

# Supply and Demand for Middle-Skill Occupations in Rural California in 2018–20

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Expected growth in the population of rural areas of California and in the number of jobs in middle-skill occupations has increased interest in the alignment of middle-skill workforce supply and occupational demand, particularly in rural regions. This study focuses on that alignment in four rural regions of the state: Central Valley and Mother Lode North, Central Valley and Mother Lode South, Northern Coastal, and Northern Inland. Middle-skill occupations are those that require a typical entry-level education greater than a high school diploma but less than a bachelor's degree. The study found that across the four regions combined, nearly 84,000 job openings in middle-skill occupations were projected for each year in 2018–20, or about 31 percent of all job openings in the four regions. The number of jobs was projected to grow in an average of 70 percent of middle-skill occupations. About 90 percent of job openings in middle-skill occupations paid a living wage at entry level in 2017. However, local postsecondary institutions were not producing enough credentialed middle-skill workers to fill projected new jobs and replace workers who retire, change jobs, or otherwise leave their job. Each year in 2014/15–2016/17, postsecondary institutions in the four regions awarded an average of nearly 20,100 middle-skill credentials (a subbaccalaureate credential that is awarded by a postsecondary institution and aligned with a middle-skill occupation). Assuming that the rate of credential awards persisted and that no other supply of middle-skill labor emerged, the average local credential deficit each year in 2018–20 was projected to be 63,665, or 76 percent of projected job openings in middle-skill occupations each year. Only 5 of the 50 most in-demand middle-skill occupations were projected to experience a local credential surplus. The analyses were conducted prior to the COVID-19 pandemic, and the findings do not include its influence on the supply and demand of the middle-skill labor market.

## Why this study?

Expected growth in the population of rural areas of California and in the number of jobs in middle-skill occupations has increased interest among California policymakers and community leaders in the alignment of middle-skill workforce supply and occupational demand, particularly in rural regions. Middle-skill occupations—which generally require education and training beyond a high school diploma but less than a bachelor's degree (see box 1 for definitions of key terms)—are expected to account for as many as 1 million new jobs in the state through 2025 and for an additional 1.4 million job openings to replace current workers (Centers of Excellence, 2015). But if recent projections of workforce supply prove accurate, many of those job openings will not be filled because of a shortage of qualified labor (Centers of Excellence, 2015; Johnson et al., 2015), which could ultimately threaten the state's economy.

The data needed to enable stakeholders to align middle-skill workforce supply and occupational demand by adjusting local education programming to produce graduates with the qualifications for available jobs are often lacking—particularly for rural areas of California.<sup>1</sup> This study addresses that problem by calculating descriptive statistics on measures of middle-skill workforce supply and projected occupational demand in four rural regions of the state—Central Valley and Mother Lode North, Central Valley and Mother Lode South, Northern Coastal, and Northern Inland. Further, data on the average starting salary by occupation are included so that

For additional information, including expanded definitions of key terms, detailed information on data sources, and analysis methods as well as analyses for each of the four regions in the study, access the report appendixes at <https://go.usa.gov/x78gq>.

1. See Goss (2016) and Seronello (2016) on statewide labor market trends.

policymakers can prioritize middle-skill credentials (subbaccalaureate credentials such as associate degrees and vocational certificates in programs of study related to middle-skill occupations) in occupations that pay workers a living wage. Workforce supply is proxied by middle-skill education supply, which is measured by the number of middle-skill credentials awarded by postsecondary institutions in the four regions. Occupational demand is measured by the projected number of job openings in middle-skill occupations. Postsecondary institutions that award middle-skill credentials are an important source of trained labor for middle-skill occupations, especially in rural areas, where education and training options are scarcer than in urban areas (Burke et al., 2015; Hillman & Weichman, 2016; Koricich, 2014).

Combined, the four rural regions in the study were home to more than 5.3 million people in 2017, or 13.5 percent of California's population (figure 1; California Department of Finance, 2018). In 2018–20, the period for which occupational demand is projected in the study, the combined population of the four rural regions was projected to grow by 3.1 percent, or more than 165,000 people.

The middle-skill education and training opportunities to serve this growing rural population varied by region over 2014/15–2016/17, the period for which the study examined labor supply data. Across the four regions 58 postsecondary institutions awarded middle-skill credentials. These include public institutions such as California community colleges as well as private, for-profit postsecondary training institutions that participate in or hope to participate in the federal student financial aid program.

