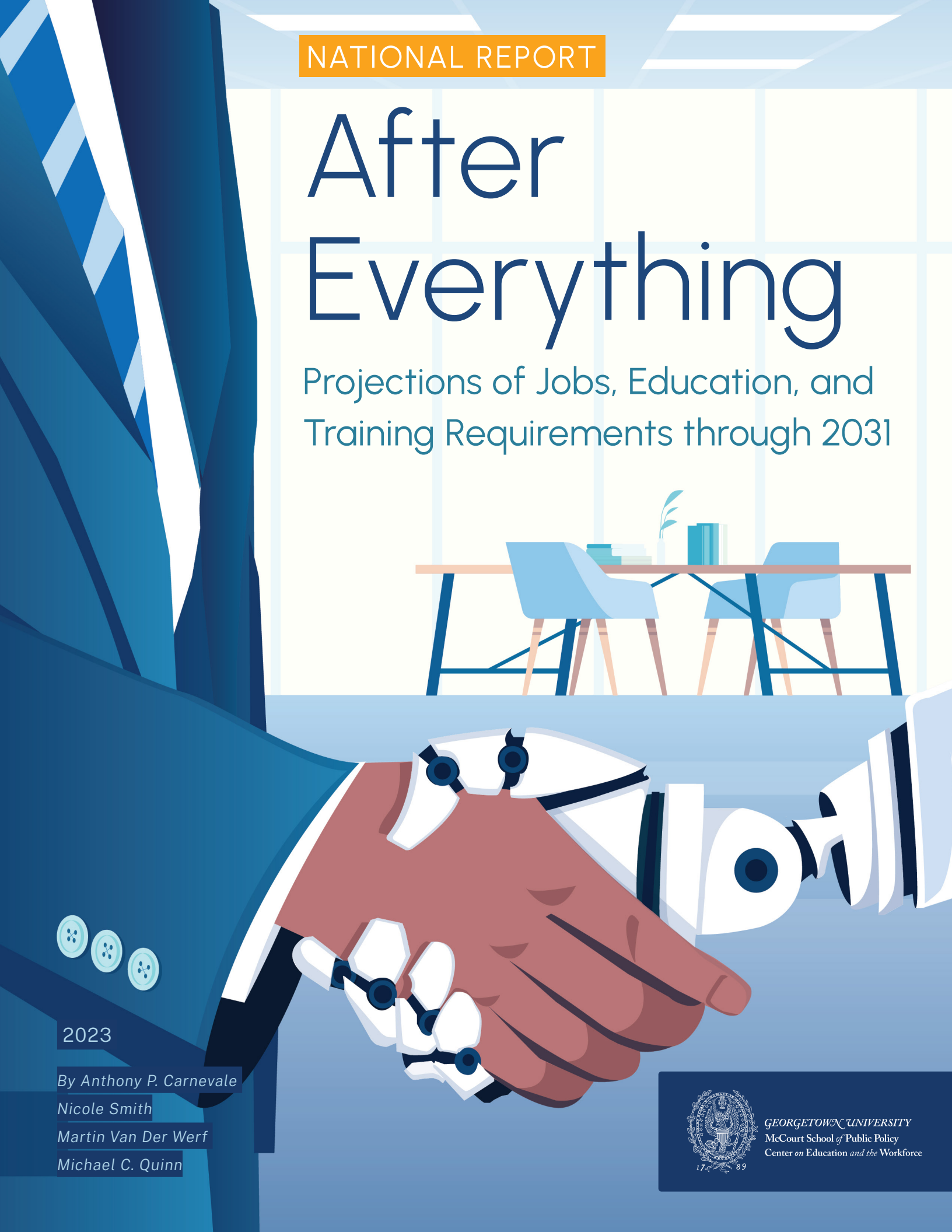
NATIONAL REPORT

# After Everything

## Projections of Jobs, Education, and Training Requirements through 2031



2023

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GEORGETOWN UNIVERSITY
McCourt School of Public Policy
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# About the Projections Report

The Georgetown University Center on Education and the Workforce's (CEW) job projections through 2031 include an executive summary, a national report, a state-by-state analysis, a technical appendix, and a webpage of data visualizations.

**National Report**
This report includes a national overview of job projections and their educational requirements across industries, occupational clusters, and detailed occupational groups.

**State Report**
The state report provides a state-by-state analysis of education demand and compares job outlooks for individual states to national estimates.

**Technical Appendix**
The technical report is a detailed explanation of CEW's methodological approach.

*Visit* cew.georgetown.edu/Projections2031 *to access these reports and interact with the data.*

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Email cewgeorgetown@georgetown.edu with any questions.

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*The views expressed in this publication are those of the authors and do not necessarily represent those of Lumina Foundation or the Bill & Melinda Gates Foundation, or any of their officers or employees. All errors and omissions are the responsibility of the authors.*

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INTRODUCTION

# Higher Levels of Educational Attainment Are Crucial to Preparing the Nation for the Future of Work

Over the past century, the United States workforce has undergone a massive structural shift. Technological change has moved the economy toward skilled labor and away from unskilled labor — a phenomenon known as skill-biased technical change.[1] This structural shift has increased the relative demand for educated and skilled labor, leading to commensurate increases in the relative wages of skilled workers,[2] and changes in the nature of work itself.

The demand for skilled workers has increased sharply over the past 50 years, along with the need for greater educational attainment. In the 1970s, about 28 percent of jobs required education and/or training beyond high school.[3] Today, close to 68 percent of all jobs require some form of postsecondary education and/or training beyond high school.[4] By 2031, 72 percent of all jobs nationally will require postsecondary education and/or training.

The economy is coming out of the largest job loss in history — the COVID-19 recession: 20.5 million jobs were lost in a single month in April 2020.[5] But the labor market soared back, recovering all those lost jobs by July 2022. Even before the COVID-19 pandemic, the unemployment rate had dropped to 3.5 percent,[6] its lowest rate in more than 50 years. It remains close to that level today. That low rate of unemployment is characterized by some economists

1 Violante, *Skill-Biased Technical Change*, 2008.

2 Carnevale and Rose, *The Undereducated American*, 2011.

3 Carnevale et al., *Recovery*, 2013.

4 Carnevale et al., *Recovery*, 2013.

5 US Department of Labor, Bureau of Labor Statistics, "News Release: The Employment Situation – April 2020," 2020. The number of job losses covers only non-farm payroll jobs.

6 US Department of Labor, Bureau of Labor Statistics, "The Employment Situation — February 2020," 2020.

as full employment.[7] However, the unemployment rate does not capture the skills gap — the distance between the skills employers need and the skills employees have. There are almost twice as many job openings as there are job seekers, contributing to a worker shortfall. Tellingly, a growing number of job opportunities call for people with postsecondary education and/or training.

We project that the United States will have 171 million jobs[8] in 2031, compared to 155 million in 2021. This total is even more impressive when compared to the low of 138 million jobs during the COVID-19 pandemic.

In 2031, the workforce will break down this way in terms of the educational attainment level required for the job:

- 27.6 million jobs, or 16 percent of the total, for workers with a graduate degree;
- 43.6 million jobs, or 26 percent of the total, for workers with a bachelor's degree;
- 22.3 million jobs, or 13 percent of the total, for workers with an associate's degree;
- 27.9 million jobs, or 16 percent of the total, for workers with some college but no degree;
- 38.2 million jobs, or 22 percent of the total, for workers with a high school diploma; and
- 10.9 million jobs, or 6 percent of the total, for workers with less than a high school diploma.

But it is not all about the total number of jobs that will exist in 2031. Most workers and employers will care about job openings between now and 2031. During that period, there will be 18.5 million job openings per year on average. Some 12.5 million of these annualized openings will require at least some college education. By educational attainment, there will be:[9]

- 2.4 million annual job openings, or 13 percent of the total, for workers with a graduate degree.
- 4.3 million annual job openings, or 23 percent of the total, for workers with a bachelor's degree;
- 2.5 million annual job openings, or 13 percent of the total, for workers with an associate's degree;
- 3.3 million annual job openings, or 18 percent of the total, for workers with at least some college but no degree;
- 4.7 million annual job openings, or 25 percent of the total, for workers with a high school diploma; and
- 1.3 million annual job openings, or 7 percent of the total, for workers with less than a high school diploma.

7 Congressional Budget Office, "The Budget and Economic Outlook: 2019 to 2029," 2019.

8 Jobs are defined here and elsewhere in the National report as the sum of nonfarm payroll employment and self-employed jobs.

9 The following do not sum to 100 percent because of rounding.

These projections show what a central role postsecondary education plays in preparing the workforce of the future. Almost without anyone noticing — and with no real public debate — the essential goal for educational reform from pre-kindergarten to high school has become to make students college-ready. Middle-class families equate college with success, and employability in middle-class jobs is now the ultimate standard for educational adequacy from kindergarten through college graduation. Few of those middle-class jobs are available without a college credential, and that will become even more true over the next decade.

And yet doubts are increasing about the strength of the labor market. Among other questions, authorities and pundits are asking what will be the impact of remote work? Of foreign wars? Of changes in technology reducing the demand for certain types of skills? Of increased tension between the United States and its leading industrial competitor, China? Of insecurity in the banking industry?

Young people increasingly doubt the value of going to college. Enrollment in colleges and universities is down markedly, even as all evidence shows that future workers will need more education, certainly not less.

