical and Clinical Laboratory Technicians	498	160	338
Physical Therapist Assistants	420	95	325
Medical Equipment Repairers	214	43	171
Computer User Support Specialists	689	524	164
Industrial Engineering Technicians	209	55	154
Civil Engineering Technicians	213	64	149
Electrical and Electronics Engineering Technicians	171	53	118
Cardiovascular Technologists and Technicians	96	13	83
Diagnostic Medical Sonographers	171	104	67
Magnetic Resonance Imaging Technologists	69	16	53
Computer Network Support Specialists	97	74	23
Electrical and Electronics Drafters	14	17	(3)
Occupational Therapy Assistants	114	121	(7)
Environmental Engineering Technicians	24	32	(8)
Desktop Publishers	24	41	(17)
Mechanical Drafters	77	94	(18)
Fire Inspectors and Investigators	6	24	(18)
Architectural and Civil Drafters	95	117	(22)
Respiratory Therapists	23	49	(26)
Radiation Therapists	9	74	(65)
Police and Sheriff's Patrol Officers	505	631	(126)
Electro-Mechanical Technicians	19	240	(221)
Registered Nurses	2,061	2,326	(265)

Source: Author's calculations

these associate degree graduates, followed by eight engineering technician occupations, totaling 9.4 percent of demand.

While health care-related occupations dominate the occupations on the list and account for most of the demand for new graduates at these award levels, they are also often the occupations exhibiting the greatest degree of misalignment relative to the courses of study graduates are coming from. Most obviously, while nursing assistants shows a significant shortage with just over 1,900 more occupational opportunities than there are graduates preparing for them, LPN training programs are graduating over 1,000 more students than are required. At the associate of arts level, registered nurses show the greatest surplus of graduates despite also being the occupation with the most employment opportunities for their graduates by a multiple of three over computer user support specialists and vet techs. To understand this, Table 3 presents the flows into and out of these three nursing occupations.

Between the transitions out of each of these occupations into other occupations and the exits from the labor market altogether, it is striking that nursing assistants experience a 25.5 percent rate of turnover each year, with LPNs faring somewhat better at 16.9 percent, while RNs experience much less turnover at 5.9 percent. In fact, despite having twice the number of workers, fewer than half as many leave their RN positions each year as leave jobs as nursing assistants. This may not be too surprising considering the much lower wages and less desirable

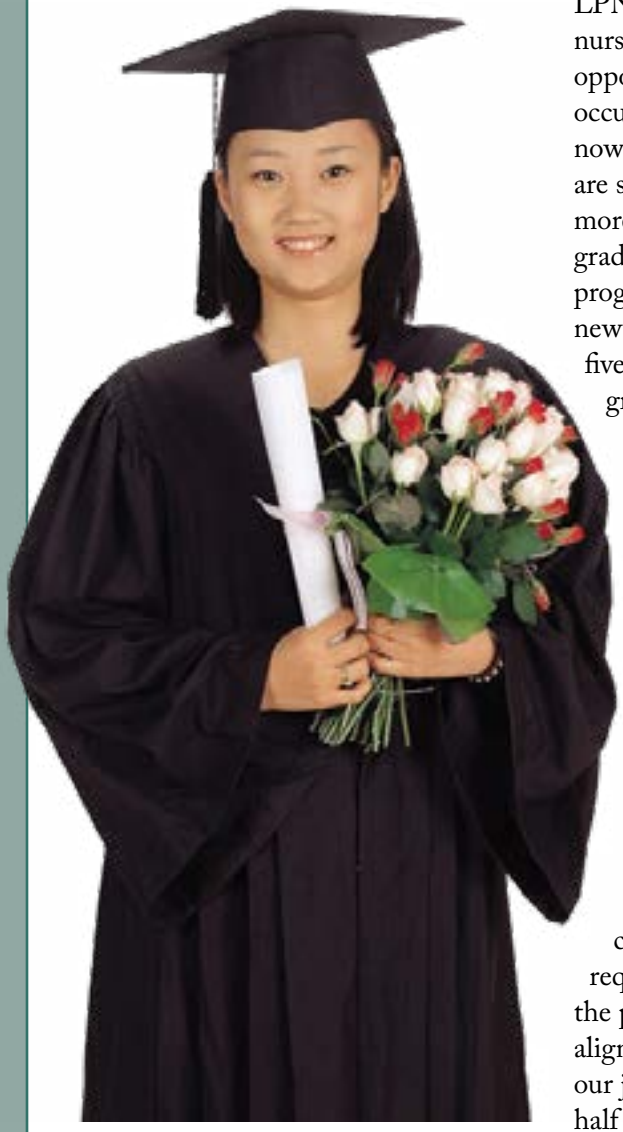
Table 3: Occupational Flows for Select Nursing Occupations