The Regional Educational Laboratory West's California Rural Partnerships (CRP) Alliance was formed to help cross-sector partnerships in rural regions of the state use data to design workforce-aligned education and training opportunities in their communities. These cross-sector partnerships strive to align local education programming with labor market needs but often lack the data and sometimes the capacity to do so. Community colleges and other postsecondary institutions, K–12 school districts, local workforce development boards, economic development agencies, and other related organizations can use the findings of this study to assess the alignment of long-term strategic plans and local near- to mid-term occupational needs, to determine where to invest education and training funding in order to best serve immediate local needs, and to assist personnel from local career services as they advise clients and students about education and training programs.

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### Box 1. Key terms

**Living wage.** The hourly wage that allows a single adult to meet the economic self-sufficiency standard in each of the four regions, assuming full-time employment, or 2,080 hours of work per year (Glasmeier, 2019).

**Local credential surplus/deficit.** The difference between the average annual number of projected middle-skill job openings in 2018–20 in a region (or across the four regions) and the average annual number of middle-skill credentials awarded in 2014/15–2016/17 by postsecondary institutions in the same region (or across the four regions). If the number of job openings exceeds the number of credentials, there is a local credential deficit; if the number of credentials exceeds the number of job openings, there is a local credential surplus.

**Middle-skill credential.** A subbaccalaureate credential such as an associate degree or a certificate that is awarded by a postsecondary institution and aligned with a middle-skill occupation in the four study regions.

**Middle-skill education supply.** The average annual number of middle-skill credentials that are awarded by postsecondary institutions and aligned with middle-skill occupations in the four study regions. The number of credentials awarded represents the number of degrees and certificates issued, not the number of students who earned a degree or certificate. A student can earn more than one credential in a given year or over the course of his or her education, such as an associate degree in addition to a certificate.

**Middle-skill job openings.** The estimated number of employment opportunities that will be available for workers entering a middle-skill occupation. They are the sum of job growth and replacement needs (including retirements, career changes, and workers leaving an occupation without intending to return).

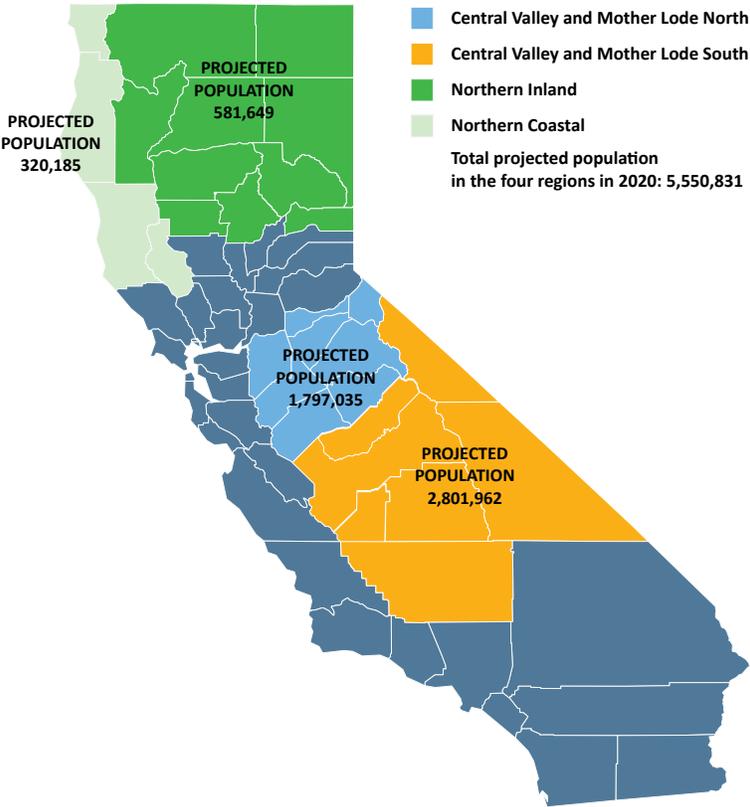
**Middle-skill occupations.** Occupations that generally require an entry-level education greater than a high school diploma but less than a bachelor’s degree (Holzer & Lerman, 2009; Unruh & Mayo, 2011). In this study, middle-skill occupations are those that require one of three education levels: some college, no degree; a postsecondary nondegree award; or an associate degree (including a vocational certificate), significant on-the-job training, previous work experience, or the completion of some college coursework (Bureau of Labor Statistics, 2019).