Increasingly, the United States has two economies: the larger but slow-growing blue-collar and skilled-trades economy and the faster-growing and dynamic managerial and professional economy. There is overlap in the educational attainment levels required in these economies — in fact, the blue-collar and skilled-trades economy employs a roughly equal number of workers with a bachelor's degree as the managerial and professional economy. The difference is that almost all workers with a high school diploma or less will only be able to find work in the blue-collar and skilled-trades economy, while almost all workers going into the managerial and professional economy will have at least some postsecondary education and training, and the large majority will have at least a bachelor's degree. By 2031, jobs in the managerial and professional economy will be held overwhelmingly by highly educated workers.

This is leading to a widening economic divide between those who have postsecondary education and training and those who do not. On average, college graduates earn more money than non-college graduates. Of course, exceptions to these general rules always exist, but someone with a bachelor's degree (but no graduate degree) earns an average of 75 percent more than a person with no more education than a high school diploma.[10] Not going to college at all costs the average individual more than half a million dollars in potential earnings over a lifetime.[11]

10 Carnevale et al., *The College Payoff*, 2021; Rugaber, "Pay Gap between College Grads and Everyone Else at a Record," 2017; and Bartik and Hershbein, "Degrees of Poverty," 2018, find similar earnings gains for those with bachelor's degrees (71 percent over a lifetime).

11 Pew Research Center, *The Rising Cost of Not Going to College*, 2014.

It is important to note that college is increasingly important for all workers, not just those in the managerial and professional economy. The workforce will be made up, in growing numbers, by workers who provide services needed by the new knowledge economy, which relies more on workers' intellectual capabilities than on physical activities to produce goods and services.

Workers in lower-skilled occupations are increasingly being required to continue their schooling and upgrade their skills. In fact, over the last few decades, about 70 percent of the increase in requirements for postsecondary education and training stemmed from upgrades in skills demanded in occupational categories that previously did not require higher education. The other 30 percent is due to the development of entirely new occupations or the expansion of occupations that already required high levels of postsecondary education and training.

This report shows:

- A breakdown of job projections by 13 major industries.
- A breakdown of job projections by nine major occupational clusters and 22 total occupational groups.

All of the industry and occupational sections include projections for jobs through 2031 by needed level of educational attainment. This report also accounts for the increasing role of technology in American society, particularly in the world of work.

**We find that the nature of work has changed dramatically to incorporate technology not only as a complement to human labor but also as a substitute for tasks within jobs and sometimes even workers.**[12] By the 1980s, skill-biased technical change and the widespread adoption of computerization fueled significant increases in the wage premiums paid to college-educated workers. Since the 1980s, the demand for college-educated workers has outpaced supply, with the future promising more of the same.[13]

Automation continues to usher in new ways of producing and consuming goods and services, redefining our way of life. But these developments come with challenges — particularly as they relate to defining work and determining whether any work remains for people to do in the wake of machines that can perform many tasks more quickly, inexpensively, and accurately than humans. Much of the anxiety about automation resulted from the mass layoffs in manufacturing that displaced millions of Americans during the first decade of the 21st century. The outsourcing, offshoring, and automation of the modern economy have streamlined production, resulting in immense increases in efficiency. Prior to the COVID-19 recession, large segments of the population were able to enjoy more products at lower

12 Autor et al., "The Skill Content of Recent Technological Change," 2003.

13 Goldin and Katz, *The Race between Education and Technology*, 2008.

prices. But these gains in efficiency have come with a cost: automation has eliminated, and will continue to eliminate, some jobs in their entirety. It also will continue to replace specific tasks within some jobs.[14] The tasks most at risk of some level of automation can be described primarily as physical or low-level cognitive tasks.

- **Physical tasks**: basic tasks such as those often performed on an assembly line.
- **Low-level cognitive tasks**: procedures with memorization or simple predefined rules, such as data entry.

But it will not be just relatively simple tasks that will be replaced. Automation, particularly in the form of artificial intelligence, is seeping into higher-level tasks that are not defined by simple rules. Even some jobs that require high skills and high levels of educational attainment are at risk of being eliminated.

These combined developments have increased the uncertainty regarding which skills are in high demand now and which will be in high demand in the future. Furthermore, uncertainty as to whether the benefits of postsecondary education and/or training outweigh the costs have left many people skeptical about the true value of college.[15]

The US economy has fully transformed from an industrial to a services economy, with all the pain and upheaval that accompanies such a change. Educational and career planning need to catch up and adjust to this new reality. This analysis removes some of the uncertainty by providing a comprehensive projection of the demand for education from the perspectives of both industry and occupation.[16]

## The overall impact of automation remains uncertain, though it assuredly will destroy and create jobs.

One thing that has remained true through the recent ups and downs of the economy is that those workers with the greatest technical skills have been the most rewarded. Technical skills are paramount in tight labor markets that favor remote work. The need for these skills was amplified during the COVID-19 recession, but this is just the latest example of a long-term trend: skills-biased technical change has resulted in higher wages for those with these skills since the 1990s. Certifications and certificates in skills related to information technology are some of the highest-paying marginal credentials.[17]

14 Arntz et al., "The Risk of Automation for Jobs in OECD Countries," 2016.

15 See Abel and Dietz, "Do the Benefits of College Still Outweigh the Costs?," 2014; Karageorge, "Is a College Degree Still Worth It?," 2014; Emmons et al., "Is College Still Worth It?," 2019; and Schleifer et al., *America's Hidden Common Ground on Public Higher Education*, 2022.

16 This report presents projections of education demand by detailed Standard Occupational Classification (SOC) codes and broad North American Industry Classification System (NAICS) codes for the period 2021 to 2031.

17 Albert, "The Certification Earnings Premium," 2017.

From auto mechanics to secretaries, the use of technology has improved efficiency and productivity for workers. But along with those improvements come many concerns. Indeed, fears of human redundancy are fueled by the extent to which technology is sometimes able to *substitute* for workers, over and above *complementing* the way in which work is being performed.

The threat of automation is very real, but its overall impact on jobs remains uncertain.[18] Technological change has eliminated jobs in the past, but many experts argue that this time is different,[19] citing a new type of technological revolution that not only eliminates jobs but also dramatically changes the way we work, the way we live, and the way we relate to and communicate with each other. In the past, new technology eliminated some jobs, but, overall, it increased productivity and created more opportunities. This revolution has the potential to affect all sectors of the economy as machines begin to make autonomous decisions and even learn from their mistakes.[20]

In recent months, artificial intelligence has captured an outsized amount of attention, due to the public release in November 2022 of the ChatGPT chatbot. Within two months, it had 100 million active users.[21] Most users prompted the chatbot to produce articles, essays, and other forms of writing. But the staggering growth in users prompted many experts to predict the disruptive capability of tools, such as ChatGPT, which are a form of generative artificial intelligence. Rather than relying only on programming, generative AI is based on a technology-created neural network that teaches itself to spot patterns in writing and data, and then "learn" from those patterns.[22] Tech companies are competing aggressively to gain pre-eminence in the artificial intelligence field, and management professors are urging companies to invest heavily in understanding how this technology can change their businesses, arguing that no one really knows the capabilities of these technology tools.[23]

The use of large language models (LLMs), such as ChatGPT, will impact, on average, about 15 percent of all tasks within an occupation, predict researchers who work for Open AI, the company that created ChatGPT.[24] Some jobs that require high levels of educational attainment, including engineering and software development, will likely be more impacted than others. In some cases, workers in these jobs will need to learn additional skills in order to adapt to the capabilities of LLMs and to use them effectively.[25]

18 Arntz et al., "The Risk of Automation for Jobs in OECD Countries," 2016.

19 Brynjolfsson and McAfee, "The Business of Artificial Intelligence," 2017.

20 Brynjolfsson and McAfee, "The Business of Artificial Intelligence," 2017.

21 Hu, "ChatGPT Sets Record for Fastest-Growing User Base," 2023.

22 Chow and Perrigo, "The AI Arms Race Is Changing Everything," 2023.

23 Mollick, "ChatGPT Is a Tipping Point for AI," 2022.

24 Eloundou et al., "GPTs Are GPTs," 2023.

25 Felten et al., "Occupational Heterogeneity in Exposure to Generative AI," 2023.

AI will replace some jobs, as the technologies continue to accelerate in a geometric fashion. But it will not replace all, and should be considered to be a tool better able to support and complement jobs than replace them entirely.[26] We are still a long way from computers and robots having the ability to do almost everything. While some job loss is inevitable, history shows that entire occupations will not vanish suddenly, especially within a decade. For instance, automatic teller machines have not completely replaced bank tellers. In fact, the overall number of tellers actually increased between 1980 and 2010, even though there were fewer tellers per branch, because the job duties of bank tellers were adapted and expanded.[27]

While many naysayers forecast the end of job creation altogether, the net number of jobs and the output of the economy have continued to grow. Most estimates of the number of jobs at high risk of automation are quite speculative.[28] They range from 9 percent[29] to 47 percent[30] of total jobs. These estimates represent total job losses that are not offset by any new occupations or jobs that could arise as the industrial economy shifts to a services economy.

Manufacturing jobs seem to be the most likely candidates for full replacement because of the physical nature of many of the tasks within these jobs. The chance of automation is higher in sectors that have incorporated technology into the production process—including wholesale and retail trade, construction, and financial services.

Automation is more likely to displace some workers than to replace them all.[31] For example, a new machine could replace some workers and leave a smaller number of workers working alongside it. Less-educated workers are more likely to be replaced because college-educated workers tend to have skills that are more adaptable to change.[32]

The impact of automation on future jobs will not be completely negative. Automation can lead to new opportunities and new jobs. Almost 10 percent of labor demand in 2030 is estimated to be in occupations that do not exist now.[33] For example, data science was not an occupation category 10 years ago.