	Nursing Assistants	Licensed Practical/ Vocational Nurses	Registered Nurses
Employment 2018	31,263	17,578	62,257
Occupational Stayers	23,279	14,612	58,594
Inter-Occupational Transfers Out	6,688	2,307	2,227
Labor Force Exits	1,296	659	1,437
Total Exits as Share of Employment	25.5%	16.9%	5.9%
Inter-Occupational Transfers In	784	1,467	1,355
Labor Force Entrants	1,558	452	1,411
Total Entries as Share of Employment	7.5%	10.9%	4.5%
Projected Annual Growth	(16)	116	641
Non-Working Grad Openings	83	119	537
Working Grad Openings	5,298	882	883
Total Grad Openings	5,365	1,117	2,061
Total Graduates	3,460	2,164	2,326
Shortage/Surplus(-)	1,905	(1,047)	(265)

Source: Author's calculations

work tasks seen in nursing assistant jobs.

To further exacerbate this difference, there are more entries from other occupations or from outside the labor force into RN positions each year (2,766) than there are into nursing assistant jobs (2,341) and LPN jobs (1,919). These dynamics of occupational entry and exit create a net 5,643 nursing assistant openings each year through flows of incumbent workers alone but only 897 RN openings and 1,048 net openings for LPNs.



Once we then add openings created through projected occupational growth where RNs add 641 new opportunities, LPNs add 119, while nursing assistants lose 16, the opportunity gap between these occupations is narrowed but nowhere near eliminated. There are still more than 2½ times more opportunities for new graduates of nursing assistant programs than there are for new RN graduates and nearly five times more than for LPN graduates.

When we then compare these opportunities with the number of graduates coming out of school, it becomes clear that we are not producing nursing students with the credentials required by the health care sector in our economy. And this misalignment is, in fact, worse than these numbers suggest. As mentioned, we classify RNs as an occupation requiring an AA degree for the purposes of measuring alignment, but we also find from our job vacancy data that in fact half of the RN positions reported to that survey ask for a bachelor's degree. And indeed, there are another 2,176 graduates of registered nursing programs (CIP 51.3801) that receive a BA degree, and another 162 graduates that receive a master's degree or higher. If we allocate half the 2,061 new graduate openings to BA-level candidates, we then find a surplus of RN graduates of nearly 1,300 at the AA level and another similar surplus at the BA and graduate degree level.

This type of misalignment is not limited to these nursing professions either. Take machinists, for example, a vocational certificate-level occupation that is filled by graduates of two detailed CIPs, Machine Tool Technology/ Machinist (CIP 48.0501) and Machine Shop Technology/ Assistant (CIP 48.0503). The supply of 138 noted in Table 1 comes from the vocational certificate graduates of these two programs, but there are also 37 AA graduates of the machinist program. As noted above, these AA recipients should have some advantage in their pursuit of employment, and it may indeed be the case that some machinist jobs legitimately require that degree level. But as guidance in making resource-constrained decisions, we feel it is appropriate to label these as a misalignment, despite the benefits that might accrue to the

individual holding them.