**Most in-demand middle-skill occupations.** The middle-skill occupations with the highest average annual number of projected job openings in 2018–20. The study analysis generally focuses on the 10 or 50 middle-skill occupations projected to be most in demand.

**Occupational wage ranges.** Estimates of hourly wages for middle-skill occupations in the four study regions. Three hourly wage estimates are included in the study—the 25th percentile, the median (50th percentile), and the 75th percentile—to account for variation across employers. The percentile wage for an occupation indicates the percentage of workers in that occupation who earn less than that wage (Economic Modeling Specialists International, 2019). This study uses the 25th percentile wage as a proxy for the entry-level wage and the 75th percentile wage as a proxy for the experienced-level wage (which assumes that as workers gain experience, their wage will also increase). The median wage represents the value between the highest paid 50 percent and the lowest paid 50 percent of workers in an occupation; half the workers in the occupation earn more than the median wage, and half earn less.

**Total jobs.** The estimated average annual number of part-time and full-time jobs (which are weighted equally). It does not refer to the number of workers because a person can hold multiple jobs. Jobs are counted and reported by the geographic place of work rather than by the worker’s place of residence (Economic Modeling Specialists International, 2019).

**Map 1. California rural regions examined in this study and their projected population in 2020**



Note: The Central Valley and Mother Lode North region includes all or parts of the following counties: Amador, Alpine, Calaveras, Mariposa, Merced, San Joaquin, Stanislaus, and Tuolumne. The Central Valley and Mother Lode South region includes all or parts of the following counties: Fresno, Inyo, Kern, Kings, Madera, Mono, and Tulare. The Northern Coastal region includes all or parts of the following counties: Del Norte, Humboldt, Lake, and Mendocino. The Northern Inland region includes all or parts of the following counties: Butte, Glenn, Lassen, Modoc, Plumas, Shasta, Sierra, Siskiyou, Tehama, and Trinity counties.

Source: Authors’ analysis of data from the California Community Colleges Chancellor’s Office and from the Foundation for California Community Colleges, 2019.

## Research questions

The study used the most recent federal data available to address four research questions for the four rural regions combined (presented in the main report) and for each region individually (presented in appendixes B–E):

1. What were the average annual number of projected job openings and the projected job growth rate in middle-skill occupations in 2018–20?
2. What was the wage range for middle-skill occupations in 2017, and what percentage of middle-skill occupations paid a living wage?
3. How many middle-skill credentials did postsecondary institutions award each year on average in 2014/15–2016/17?
4. To what extent did the average annual number of middle-skill credentials awarded align with the average annual number of job openings in middle-skill occupations in 2018–20?

See box 2 for a summary of the data sources, sample, and methods and appendix A for more details.

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### Box 2. Data sources, sample, and methods

**Data sources.** The study incorporated data from three sources. Data on projected job openings and occupational wage ranges are from the Economic Modeling Specialists International (EMSI) data system, a composite dataset that integrates more than 90 federal and state labor market data sources and replaces suppressed data with mathematically educated estimates (Economic Modeling Specialists International, 2019). The wage data in the EMSI data system are derived primarily from occupational earnings reported by the Occupational Employment Statistics program at the Bureau of Labor Statistics (2019). Data on the living wage for each region are from the Massachusetts Institute of Technology Living Wage Calculator (Glasmeier, 2019). Data on credentials awarded are from the National Center for Education Statistics (2019b) Integrated Postsecondary Education Data System. Those data cover 58 postsecondary institutions across the four rural regions being studied. Those institutions include public community colleges and private, for-profit postsecondary training institutions that participate in or hope to participate in the federal student financial aid program.

**Sample.** The study covered the 294 middle-skill occupations and related programs of study for middle-skill credentials in four rural California regions: Central Valley and Mother Lode North, Central Valley and Mother Lode South, Northern Coastal, and Northern Inland.

**Methodology.** The study team sorted the data on projected job openings and credentials and aggregated the data by county and then by region and across the four regions. The study team then calculated descriptive statistics to address each research question.

*Identifying the highest living wage.* The study used the living wage in the county with the highest living wage for a single adult (\$12.28 per hour for Sierra County in the Northern Inland region) as the living wage threshold in the analysis of the four regions combined. Occupations for which the entry-level wage met or exceeded that threshold were classified as paying a living wage.