Technology adoption is both a substitute for skill (resulting in overall job losses) and a complement to skill (resulting in new jobs and upskilling).[34] Technology adoption requires

26 "Your Job Is (Probably) Safe from Artificial Intelligence," *The Economist*, 2023.

27 Wolla, "Will Robots Take Our Jobs?," 2018.

28 This is because the lack of reliable data and of transparency in some researchers' methods precludes other researchers from judging the estimates on their merits.

29 Arntz et al., "The Risk of Automation for Jobs in OECD Countries," 2016.

30 Frey and Osborne, "The Future of Employment," 2017.

31 Bessen et al., "Automation: A Guide for Policymakers," 2020.

32 Holzer, "Understanding the Impact of Automation on Workers, Jobs and Wages," 2022.

33 Manyika et al., *A Future That Works*, 2017.

34 See Appendix A, which summarizes the likelihood of automation within each occupational group.

training and retraining, often on the job. This need forces continuous upskilling and fuels workers' lifelong learning.

**On average, 28 percent of all tasks in current jobs will be at risk of automation by 2031,** according to our calculations. Jobs that combine repetitive physical and low-level cognitive tasks — such as those performed by farmworkers, property claims examiners, and production workers — are most likely to be automated.

The possible automation of jobs with low-level cognitive characteristics is especially notable because this defies the original trends in automation, which were initially confined to physical and manual tasks. These low-level cognitive tasks at risk of automation are found even in white-collar jobs filled by college-educated workers. In years past, these jobs were protected from the automation wave that first affected agriculture and manufacturing jobs. As time has passed, many of the physical and manual tasks that could be automated have been. Automation is now replacing some low-level cognitive tasks. It may also begin to replace some higher-level cognitive tasks, depending on how quickly large language models continue to develop.

Twenty-six percent of low-level cognitive tasks in a typical job are at risk of automation by 2031. Jobs that rely heavily on interpersonal skills — such as education and personal care jobs — or jobs that require a high degree of creativity are at the lowest risk from automation. Musicians, artists, and dancers are examples of jobs that require creativity, but creativity is also found in jobs that require broad strategic thinking. (See Appendix A for more details about the occupations that are most likely to be affected by automation.)

Technology in general improves overall productivity and creates net overall growth. As a result, even though some sectors will experience disproportionate job losses, jobs will be created elsewhere in the economy. The fastest growth will occur in occupations and industries that intensively rely on workers with postsecondary education and/or training.

## Our job projections have held up very well to actual events.

Given the quick recovery of the economy following the COVID-19 pandemic and the strong pace of economic growth, we are confident in these projections. Past CEW projections for job growth and requirements of educational attainment were within 4 percent of the actual results in the aggregate.

It is important to note that this report also introduces a new methodology for projecting jobs. In previous reports, the Georgetown University Center on Education and the Workforce broke down projections into two categories: new and replacement jobs. However, we became increasingly convinced that those projections misrepresented "churn" in jobs, and the turnover of employees in existing jobs, when compared to the creation of new jobs. The Bureau of Labor Statistics in the US Department of Labor changed its methods for forecasting jobs beginning in 2016 to de-emphasize job churn and more closely represent opportunities for job market entrants.

Readers will note that the projections for job growth in this report (18.5 million annual job openings) are significantly different when compared to previous reports. For example, in 2013, we forecast 55 million total job openings in the economy through 2020: 24 million openings from newly created jobs and 31 million openings due to retirements.[35] This report does not project total job openings during the forecast period, relying instead on projections of annual average job openings during that period. While we recognize that there is an opportunity for confusion, the new methodology results in significantly improved projections of job replacements and therefore is a better measure of employment demand, in our judgment. (For more details on the new methodology, please see Appendix I.)

35 Carnevale et al., *Recovery*, 2013.

# Projections Report Series

CEW's job projections include an executive summary, a national report, a state-by-state analysis, a technical appendix, and a webpage of data visualizations. The projections are designed to help policymakers set broad goals at the state level and to inform the educational choices and career plans of individuals and their counselors.

## National Report

This report includes a national overview of job projections and their educational requirements across industries, occupational clusters, and detailed occupational groups.

## State Report

The state report provides a state-by-state analysis of education demand and compares individual states to national estimates.

- The five states with the highest share of jobs requiring postsecondary education and/or training will be the District of Columbia[36], Minnesota, Massachusetts, Colorado, and Washington.
- The five states with the lowest share of jobs requiring postsecondary education and/or training will be Louisiana, Arkansas, Oklahoma, West Virginia, and Nevada.

## Technical Appendix

The technical appendix is a detailed explanation of CEW's methodological approach.

36 This report forecasts job growth for all 50 states and the District of Columbia. We included the District of Columbia when comparing the states in terms of needs for educational attainment.

PART 1

# Job Projections, 2021–31

## Without a postsecondary degree, a certificate, or at least some college coursework, the path to middle-class jobs is narrow.

The future of employment in the United States boils down to this — for all but a small share of workers, landing a job will require some form of postsecondary degree and/or a training certificate or at least some college coursework.

We project that there will be 171 million jobs in 2031, an increase of 16 million net new jobs over the base year estimate in 2021 of 155 million jobs.

Job openings represent the state of current job opportunity. Recent college graduates and those seeking employment are able to gauge the likelihood of success by the number of job openings in their field. Total jobs are a count of all jobs in the economy, including those that are presently filled. Between 2021 and 2031, the economy will create 18.5 million average annualized job openings. Seventy-two percent of these 18.5 million annualized job openings will require at least some college education. About 41 percent will require a bachelor's degree or higher, while 31 percent will require some college or a two-year associate's degree. Only about 28 percent will require workers with no more than a high school diploma (Figure 1).

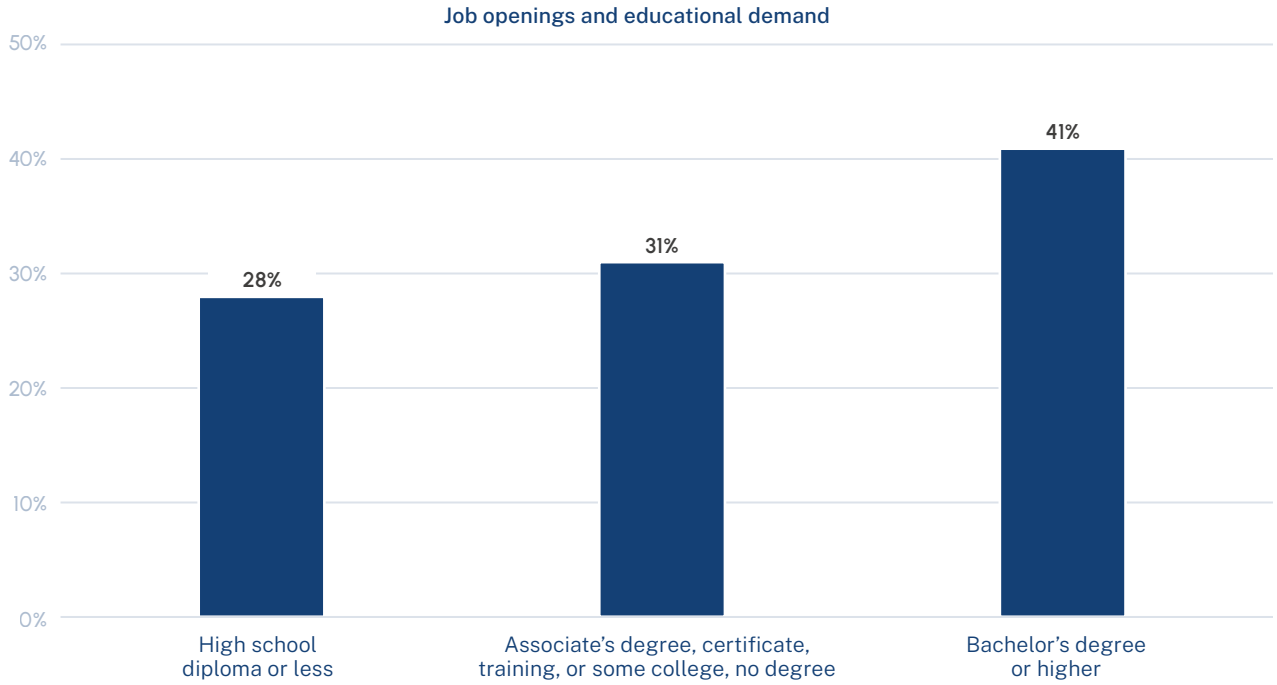
This growth in demand for postsecondary education and training is the culmination of two major trends. First, the fastest-growing industries require workers with disproportionately higher education levels compared to industries that have not grown as quickly. Second, over time, occupations as a whole are steadily requiring more education.

The implications of these shifts represent a sea change that has accelerated over the past four decades. Essentially, postsecondary education and training has become the threshold requirement for access to middle-class status and earnings. It is no longer the preferred pathway to middle-class jobs; it is increasingly the only pathway.