There are also numerous instances where graduates are coming out with degrees or certificates that fall short of necessary qualifications for the jobs they presumably are preparing for. For example, a major in accounting (CIP 52.0301), by our CIP-SOC crosswalk, prepares students for careers in nine distinct business and financial operations occupations, all nine of which are classified as BA level occupations. However, there were 349 AAs awarded to accounting majors, an award that has no matching opportunities. These may be students who then continue on to pursue that needed BA degree, in which case we capture them as they transition into appropriate employment. But to the extent that this is a terminal degree for any recipient, it is another example of misalignment. Table 4 presents a list of the largest programs that lack a clear occupational outcome.

These examples provide clear-cut cases of numeric misalignment. But as we consider less extreme examples, we recognize that there is no clear point at which we can call an occupation 'in alignment' with its educational pipeline. These data clearly suggest that conditions facing a machinist or a vet tech might suggest such a course of study as a good option for a student to consider or for a post-secondary institution to consider expanding. But should we expand programs to train EMTs and paramedics simply because we estimate a shortage of 78 graduates per year with appropriate training? Or should a student not consider a program training respiratory therapists because our estimates show a surplus of 26 graduates?

These should serve as a guide to decision-making, and in certain instances that guidance is unambiguous. But program enrollment, occupational growth, inter-occupational transitions, and other economic characteristics vary from one year to the next. In addition, the application of national-level transition estimates to our state's labor markets, the uncertainty in occupational projections even just a year ahead, and the inherent imprecision in the links between programs of study and occupational qualifications each introduce uncertainty into this effort. So in many instances, the information here should be considered alongside

Table 4: CIP Grads Where No Occupational Link Exists

	Award Level	Graduates
Liberal Arts and Sciences/Liberal Studies	AA	6,215
Registered Nursing/Registered Nurse	BA	2,176
Psychology, General	BA	1,816
Welding Technology/Welder	Voc Cert	1,089
Criminal Justice/Police Science	Voc Cert	810
Multi-/Interdisciplinary Studies, Other	BA	773
Medical/Clinical Assistant	Voc Cert	706
Accounting Technology/Technician and Bookkeeping	Voc Cert	686
Business Administration and Management, General	AA	654
English Language and Literature, General	BA	578
Construction Trades, General	Voc Cert	562
Farm/Farm and Ranch Management	Voc Cert	518
Mathematics, General	BA	462
Accounting	AA	349
Rhetoric and Composition	BA	326
History, General	BA	312
Electrician	AA	309

Source: Author's calculations

other relevant information as we continue to refine and improve our effort to properly capture the significant impact of occupational dynamics on this question of education and employment alignment.

These results should also make it clear that accounting for inter-occupational dynamics is crucial to properly identifying where the opportunities lie for those looking to choose their educational course of study and to enter the workforce. We frequently emphasize the importance of career ladders' as a crucial component of a successful working life, and nearly 80 percent of open positions are filled by incumbent workers moving from one occupation to the next, often in pursuit of this success. To disregard these dynamics as projected net job growth or total replacement openings do is to distort the information needed to make the best decisions possible when it comes to our education and workforce alignment.

More Results to Come

We mentioned above that through a reversal of our application of the CIP-to-SOC crosswalk, we can readily estimate the alignment of supply and demand by instructional program (CIP) rather than by occupation (SOC). This may be of particular use to post-secondary program planners trying to properly calibrate their school's offerings. In a forthcoming article, we will describe and analyze this alignment by CIP.

This presentation has been limited to the alignment by occupations requiring a vocational certificate or associate degree, in large part because the crosswalk between CIPs and SOCs at the bachelor's level is more equivocal. Nonetheless, we continue to refine these relationships and will provide results at the bachelor's degree level.

Lastly, this presentation just scratches the surface of the information made available by this effort. Much more will soon be available including downloadable data sets. T

The author thanks Matthew Bombyk for his significant effort and contribution to this project.

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