*Calculating middle-skill education supply.* The study team calculated the average number of middle-skill credentials that postsecondary institutions awarded over three years (2014/15–2016/17) to minimize the effects of atypical variation in a single year.

*Matching credentials to occupations.* The study team used a crosswalk developed by the National Center for Education Statistics (2011) to match programs of study with occupations based on postsecondary program classifications in the National Center for Education Statistics (2019a) Classification of Instructional Programs and occupational classifications in the Standard Occupational Classification (Bureau of Labor Statistics, 2016, 2018).

*Calculating local credential surplus or deficit.* To determine whether a local credential surplus or deficit existed for each occupation, the study team subtracted the average annual number of projected job openings in 2018–20 in that occupation from the average annual number of middle-skill credentials matched to that occupation awarded by postsecondary institutions in 2014/15–2016/17. A negative value indicates a local credential deficit (more job openings than credentials awarded), and a positive value indicates a local credential surplus (more credentials awarded than job openings).

## Findings

This section summarizes the combined key findings across the four rural regions. Detailed findings for each region are in appendixes B–E.

### *More than 83,700 job openings in middle-skill occupations were projected for each year in 2018–20*

Middle-skill occupations accounted for more than 734,000 jobs in 2017 across the four regions combined, or 36 percent of the total jobs. The average annual number of projected job openings in middle-skill occupations in 2018–20 across the four regions was 83,756, or 31 percent of all annual job openings in the four regions. The 10 middle-skill occupations projected to be most in demand in 2018–20 across the four regions are listed in table 1.

### *The number of jobs was projected to grow in most middle-skill occupations in 2018–20*

Across the four regions an average of 70 percent of middle-skill occupations were projected to experience job growth in 2018–20. See appendixes B–E for details on job growth by region.

**Table 1. Total jobs in 2017 and projected job growth and job openings in 2018–20 for the 10 middle-skill occupations projected to be most in demand in 2018–20 across four rural regions of California combined**

Demand rank	Occupation	Total jobs, 2017	Average annual change in projected number of total jobs, 2018–20 (percent <sup>a</sup> )	Average annual number of projected job openings, 2018–20
1	Office clerks, general	36,239	2	4,476
2	Heavy and tractor-trailer truck drivers	34,858	5	4,295
3	Teacher assistants	26,711	4	3,158
4	Secretaries and administrative assistants, except legal, medical, and executive	28,590	0	3,126
5	Customer service representatives	18,635	5	2,673
6	Registered nurses	35,422	6	2,540
7	Childcare workers	17,536	-5	2,523
8	Bookkeeping, accounting, and auditing clerks	21,713	0	2,463
9	Maintenance and repair workers, general	18,959	4	2,127
10	First-line supervisors of retail sales workers	18,662	1	2,118
	Subtotal, 10 middle-skill occupations projected to be most in demand in 2018–20	257,325	3 (average)	29,500
	Subtotal, 284 other middle-skill occupations	477,388	4 (average)	54,256
	Total, all 294 middle-skill occupations	734,712	3 (average)	83,756

a. The percentage increase or decrease in total jobs in each occupation between 2018 and 2020, rounded to the nearest whole number.

Note: Values may not sum to totals because of rounding. Occupations with 0 percent projected growth (such as bookkeeping, accounting, and auditing clerks) and occupations with negative projected growth (such as childcare workers) are still projected to have job openings (due to replacement needs) and are thus counted as growing occupations.

Source: Authors' analysis of data from Economic Modeling Specialists International (2019).

### *The majority of job openings in middle-skill occupations paid a living wage in 2017*

In 2017, 90 percent of job openings in middle-skill occupations across the four regions paid an entry-level wage that met or exceeded the threshold for a living wage (\$12.28 per hour; table 2). So, a recent graduate with credentials in a program of study related to one of these middle-skill occupations could expect to earn a starting pay that met the economic self-sufficiency standard for a single adult. The average entry-level wage for middle-skill

occupations, weighted by the projected number of job openings in each occupation, was \$16.21 per hour (not shown).<sup>2</sup>

Wages differed widely across middle-skill occupations. Of the 10 middle-skill occupations projected to be most in demand in 2018–20 across the four regions combined, 8 paid a living wage. The entry-level wage for those occupations ranged from \$12.43 per hour for teacher assistants to \$36.22 per hour for registered nurses (see table 2). The entry-level wage for the two occupations that did not pay a living wage was \$7.49 per hour for childcare workers and \$11.90 per hour for general office clerks.