Over the past several decades, about 70 percent of the increase in requirements for postsecondary education and training stemmed from upgrades in skills demanded by occupations that previously did not require higher education.[37] For example, many of the functions performed by a foreman or manufacturing supervisor in the 1960s have given rise

37 Carnevale et al., *Help Wanted,* 2010.

**FIGURE 1. By 2031, 72 percent of job openings will require workers with at least some postsecondary education and/or training.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

to the modern manufacturing engineer, an occupation that requires postsecondary education and training. A significant but smaller share of the increase (about 30 percent) has resulted from the development of entirely new occupations or the expansion of occupations that already required high levels of postsecondary education.[38] Medical specialists, with a range of college-level skill requirements, now perform many of the functions performed by the medical doctor in the 1950s. Meanwhile, the jobs of middle managers have been divided into myriad occupations that are classified as business services, all requiring significant levels of postsecondary preparation.

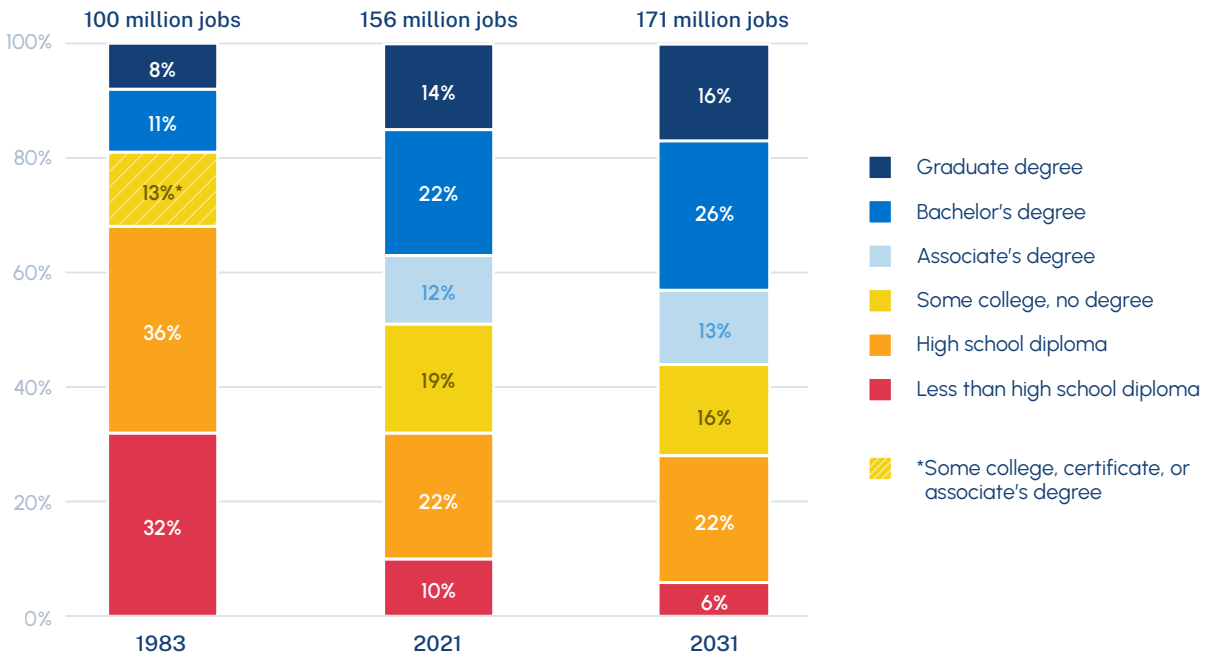
For proof of this upskilling trend, just look at the statistics. In 1983, only 32 percent of jobs required any postsecondary education and training beyond high school. By 2021, that share had climbed to 68 percent. The share of jobs for workers with an associate's degree, certificate, or some college more than doubled from 13 percent to 31 percent of the workforce. The percentage of jobs for workers with bachelor's degrees also doubled, from 11 percent in 1983 to 22 percent in 2021. The share of jobs for graduate degree holders has increased at a

38 Carnevale et al., *Help Wanted,* 2010.

slightly slower pace, growing from 8 percent to 14 percent over the same period. In the early 1980s, the American economy featured more jobs for workers with less than a high school education than for college graduates. Now jobs for workers without a high school education make up just 10 percent of the workforce (Figure 2).

The projections of education demand outlined in this report rest on a combination of historical data and growth forecasts based on a model outlined in the technical appendix.[39] CEW analysis of IHS Markit data estimates that the return to the long-run growth path for GDP was in place by 2022, after the extraordinary losses in output suffered in both 2020 and 2021, during the COVID-19 pandemic. The Congressional Budget Office projected economic recovery beginning in 2021, but cautioned that inflationary pressures in 2022 and continuing into 2023

**FIGURE 2. Forty-two percent of jobs in 2031 will require at least a bachelor's degree, while only 28 percent will go to workers with a high school diploma or less.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1983.

*Note: Before 1992, the education variable in the Current Population Survey was identified as years of schooling. We are therefore unable to differentiate between "some college or certificate" and "associate's degree" in those years. .

Columns may not sum to 100 percent due to rounding.

39 The technical appendix can be found at cew.georgetown.edu/Projections2031.

would contribute to slower growth in real GDP. That effect is estimated to last until 2024.[40]

Given positive momentum in the economy before the COVID-19 pandemic and the current pace of economic growth, we feel that the job projections in this report are reliable through 2031.

These projections for educational requirements are relatively high in comparison with official US Bureau of Labor Statistics (BLS) estimates. We believe the official BLS data underestimate the true demand for postsecondary education and training in our country.[41] Both education and labor data sources commonly miss postsecondary training programs that result in certificates and certifications. Education data typically count only people who pass through educational institutions in pursuit of formal degrees, while labor market data do not include certificates or industry-based certifications. Both types of data, then, ignore the role played by formal and informal learning outside the traditional education system, including industry and occupational licensure, apprenticeships, and employer-based training.

The official data also understate the importance of postsecondary education and training by over-counting low-skill jobs. Low-skill jobs generally have high worker turnover because they often are filled by young people who are working their way through school or toward better jobs.[42] In addition, low-skill jobs, which require a high school diploma or less, often are divided into part-time positions. Therefore, relying solely on vacancy data can exaggerate the significance of low-skill jobs and, in turn, underestimate the demand for education and training.[43] In other words, as robust as the demand for postsecondary education and training seems to be in our forecast, the actual demand may be greater.

40 Congressional Budget Office, "The Budget and Economic Outlook: 2022 to 2032," 2022.

41 Carnevale et al., "Too Many College Grads?" 2014.

42 Carnevale et al., *Learning While Earning*, 2015.

43 Carnevale et al., *The Online College Labor Market*, 2014.

PART 2

# Job Projections through 2031 by Industry

Industry growth rates often are related to changing demographics and the demand for new goods or services within that industry. Many industries are experiencing rapid sales increases and job growth.

In this analysis, we break down the US economy into 13 major industry groups. Between 2021 and 2031, the healthcare services industry will grow the fastest among those industries, adding the most net new jobs (4.2 million). Three other industries will add more than 1 million net new jobs — professional and business services, leisure and hospitality services, and government and public education services. The natural resources industry stands to gain the least: about 200,000 net new jobs (Table 1).

**TABLE 1. All industries are expected to see increases in employment between 2021 and 2031.**

| | Economic Output | 2021 | | 2031 | | Change | |
|---|---|---|---|---|---|---|---|
| Industry | **Billions of dollars** *Seasonally adjusted at annual rates as of* 2022 Q1 | **Employment** *(in thousands)* | **Rank** | **Employment** *(in thousands)* | **Rank** | **Employment** *(in thousands)* | **Rank** |
| Professional and business services | $ 5,132.9 | 22,600 | 2 | 25,500 | 1 | 2,900 | 2 |
| Government and public education services | $ 4,573.0 | 23,900 | 1 | 25,500 | 2 | 1,600 | 3 |
| Healthcare services | $ 2,841.1 | 20,800 | 4 | 25,000 | 3 | 4,200 | 1 |
| Wholesale and retail trade services | $ 5,261.1 | 20,900 | 3 | 21,800 | 4 | 900 | 6 |