**Table 2. Living wage status and entry-level, median, and experienced-level hourly wages in 2017 for the 10 middle-skill occupations projected to be most in demand in 2018–20 across four rural regions of California combined**

Demand rank	Occupation	Entry-level hourly wage meets or exceeds the threshold for a living wage for a single adult <sup>a</sup> (\$12.28 per hour)	Hourly wage, 2017 (\$)		
			Entry level <sup>b</sup> (25th percentile)	Median	Experienced level <sup>c</sup> (75th percentile)
1	Office clerks, general	No	11.90	15.45	18.86
2	Heavy and tractor-trailer truck drivers	Yes	16.12	18.73	22.95
3	Teacher assistants	Yes	12.43	14.77	17.57
4	Secretaries and administrative assistants, except legal, medical, and executive	Yes	14.03	17.39	21.53
5	Customer service representatives	Yes	12.50	16.64	21.26
6	Registered nurses	Yes	36.22	44.80	53.99
7	Childcare workers	No	7.49	10.50	12.05
8	Bookkeeping, accounting, and auditing clerks	Yes	15.48	18.86	23.17
9	Maintenance and repair workers, general	Yes	13.81	18.28	24.16
10	First-line supervisors of retail sales workers	Yes	13.16	15.94	21.11
	Average, 10 middle-skill occupations projected to be most in demand in 2018–20	Yes = 8 (80 percent) No = 2 (20 percent)	15.32 <sup>d</sup>	19.13 <sup>d</sup>	23.66 <sup>d</sup>
	Average, 284 other middle-skill occupations	Yes = 256 (90 percent) No = 28 (10 percent)	18.74 <sup>d</sup>	23.37 <sup>d</sup>	28.95 <sup>d</sup>
	Average, all 294 middle-skill occupations	Yes = 264 (90 percent) No = 30 (10 percent)	18.63 <sup>d</sup>	23.22 <sup>d</sup>	28.77 <sup>d</sup>

a. For the four regions combined the \$12.28 threshold was based on the county with the highest living wage for a single adult (Sierra County in the Northern Inland region).

b. The 25th percentile wage was used as the proxy for an entry-level wage in this study and is consistent with starting pay, or the wage that a worker can expect to earn when he or she meets the credential requirements for an occupation but has little to no experience in it.

c. The 75th percentile wage was used as a proxy for an experienced-level wage and is consistent with the wage that a worker can expect to earn after gaining experience in an occupation.

d. Weighted by the number of job openings in each occupation.

Source: Authors' analysis of data (including 25th percentile, median, and 75 percentile values) from Economic Modeling Specialists International (2019).

2. The unweighted average entry-level wage for all middle-skill occupations was \$18.63 per hour.

***In 2014/15–2016/17 an average of nearly 20,100 middle-skill credentials were awarded each year***

Each year in 2014/15–2016/17, postsecondary institutions in the four regions awarded an average of 20,091 middle-skill credentials (table 3). About 22 percent of those credentials (4,481) were in 8 of the 10 middle-skill occupations projected to be most in demand in 2018–20 across the four regions. None of the credentials awarded during that timeframe were for programs related to customer service representatives (the fifth most in-demand occupation) or general maintenance and repair workers (the ninth most in-demand occupation).

**Table 3. Average annual number of middle-skill credentials in the 10 middle-skill occupations projected to be most in demand in 2018–20 across four rural regions of California combined that postsecondary institutions in those regions awarded in 2014/15–2016/17**

Demand rank	Occupation <sup>a</sup>	Program of study	Average annual number of credentials awarded, 2014/15–2016/17
1	Office clerks, general	General office occupations and clerical services	397
2	Heavy and tractor-trailer truck drivers	Truck and bus driver/commercial vehicle operator and instructor	354
3	Teacher assistants	Teacher assistant/aide	33
4	Secretaries and administrative assistants, except legal, medical, and executive	Administrative assistant and secretarial science, general	350
5	Customer service representatives	Receptionist; customer service support/call center/teleservice operation	0
6	Registered nurses	Registered nursing/registered nurse	1,105
7	Childcare workers	Childcare provider/assistant	1,769
8	Bookkeeping, accounting, and auditing clerks	Accounting technology/technician and bookkeeping	428
9	Maintenance and repair workers, general	Building/property maintenance	0
10	First-line supervisors of retail sales workers	Floriculture/floristry operations and management; retail management; selling skills and sales operations	44
	Subtotal, the 10 middle-skill occupations projected to be most in demand in 2018–20	na	4,481
	Subtotal, the 284 other middle-skill occupations	na	15,610
	Total, all 294 middle-skill occupations	na	20,091

na is not applicable.

a. More than one occupation is listed in a single row when programs of study prepare students for more than one occupation.

Note: Values may not sum to total because of rounding. The study team used a crosswalk developed by the National Center for Education Statistics (2011) to match programs of study with occupations based on occupational classifications in the Standard Occupational Classification (Bureau of Labor Statistics, 2016, 2018) and postsecondary program classifications in the Classification of Instructional Programs (National Center for Education Statistics, 2019a).

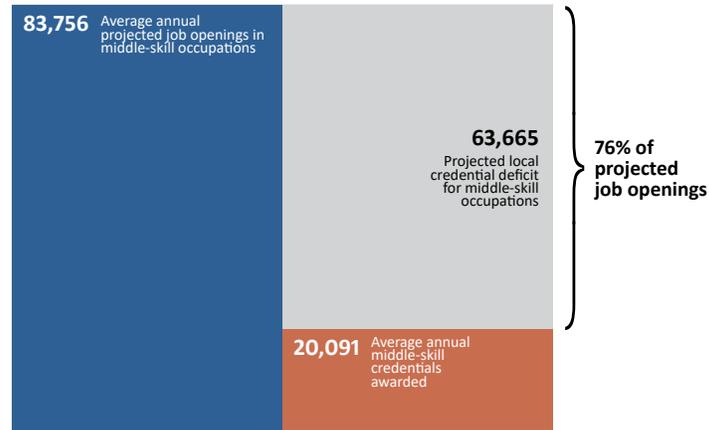
Source: Authors' analysis of data from Economic Modeling Specialists International (2019) and National Center for Education Statistics (2019b).

***The average annual number of jobs in middle-skill occupations projected to be available in 2018–20 far exceeded the number of middle-skill credentials that postsecondary institutions awarded—even in the 10 middle-skill occupations projected to be most in demand in 2018–20***

The average local credential deficit was projected to be 63,665 jobs each year (83,756 job openings – 20,091 middle-skill credentials), or 76 percent of projected job openings in middle-skill occupations each year (figure 1), assuming that postsecondary institutions in the four regions issued middle-skill credentials at the same rate in 2018–20 as in 2014/15–2016/17.<sup>3</sup> The number of credentials awarded by postsecondary institutions in the four

3. Though the number of credentials awarded within and across programs was relatively consistent over the three-year period, the totals were averaged over the three years to minimize the effects of atypical variation that might have been present in a single year.

**Figure 1. A local credential deficit was projected in 2018–20 for the majority of middle-skill occupations across four rural regions of California combined**



Source: Authors’ analysis of data from Economic Modeling Specialists International (2019) and National Center for Education Statistics (2019b).

regions in 2017 would fill only 24 percent of projected job openings in middle-skill occupations each year in 2018–20—far less than needed to meet growing demand.

*A local credential deficit was projected for the 10 middle-skill occupations projected to be most in demand in 2018–20.* The magnitude of projected local credential deficits varied greatly by occupation (table 4). Of the 10 middle-skill occupations projected to be most in demand in 2018–20, general office clerks, the occupation with the most projected annual job openings across the four regions combined, faced the largest projected local credential deficit (4,079 more job openings than credentials each year), while childcare workers faced the smallest (754 more job openings than credentials).

**Table 4. Projected local credential deficits for the 10 middle-skill occupations projected to be most in demand in 2018–20 across four rural regions of California combined**

Demand rank	Occupation	Average annual number of projected job openings, 2018–20	Average annual number of credentials awarded, 2014/15–2016/17	Difference between job openings and credentials awarded
1	Office clerks, general	4,476	397	(4,079)
2	Heavy and tractor-trailer truck drivers	4,295	354	(3,941)
3	Teacher assistants	3,158	33	(3,125)
4	Secretaries and administrative assistants, except legal, medical, and executive	3,126	350	(2,776)
5	Customer service representatives	2,673	0	(2,673)
6	Registered nurses	2,540	1,105	(1,435)
7	Childcare workers	2,523	1,769	(754)
8	Bookkeeping, accounting, and auditing clerks	2,463	428	(2,035)
9	Maintenance and repair workers, general	2,127	0	(2,127)
10	First-line supervisors of retail sales workers	2,118	44	(2,074)
	Subtotal, 10 middle-skill occupations projected to be most in demand in 2018–20	29,500	4,481	(25,019)
	Subtotal, 284 other middle-skill occupations	54,256	15,610	(38,646)
	Total, all 294 middle-skill occupations	83,756	20,091	(63,665)

Source: Authors’ analysis of data from Economic Modeling Specialists International (2019) and National Center for Education Statistics (2019b).