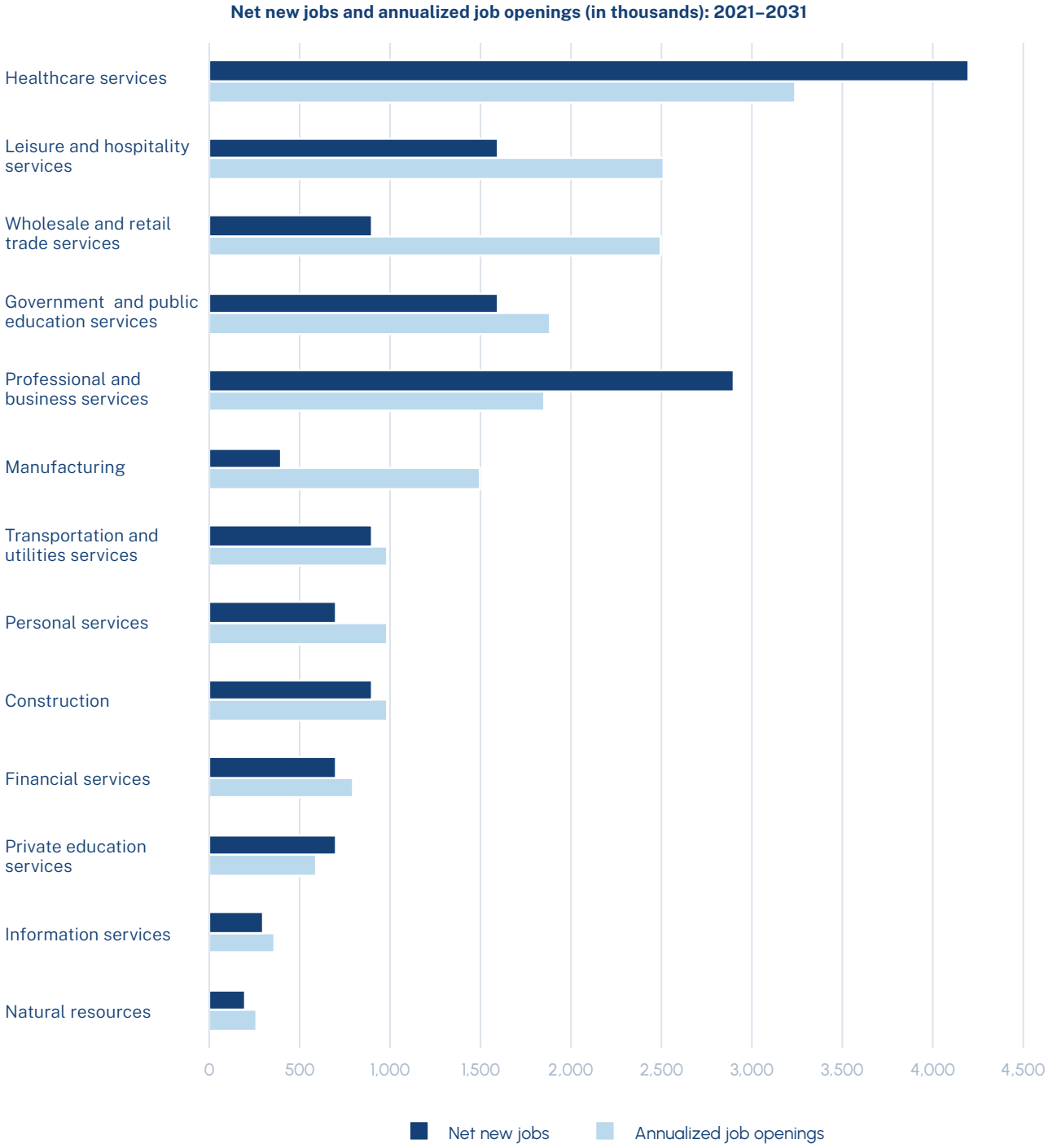
| | Economic Output | 2021 | | 2031 | | Change | |
|---|---|---|---|---|---|---|---|
| Industry | Billions of dollars *Seasonally adjusted at annual rates as of* 2022 Q1 | Employment *(in thousands)* | Rank | Employment *(in thousands)* | Rank | Employment *(in thousands)* | Rank |
| Leisure and hospitality services | $ 1,801.6 | 13,300 | 5 | 14,900 | 5 | 1,600 | 4 |
| Manufacturing | $ 7,018.3 | 12,200 | 6 | 12,600 | 6 | 400 | 11 |
| Financial services | $ 8,243.6 | 9,400 | 7 | 10,100 | 7 | 700 | 10 |
| Construction | $ 2,019.0 | 9,100 | 8 | 10,000 | 8 | 900 | 7 |
| Personal services | $ 812.0 | 8,100 | 9 | 8,800 | 9 | 700 | 8 |
| Transportation and utilities services | $ 2,368.2 | 7,100 | 10 | 8,000 | 10 | 900 | 5 |
| Private education services | $ 395.0 | 4,100 | 11 | 4,800 | 11 | 700 | 9 |
| Information services | $ 2,493.4 | 2,800 | 12 | 3,100 | 12 | 300 | 12 |
| Natural resources | $ 1,332.4 | 1,200 | 13 | 1,400 | 13 | 200 | 13 |
| **Total** | **$ 44,291.6** | **155,500*** | | **171,500*** | | | |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau, the US Bureau of Labor Statistics, and the US Bureau of Economic Analysis.

*Industry and Occupation totals vary due to rounding of occupations within industries.

Notably, the two industries that will be adding the most net new jobs between 2021 and 2031—healthcare services and professional and business services—will grow so quickly that most annual job openings will be for completely new positions. In every other industry, the majority of annual job openings will be replacing workers who retired or otherwise permanently left an occupation (Figure 3).

## FIGURE 3. The healthcare services and professional and business services industries will have more net new jobs than any other industries over the next decade.




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: The job openings metric counts new jobs and jobs created when workers move from one occupational category to another. It does not count when workers move from job to job within an occupational category.

The demand for workers with postsecondary education and training has been growing and will continue to grow, especially as service industries expand. Across the entire economy, 7.2 million annual job openings will require a bachelor's degree or higher between 2021 and 2031. A smaller number of annual job openings (5.6 million) will not require a bachelor's degree but will require some postsecondary education and/or training — such as a certificate, certification, or associate's degree — while another 5.6 million annual job openings will be filled by workers with a high school diploma or less.

For workers with a high school diploma or less, annualized job openings will be most plentiful in the following industries (Figure 4):

- Leisure and hospitality (1.2 million);
- Wholesale and retail trade services (763,000); and
- Healthcare services (679,000).

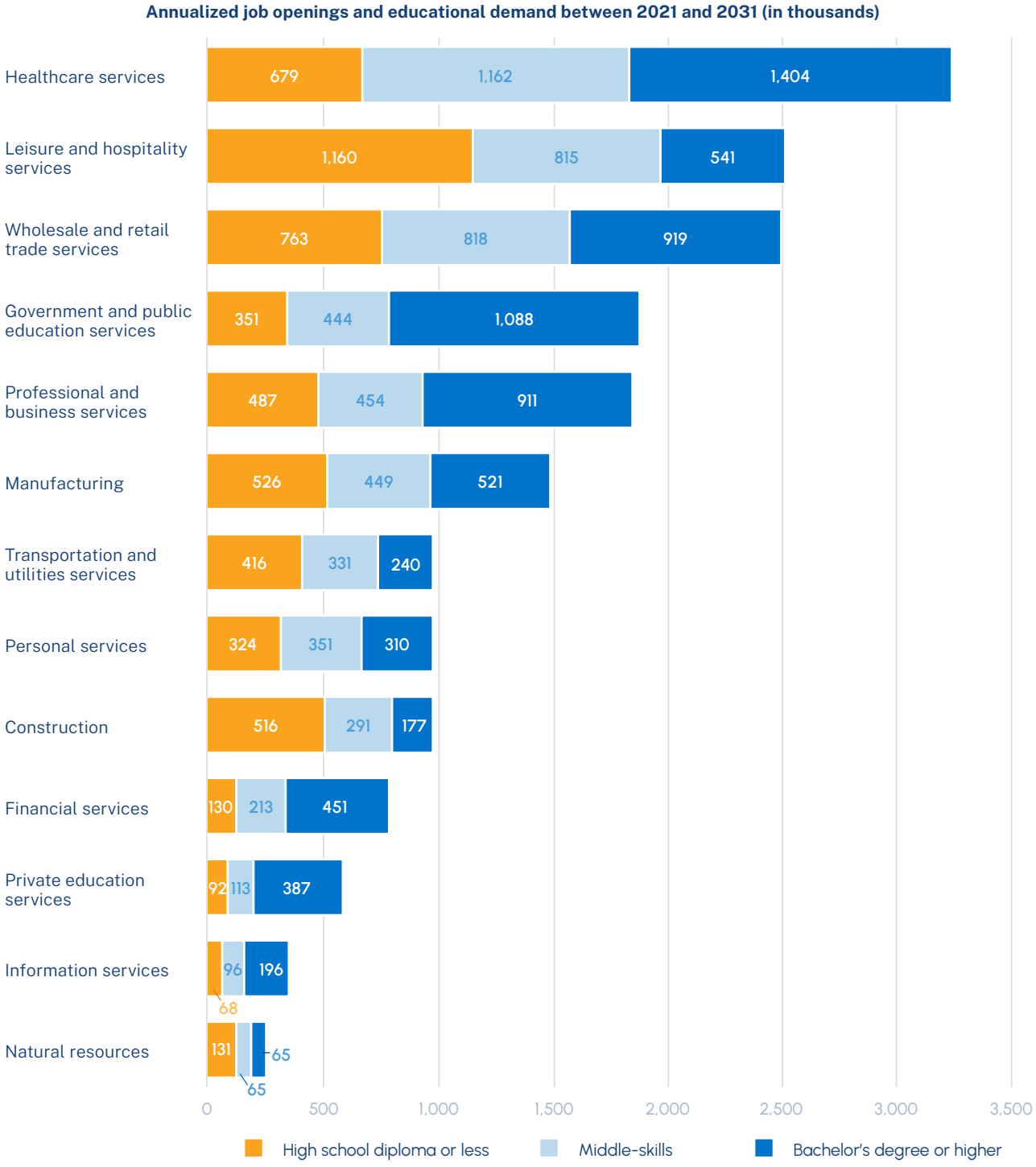
At the other end of the spectrum, the industries with the largest number of annualized job openings requiring a bachelor's degree or higher will be:

- Healthcare services (1.4 million);
- Government and public education services (1.1 million);
- Wholesale and retail trade services (919,000); and
- Professional and business services (911,000).

In the middle-skills jobs tier, these industries will have the most annualized job openings that require an associate's degree or some college but no degree:

- Healthcare services (1.2 million);
- Wholesale and retail trade services (818,000); and
- Leisure and hospitality services (815,000).