*A local credential surplus was projected for only 5 of the 50 most in-demand middle-skill occupations.* Across the four regions combined, only 5 of the 50 most in-demand middle-skill occupations were projected to experience a local credential surplus, resulting in 2,211 more credentials than job openings each year (table 5). The only occupation that was projected to experience a surplus in every region and across all four regions combined is police and sheriff’s patrol officers. See appendixes B–E for detailed information on local credential deficits and surpluses in each region.

**Table 5. Local credential surpluses among the 50 most in-demand middle-skill occupation across four rural regions of California combined in 2018–20**

Surplus rank	Occupation	Central Valley Mother Lode North	Central Valley Mother Lode South	Northern Coastal	Northern Inland	Four regions combined
1	Medical assistants	na	1,634	na	na	1,370
2	Police and sheriff’s patrol officers	171	357	16	145	689
3	Hairdressers, hairstylists, and cosmetologists	91	na	na	68	72
4	Firefighters	na	na	na	146	44
5	Pharmacy technicians	na	182	na	na	36
	Total surplus, top 50 in-demand middle-skill occupations	262	2,397	20	544	2,211

na is not applicable because there was a local credential deficit for the occupation in the region.

Note: The Central Valley Mother Lode North region has two other occupations with a local credential surplus: heating, air conditioning, and refrigeration mechanics and installers (116) and dental assistants (108); the Northern Coastal region has one other occupation with a local credential surplus: wood sawing machine setters, operators, and tenders (4); and the Northern Inland region has one other occupation with a local credential surplus: welders, cutters, solderers, and brazers (185).

Source: Authors’ analysis of data from Economic Modeling Specialists International (2019) and National Center for Education Statistics (2019b).

## Limitations

The study has several data and methodological limitations.

### Data limitations

Limitations in the available data prevented the study team from examining the relationship between the exact quantity of labor supplied and the exact quantity of labor demanded at varying wages.

Three main data limitations prevented the study team from examining the exact labor supply in the four regions. First, the measure of credentials may overestimate or underestimate the labor supply. The study used the number of credentials awarded rather than the number of people who were awarded credentials as the measure of workforce supply, a limitation of the Integrated Postsecondary Education Data System database. Data on the number of credentials awarded would overestimate the labor supply if individuals did not seek employment in the field in which they were credentialed, if some individuals earned more than one credential, or if postsecondary institutions awarded fewer credentials in 2018–20 than in 2014/15–2016/17. The data would underestimate the labor supply if individuals with credentials in middle-skill occupations who were awarded credentials before 2014/15 were seeking employment in 2018–20 or if postsecondary institutions awarded more credentials in 2018–20 than in 2014/15–2016/17. The study team could not determine the extent to which the labor supply was overestimated or underestimated because of these issues.

Second, data on credentials awarded were limited to institutions that participate in or hope to participate in the federal student financial aid program, as those are the institutions that report data to the Integrated Postsecondary Education Data System. The system excludes other kinds of training programs, such as high school

vocational training, workforce development training, regional occupational programs, union training, employer internal training, and all other training that does not accept federal financial aid. Data on credentials awarded by these programs were unavailable from other sources, but the number is likely to be small compared with the total number of credentials included in the study, so the data might only slightly underestimate the labor supply.

Third, the data on credentials awarded exclude individuals who take some postsecondary courses without earning an official degree, because they are in an occupation whose entry-level education requirement is “some college, no degree.” This applies to only 6 of the 294 middle-skill occupations included in the study, but the number of individuals in the middle-skill labor supply to which this applies is unknown and may result in an underestimate of the labor supply, which would lead the study findings to overstate the gap between labor demand and supply.