**FIGURE 4. The healthcare services industry will have the most annualized job openings through 2031 for workers with a bachelor's degree or above and for workers with middle skills.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

## Government and Public Education Services Industry

The government and public education services industry — composed of public school systems, legislative bodies, government executive offices, and other public administration and public finance activities — is currently the nation's largest employer (but it will drop to the second-largest by 2031, narrowly behind professional and business services). The government and public services industry provides nearly 24 million jobs, or 15 percent of US employment. Of all industries, it employs by far the most workers with postsecondary education and training. Overall, it provides more than one in five such jobs.

The government and public education services industry is responsible for $4.6 trillion in economic activity. The bulk of this output comes at the state and local government level ($3.2 trillion), with the remaining $1.4 trillion generated by the federal government. Taken together, this industry generates the fifth-largest share of all economic output.

This industry, however, is not expected to grow significantly in economic output between 2021 and 2031. Every other industry is expected to increase output more quickly. By 2031, the government and public education services industry is expected to increase in total jobs by 7 percent, or 1.6 million.[44]

As is happening in other service industries, jobs for those without a postsecondary education are virtually disappearing in the government and public education services industry. As in other industries, automation and technology have changed the work and required greater skills. For example, dramatic advances in computing technology and digital file processing changed the need for and role of file clerks and data entry workers — jobs that previously were available to low-skill workers.

Between 2021 and 2031, government and public education services will generate 1.9 million annual job openings. Most of the annual job openings will require postsecondary education and/or training, and all the new positions will require at least some college.

Between 2021 and 2031, government and public education services will have annual job openings for:

- 351,000 workers with a high school diploma[45] or less;
- 444,000 workers with an associate's degree, or some college but no degree; and
- 1.1 million workers with a bachelor's degree or more.

44 US Bureau of Labor Statistics, Table 2.2 of *Employment Projections 2016–2026*, 2017.

45 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Wholesale and Retail Trade Services Industry

Wholesale and retail trade establishments do not create goods of their own. Instead, they act as intermediaries between producers and their customers. Wholesalers sell merchandise in bulk to other businesses (including retailers), and retailers generally sell small quantities to a large volume of consumers.

The wholesale and retail trade services industry is currently the third-largest industry by number of jobs and the third-largest in terms of economic output. The industry provided 20.9 million jobs in 2021, or 14 percent of the workforce, and generated about $5.3 trillion in output. Retail trade constitutes the vast majority of this industry's employment (more than 70 percent) but slightly less than half of its output.

The wholesale and retail trade services industry is expected to expand both employment (by a relatively modest 4 percent) and economic output by 2031. As a result, the industry will remain the third-largest industry in terms of economic output, but will drop to fourth in total employment. While wholesale and retail trade are expected to expand output by roughly even amounts, almost three-quarters of the increase in employment will come from the retail trade services part of the industry.

Computer-based technology has powerfully affected the wholesale and retail trade services industry. The rise in electronic commerce has made it easier for retailers and wholesalers to identify and reach new customers and suppliers, but it also has made it easier for producers to bypass them by selling directly to customers.

As technological change has left its mark, the industry has steadily increased its use of workers with postsecondary education and training. However, because of its sheer size, the industry will remain the largest employer of workers without a postsecondary education and training.[46]

Between 2021 and 2031, the wholesale and retail trade services industry is expected to generate 2.5 million annual job openings. During this period, there will be 1.7 million annual job openings that require at least some higher education.

Between 2021 and 2031, wholesale and retail trade services will provide annual job openings for:

- 763,000 workers with a high school diploma[47] or less;
- 818,000 workers with an associate's degree, or some college but no degree; and
- 919,000 workers with a bachelor's degree or more.

46 In 2031, this industry will employ 18 percent of the nation's workers who do not have a college education.

47 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Professional and Business Services Industry

The professional and business services industry includes such work as consulting, temporary staffing, technical support, and network computing and communications support. The professional and business services industry has grown apace with the increasing complexity of far-flung institutional networks that rely on multiple companies or institutions to produce final products or services. Workers in professional and business services enable such networks by providing highly-skilled professional and managerial expertise that cuts across traditional industry, geographic, and occupational boundaries.

A growing share of jobs in the professional and business services industry is in consulting and contracting work. Future growth will be driven by companies' need for consultants and contractors to assist them with everything from running cafeterias to ensuring regulatory compliance to marketing, design, and logistics. In addition, companies increasingly will shift human resources management functions to contractors to reduce costs and risk as they operate in complex regulatory and benefits environments.

The professional and business services industry is the fourth-largest industry in economic output. The professional and business services industry provided nearly 22.6 million jobs in 2021, making it the second-largest industry by employment (14 percent of US employment). Only the government and public education services industry employed more workers. By 2031, professional and business services employment will grow by 13 percent. As a result, the industry will add nearly 2.9 million net new jobs and become the largest industry by number of jobs.

Between 2021 and 2031, the professional and business services industry will generate nearly 1.9 million annual job openings.

Between 2021 and 2031, the professional and business services industry will have annual job openings for:

- 487,000 workers with a high school diploma[48] or less;
- 454,000 workers with an associate's degree, or some college but no degree; and
- 911,000 workers with a bachelor's degree or more.

48 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Healthcare Services Industry

The healthcare services industry, composed of healthcare and social assistance providers, is the sixth-largest industry in terms of economic output and the fourth-largest industry in terms of number of jobs. In 2021, the industry had 20.8 million jobs and generated more than $2.8 trillion in economic output. Hospitals and outpatient clinics generated the majority of this output, with nursing and residential care facilities contributing 10 percent, and social assistance facilities (such as daycare services) contributing 8 percent.

An aging baby boomer population and the rapid advance of health technologies are driving the growth in healthcare services. By 2030, all baby boomers will be older than age 65. This will expand the size of the older population so that 1 in every 5 US residents will be retirement age.[49] New technologies and drugs will allow people to live to advanced ages, and older patients generally require more care. Advances in technology and research also will ensure increased survival rates from major diseases but will trigger increased costs for critical recovery care.

The burgeoning need for care will propel the healthcare services workforce to grow faster than any other. Between 2021 and 2031, employment in this industry is projected to increase by 20 percent, or more than 4.2 million net new jobs. That is greater than any other industry by a margin of more than 1 million jobs. By 2031 it will become the third-largest industry in terms of jobs.

The use of workers with postsecondary education and training has expanded steadily in healthcare. Between 2021 and 2031, healthcare services will have the most annual job openings of any industry, with 3.2 million. This is 30 percent more than the number of annual openings in the leisure and hospitality services industry, the industry with the second-most annual openings.

Between 2021 and 2031, healthcare services will have annual job openings for:

- 679,000 workers with a high school diploma[50] or less;
- 1.2 million workers with an associate's degree, or some college but no degree; and
- 1.4 million workers with a bachelor's degree or more.

49 US Census Bureau, "Projected Age Groups and Sex Composition of the Population," 2018.

50 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Leisure and Hospitality Services Industry

The leisure and hospitality services industry includes businesses involved in a wide range of services related to accommodations, and cultural, entertainment, recreational, and food services. Establishments in this industry range from fast-food burger joints to hotels and motels to community theaters and bowling alleys. Currently, the leisure and hospitality services industry generates the 10th-largest share of economic output but is the fifth-largest employer by industry. In 2021, the leisure and hospitality services industry employed 13.3 million workers, or close to 9 percent of US employment, and generated $1.8 trillion in economic output.[51]

Restaurants and bars are by far the largest part of this industry, generating more than half (55 percent) of the total economic output. Growth in output from the accommodations and food services subsector alone will account for nearly 70 percent of the expected increase in this industry between now and 2031, but the output of the arts, entertainment, and recreation subsector is expected to grow at a faster rate.

Despite being the second-largest employer of workers without postsecondary education and/or training, the leisure and hospitality services industry is not immune to the rising need for further education. In the early 1980s, 37 percent of its jobs required postsecondary education and/or training, compared to 52 percent in 2021.

Between 2021 and 2031, the leisure and hospitality services industry will generate 2.5 million annual job openings. (Only the healthcare services industry will have more annual job openings.) The leisure and hospitality services industry will add a total of 1.6 million net new jobs during this period—an increase of 12 percent.

Between 2021 and 2031, the leisure and hospitality services industry will have annual job openings for:

- 1.2 million workers with a high school diploma[52] or less;
- 815,000 workers with an associate's degree, or some college but no degree; and
- 541,000 workers with a bachelor's degree or more.

51 US Bureau of Economic Analysis, 2022.

52 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Manufacturing Industry

In 2021, the manufacturing industry produced a staggering $7 trillion in goods and services, or 16 percent of all US economic output. That made manufacturing the second largest industry in terms of output, about $1.2 trillion smaller in economic output than the financial services industry.

In past decades, manufacturing was also the largest employer of any industry. At its height in 1979, manufacturing provided nearly 20 million jobs, or 22 percent of US employment at the time.[53] By 2021, the manufacturing industry had 7.7 million fewer jobs than it did in 1979, with 12.2 million jobs (8 percent of US employment). Employment in manufacturing has recovered slightly during the past decade but it still ranks sixth among the industries in total jobs.

Technological change, especially automation, has reshaped manufacturing to a greater extent than any other industry. Early automation efforts such as the assembly line were complementary to low-skill workers. They increased productivity while creating more jobs for less-skilled workers performing repetitive tasks. However, technological change increasingly is automating those repetitive tasks and eliminating the jobs of less-skilled workers. A study of employment data from 1997 to 2007 found that three manufacturing jobs were lost for every industrial robot added.[54]

Technology also is changing the skills and knowledge required for the jobs that remain. In 1983, only 33 percent of manufacturing jobs required at least some postsecondary education and/or training. This share increased to 56 percent in 2021.