Three main data limitations prevented the study team from examining the exact labor demand in the four regions. First, the number of job openings in middle-skill occupations would be overestimated if open positions were filled by individuals who hold a bachelor’s degree, by individuals with credentials from a postsecondary institution in another region of California, or by individuals with credentials from outside the state. The study team did not have access to data on in-migration from other regions of California. However, in-migration of middle-skill workers from other states is not expected to affect the analysis—research shows a decrease in middle-skill workers moving to California due to the high cost of living (Perry et al., 2016).

Second, the data on labor demand might not completely reflect the current labor market. Data on projected job openings (from Economic Modeling Specialists International) were based on historical trends in job openings, which do not take into account economic or other events that might have affected employment levels. And the Standard Occupational Classification system, which the study team used to categorize occupations as middle-skill, might not reflect emerging or new occupations in its titling and in estimates of current and future employment demand.

Third, demand data combine both part-time and full-time positions and count them equally, potentially leading to overestimation of the demand for full-time jobs, though this does not affect the total number of projected job openings.

### ***Methodological limitations***

The threshold in the living wage analysis is based on a single-adult household. While this is an appropriate minimum standard against which to evaluate the “quality” of the jobs in the occupations being studied, the study findings might overestimate the percentage of occupations that provide a living wage, given the large number of households with more than a single adult.

The combined analysis masks the variation in higher education and occupational opportunities across regions. The Central Valley and Mother Lode South region had 10 community colleges, the most in the four regions, to serve a population of more than 2.7 million, while the Northern Coastal region had 2 community colleges to serve a population of more than 317,000. The sheer difference in size means that the Northern Coastal region is generally overshadowed in the combined analysis. For example, pharmacy technicians were an in-demand occupation in both regions, but only the Central Valley and Mother Lode South region had middle-skill credentials awarded in this occupation.

Specific findings from each of the four rural regions in this study are not generalizable to differences in other regions in California and the nation because of differences in education, economic, social, and commercial characteristics. But the methods used in this study could be employed to conduct similar analyses for other regions. There are also specific limitations that pertain to the analysis for the four regions combined. Each region has

education and occupational characteristics that make it unique, which can be overlooked in the cross-region analysis. These include the middle-skill education and training opportunities (as measured by the number of community colleges), the industry composition of local businesses, the educational attainment of each population, and the cost of living.

## Implications

The findings from this study have several implications for stakeholders who are invested in aligning education and labor market opportunities to strengthen the economy in rural California.

Institutions in the four study regions might want to identify opportunities to prepare more students for credentials in programs related to the most in-demand middle-skill occupations that pay a living wage. Strategies could include expanding existing programs or starting new ones, depending on such factors as the time needed to receive system-level approvals; the institution's risk tolerance; and the resources needed to hire and train new faculty or reallocate existing faculty, assign classroom space, and acquire any new technology needed. Institutions might need to work incrementally to generate demand for these programs, including partnering with high schools in the region to recruit students, and then carefully grow the programs in response. Doing so could help ensure that the expansions are financially feasible and have a meaningful impact on the local labor supply. For regions with especially small college-going populations, institutional, local government, and community leaders might also consider encouraging unemployed people and workers currently in low-skill and low-wage occupations to pursue these programs.

For the few middle-skill occupations for which a local credential surplus is projected, institutions might want to avoid expanding credential programs or might consider shrinking them.

Local government, workforce investment boards, and chambers of commerce might also identify other sources of qualified labor to fill job openings in middle-skill occupations with a local credential deficit. Potential sources include "overqualified" workers (those with a four-year degree) and workers from other regions who have the appropriate credentials.

Practitioners, policymakers, and researchers might consider developing career pathways in middle-skill occupations with a local credential deficit and communicating the job opportunities in those occupations and descriptions of the credential pathways that lead to those jobs. Doing so could help students and workers in rural areas remain in their communities and thereby decrease the rate of rural brain drain, in which individuals leave rural areas in search of better postsecondary education and employment opportunities elsewhere. The effectiveness of this approach would be limited by the extent to which individuals prefer to obtain a four-year degree and believe that such a degree represents the most viable pathway to economic stability and success. To help policymakers determine how to allocate funding for career pathways, research would be needed on the extent to which the communication efforts around pathways lead to an increase in the proportion of students in each rural area who enter and complete a career pathway program and are employed in a related occupation.

The results of this study suggest that middle-skill occupations could continue to be an important source of economic prosperity in the years ahead, particularly if policymakers, employers, and postsecondary institutions with programs related to middle-skill occupations are nimble enough to better align the education supply and the occupational demand for middle-skill labor.

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