Between 2021 and 2031, there will be 1.5 million annual job openings in the manufacturing industry. These will include annual job openings for:

- 526,000 workers with a high school diploma[55] or less;
- 449,000 workers with an associate's degree, or some college but no degree; and
- 521,000 workers with a bachelor's degree or more.

53 Georgetown University Center on Education and the Workforce analysis of data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), various years.

54 The Georgetown University Center on Education and the Workforce estimated this change based on the findings in Acemoglu and Restrepo, "Robots and Jobs," 2017.

55 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Financial Services Industry

As measured by economic output, financial services is the largest industry in the economy. Despite having such a large economic output (more than $8 trillion), financial services ranked only seventh by number of jobs in 2021, and it will remain in that position in 2031. In 2021, the financial services industry had 9.4 million jobs (6 percent of US employment).

Several factors have converged to fuel the marked growth of the financial services industry in recent decades — the move from defined benefit to defined contribution retirement plans, increasing consumer debt, and the globalization of financial services. The Great Recession, which lasted from December 2007 to June 2009, hit financial services hard because the collapse of the financial and housing markets triggered the crisis. By 2021, the economic output and employment of the financial services industry rivaled pre-2007 levels, and they are on track to surpass them soon.

The financial services industry once employed a significant number of workers who had not gone to college. In the early 1980s, 43 percent of jobs in financial services required no postsecondary education and/or training. As new technology was developed, however, the educational requirements for jobs often increased to reflect more complex job duties. For example, banks did not completely replace bank tellers with automatic teller machines but instead assigned tellers more customer service responsibilities.[56]

Between 2021 and 2031, the financial services industry will have 795,000 annual job openings. Of those annual job openings, 84 percent will require at least some college education.

Between 2021 and 2031, the financial services industry will have annual job openings for:

- 130,000 workers with a high school diploma[57] or less;
- 213,000 workers with an associate's degree, or some college but no degree; and
- 451,000 workers with a bachelor's degree or more.

56 Autor, "Why Are There Still So Many Jobs?," 2015.

57 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Construction Industry

Construction is the nation's ninth-largest industry as measured by economic output and the eighth-largest by employment. In 2021, the industry had 9.1 million jobs, or 6 percent of US employment, and produced $2 trillion in economic output. By 2031, construction will surpass the transportation and utilities services industry to become the eighth-largest industry as measured by economic output.[58]

While the construction industry is booming, construction contractors have consistently raised concerns about the difficulty of finding skilled workers. This perspective is even more pronounced as infrastructure spending increases through the Infrastructure Investment and Jobs Act.

Restrictive immigration policies could exacerbate this shortage. American-born workers have been reluctant to return to construction since the Great Recession, so the industry increasingly has turned to foreign-born workers. Now, 30 percent of construction workers are foreign-born, and foreign-born workers fill a disproportionate share of occupations that are consistently in short supply.[59]

Long-term investments in infrastructure are expected to create even more jobs for welders, electricians, technicians, and truck drivers. The vast majority of jobs would be in male-dominated career fields like the construction and transportation industries.[60]

Even with its labor-intensive jobs, construction is not immune from job displacement by technology. Contractors increasingly are embracing new technology, including drones, wearable technology, reality capture, 3D printing, and other automatic equipment.[61] In the face of labor shortages, it is particularly likely that offsite construction (such as pre-fabrication) will spread. In 2018, 67 percent of contractors predicted this practice would increase over a three-year period.[62]

Between 2021 and 2031, construction will have 984,000 annual job openings. Those openings will include:

- 516,000 workers with a high school diploma[63] or less;
- 291,000 workers with an associate's degree, or some college but no degree; and
- 177,000 workers with a bachelor's degree or more.

58 US Bureau of Labor Statistics, Table 2.2 of *Employment Projections 2016–2026*, 2017.

59 Siniavskaia, "Concentration of Immigrant Workers across Construction Occupations," 2018.

60 Carnevale and Smith, *Trillion Dollar Infrastructure Proposals Could Create Millions of Jobs,* 2017.

61 USG Corporation and US Chamber of Commerce, *Commercial Construction Index, Q4 2018,* 2018.

62 USG Corporation and US Chamber of Commerce, *Commercial Construction Index, Q1 2018,* 2018.

63 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Personal Services Industry

The personal services industry covers services that relate to the maintenance of people, private property, households, and communities. Examples include automotive repair and maintenance services, nail salons, barbers, religious organizations, civic advocacy groups, funeral services, and laundry services.[64]

In 2021, 8.1 million personal services jobs generated $812 billion in economic output. This industry is expected to create 700,000 net new jobs between 2021 and 2031. As a result, this industry will retain its rankings of 12th in output and ninth in total employment among the 13 major industry groups.

The share of jobs in this industry that require postsecondary education and/or training has climbed slowly over time. In 1983, only 34 percent of its jobs required postsecondary education and/or training, compared to 56 percent in 2021.

Between 2021 and 2031, personal services will generate 985,000 annual job openings. About 660,000 of the annual job openings during this period will require at least some postsecondary education and/or training.

Between 2021 and 2031, the personal services industry will have annual job openings for:

- 324,000 workers with a high school diploma[65] or less;
- 351,000 workers with an associate's degree, or some college but no degree; and
- 310,000 workers with a bachelor's degree or more.

64 US Bureau of Labor Statistics, Table 2.2 of *Employment Projections 2016–2026*, 2017.

65 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Transportation and Utilities Services Industry

The transportation and utilities services industry helps provide for the transportation of passengers and cargo (by air, rail, water, road, and pipeline), warehousing and storage of goods, and utility services (such as electricity, water, gas, and sewage). The transportation and warehousing services subsector generates $1.7 trillion in economic output, whereas the utilities services subsector generates $629 billion. Taken together, this industry is the eighth-largest industry in terms of economic output, contributing 5 percent of national GDP.[66]

The transportation and utilities services industry is expected to grow moderately between 2021 and 2031, increasing its total employment from 7.1 million to 8 million jobs. After this growth, the industry will remain the 10th-largest industry in terms of employment.

Technological change, especially automation and robotics, has infiltrated the transportation and utilities services industry and soon could prove very disruptive. For the utilities services subsector, green energy sources such as solar and wind power are becoming more practical for widespread use, and better analytics provide more efficient management of the power grid.[67] The online retail boom, which encouraged automation of storage and retrieval systems and door-to-door delivery, has had a large impact on the transportation subsector over the past decade.[68] The promise of autonomous vehicles, which likely will bring tremendous logistical savings by reducing labor costs, looms large over the transportation and utilities services industry.[69]

The share of jobs in this industry requiring postsecondary education and/or training has risen steadily over time. Still only three other industries rely less on workers with a postsecondary education and training.

Between 2021 and 2031, transportation and utilities services will rank seventh in annual job openings, with 987,000. The total number of jobs for workers without postsecondary education and/or training will decline by 2 percent.

Between 2021 and 2031, transportation and utilities services will have annual job openings for:

- 416,000 million workers with a high school diploma[70] or less;
- 331,000 workers with an associate's degree, or some college but no degree; and
- 240,000 workers with a bachelor's degree or more.

66 US Bureau of Labor Statistics, Table 2.2 of *Employment Projections 2016–2026*, 2017.

67 Smith, "2019 Power and Utilities Industry Outlook," 2018.

68 Allais, "Automation in the Warehouse," 2017.

69 US Government Accountability Office, "Automated Trucking," 2019.

70 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

## Private Education Services Industry

Education services constitute the core method for providing workforce development in the postindustrial economy. Thirty-five percent of education services workers work in the private sector. Most of them work in postsecondary education and training, where they make up 58 percent of workers.[71]

The private education services industry is the smallest in terms of economic output and the third-smallest in terms of employment. Its 4.1 million jobs generate $395 billion in economic output.[72] In 2031, employment in private education services will grow to 4.8 million jobs.

Workers in this industry are responsible for the upskilling of other workers. The technological changes that are increasing the demand for skilled workers across the economy are increasing the need for adult education, which boosts the demand for private education services.

Understandably, the education services industry has always had one of the most highly-educated workforces.

Between 2021 and 2031, the private education services industry will generate 700,000 net new jobs and 592,000 annual job openings. Of the 592,000 annual job openings in this period, 500,000 will require at least some postsecondary education and/or training.

Between 2021 and 2031, the private education services industry will have annual job openings for:

- 92,000 workers with a high school diploma[73] or less;
- 113,000 workers with an associate's degree, or some college but no degree; and
- 387,000 workers with a bachelor's degree or more.

## Information Services Industry

Information services, the marquee industry of the knowledge economy, is the seventh-largest industry in terms of economic output even while it is the second-smallest employer among the 13 major industry groups. In 2021, the information services industry had 2.8 million jobs, or 2 percent of US employment, and produced $2.5 trillion in output, or 5 percent of the country's GDP. By 2031, the total number of jobs in the information services industry will increase to 3.1 million.

71 Georgetown University Center on Education and the Workforce analysis of data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), various years.

72 US Bureau of Labor Statistics, Table 2.2 of *Employment Projections 2016–2026*, 2017.

73 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

The information services industry includes software publishing and internet companies, but more traditional companies — print publishing, traditional broadcasting, and the motion picture and recording industries — are part of it as well. As the digital revolution has spread, higher levels of worker training have became more important as traditional companies adopted new technologies and as highly technical jobs emerged in the burgeoning digital publishing subsector.

In the early 1980s, when only about 8 percent of consumers had a personal computer,[74] about half the jobs in this industry required at least some college education. By the early 1990s, as the internet was made available to the public and digital technologies enhanced business operations, employment in this industry boomed. And with the tide of new opportunities, the share of jobs in this industry requiring at least some college education swelled. This trend continued throughout the 2000s as the internet became ubiquitous in American life. By the late 2010s, when four out of five Americans had access to a personal computer, more than 80 percent of jobs in this industry required at least some college education.[75]

The technology revolution has profoundly reshaped this industry and will continue to do so. Demand for non-electronic publishing, such as print newspapers, is expected to keep declining, and further technological adoption will reshape the industries that remain.[76] Software and internet publishing will continue to have the strongest employment growth in this industry, as electronic media continues to capture a larger market share from traditional media. The rising trend of required postsecondary education and/or training for workers in this industry will continue into 2031.

Between 2021 and 2031, the information services industry will have 359,000 annual job openings. These will include:

- 68,000 for workers with a high school diploma[77] or less;
- 96,000 for workers with an associate's degree, or some college but no degree; and
- 196,000 for workers with a bachelor's degree or more.

## Natural Resources Industry

The natural resources industry is a small part of the US economy in terms of both employment and output. The two main subsectors of the natural resources industry are mining; and

74 Georgetown University Center on Education and the Workforce analysis of data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), various years.

75 Georgetown University Center on Education and the Workforce analysis of data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), various years.

76 Lee, "Print Newspapers Are Dying Faster Than You Think," 2016.

77 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

agriculture, forestry, fishing, and hunting. In 2021, the 1.2 million workers (less than 2 percent of US employment) in this industry produced about $1.3 trillion worth of goods and services (about 3 percent of GDP).[78]

Technological change is reshaping the natural resources industry. New technologies and tools are putting inaccessible resources within reach and enabling more efficient extraction. Technological advances are likely to increase productivity in this labor-intensive industry, especially for mining and oil and gas extraction.[79]

By 2031, the natural resources industry will increase economic output by a projected 26 percent. Mining is the largest part of this growth, with a projected growth in output of 33 percent. That is one of the fastest growth rates projected in any industry. In fact, only the healthcare industry will grow faster in economic output, and only the information services industry will grow as quickly.[80] By contrast, only two industries — government and public education services and private educational services — are projected to grow more slowly than the agriculture, forestry, fishing, and hunting subsector.

The natural resources industry will have the fewest annual job openings of the 13 major industries between 2021 and 2031. The total number of natural resources industry jobs will increase from 1.2 million to 1.4 million between 2021 and 2031. Almost all these new jobs will occur in the mining subsector and are attributable to an increased demand for domestic energy. Yet, even with this growth, the natural resources industry will fall well short of the 3 million jobs it had in 2008.[81]

Jobs in natural resources industries have the second-lowest level of postsecondary education and training requirements, but the need for postsecondary training is increasing alongside increased automation and new technological adoption.

Between 2021 and 2031, natural resources industries will have annual job openings for:

- 131,000 workers with a high school diploma[82] or less;
- 65,000 workers with an associate's degree, or some college but no degree; and
- 65,000 workers with a bachelor's degree or more.

78 US Bureau of Labor Statistics, Table 2.2 of *Employment Projections 2016–2026*, 2017.

79 The McKinsey Global Institute estimates that in a moderate technology adoption scenario, producers will increase productivity by a factor of 20 percent by 2035 (Woetzel et al., *Beyond the Supercycle*, 2017).

80 US Bureau of Labor Statistics, Table 2.2 of *Employment Projections 2016–2026*, 2017.

81 Georgetown University Center on Education and the Workforce analysis of data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), various years.

82 Workers with a high school diploma include workers with GEDs and those who achieved other certificates considered equivalents of a high school diploma.

PART 3

# Job Projections through 2031 by Occupation

There are thousands upon thousands of unique job titles that are categorized into occupations. To present a cogent analysis, we sorted these occupations by function into 22 occupational groups and then categorized these groups into nine major occupational clusters (Table 2).

**TABLE 2. Employment in every occupational group will grow through 2031, but healthcare support occupations will increase the most (2 million net new jobs).**

| **JOBS BY OCCUPATION** (in millions of jobs) | | | | |
|---|---|---|---|---|
| **Occupations** | **Jobs in 2021** | **Jobs in 2031** | **Net new** | **Annualized job openings** |
| **Blue-collar** | | | | |
| Transportation and material moving | 13.4 | 14.6 | 1.3 | 1.8 |
| Production | 9.1 | 9.3 | 0.2 | 0.9 |
| Construction and extraction | 6.4 | 7.1 | 0.7 | 0.7 |
| Installation, maintenance, and repair | 6.2 | 6.7 | 0.6 | 0.6 |
| Farming, fishing, and forestry | 0.7 | 0.7 | 0.1 | 0.2 |
| **Sales and office support** | | | | |
| Office and administrative support | 20.5 | 21.1 | 0.6 | 2.1 |
| Sales and related | 14.2 | 15.0 | 0.8 | 1.8 |
| **Food and personal services** | | | | |
| Food preparation and serving related | 11.8 | 13.2 | 1.4 | 2.5 |
| Personal care and services | 3.5 | 3.9 | 0.4 | 0.7 |
| Building and grounds cleaning and maintenance | 4.9 | 5.3 | 0.5 | 0.7 |
| Protective services | 3.7 | 4.0 | 0.3 | 0.4 |

**JOBS BY OCCUPATION** (in millions of jobs)

| Occupations | Jobs in 2021 | Jobs in 2031 | Net new | Annualized job openings |
|---|---|---|---|---|
| **Managerial and professional office** | | | | |
| Management | 8.9 | 10.0 | 1.2 | 0.9 |
| Business and financial operations | 9.4 | 10.5 | 1.1 | 0.9 |
| Legal | 1.3 | 1.4 | 0.1 | 0.1 |
| **Healthcare professional and technical** | | | | |
| Healthcare professional and technical | 9.4 | 10.8 | 1.4 | 0.6 |
| **STEM and social sciences** | | | | |
| Computer and mathematical | 5.1 | 6.1 | 0.9 | 0.5 |
| Architecture and engineering | 2.7 | 3.0 | 0.2 | 0.2 |
| Life, physical, and social sciences | 1.5 | 1.7 | 0.2 | 0.1 |
| **Education** | | | | |
| Education, training, and library | 9.6 | 10.6 | 1.0 | 0.9 |
| **Healthcare support** | | | | |
| Healthcare support | 7.6 | 9.6 | 2.0 | 1.1 |
| **Community services and arts** | | | | |
| Arts, design, entertainment, sports, and media | 2.1 | 2.4 | 0.2 | 0.3 |
| Community and social services | 2.9 | 3.4 | 0.5 | 0.3 |
| **TOTAL** | **154.8** | **170.5** | **15.7** | **18.5** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: Columns and rows may not sum due to rounding.

The job projections by industry in Part 2 are important, but job projections by occupation allow a different look at the workforce. Industries consist of various occupations, some that demand college degrees and some that do not. For example, a company in the private education services industry will definitely employ teachers, but it may also employ food services and building maintenance workers. This tends to dilute the concentration of workers with postsecondary education and/or training in many industries, depending on the mix of higher education required for the various occupations.

On the other hand, occupations tend to have similar educational requirements regardless of the industry in which they are located, though particular competencies can be industry-specific. Accountants perform comparable tasks whether they work for a mining company or a hospital, and the training required for entry-level work is virtually the same. Some occupations vary somewhat in educational requirements by industry. For example, the educational requirements for managers in the leisure and hospitality services industry are quite different from those for managers in the healthcare services industry.

The variation in demand for postsecondary education and training among occupations is evident even at the aggregated level. At one extreme, as of 2021, 95 percent of all workers in STEM and social sciences occupations (which includes engineers, computer programmers, and chemists) required postsecondary education. At the other extreme, fewer than half (47 percent) of blue-collar occupations (such as welders, bus drivers, and construction workers) required postsecondary education and training (Table 3). Some occupations have smaller shares of jobs that require postsecondary education and/or training, but those differences can get lost when we aggregate occupations into groups.

**TABLE 3. Occupations in the STEM and social sciences cluster will have the largest proportion of workers with postsecondary education and training in 2031.**

| | 2021 | | 2031 | |
|---|---|---|---|---|
| | Share of workers required to have at least some college | | Share of workers required to have at least some college | |
| Occupational cluster | | Rank | | Rank |
| STEM and social sciences | 95% | 1 | 98% | 1 |
| Education | 89% | 2 | 97% | 2 |
| Community services and arts | 84% | 4 | 95% | 3 |
| Healthcare professional and technical | 88% | 3 | 93% | 4 |

| | 2021 | | 2031 | |
|---|---|---|---|---|
| | Share of workers required to have at least some college | | Share of workers required to have at least some college | |
| Occupational cluster | | Rank | | Rank |
| Managerial and professional office | 84% | 5 | 92% | 5 |
| Sales and office support | 71% | 7 | 74% | 6 |
| Healthcare support | 73% | 6 | 73% | 7 |
| Food and personal services | 49% | 8 | 51% | 8 |
| Blue-collar | 47% | 9 | 46% | 9 |
| **Total** | **68%** | | **72%** | |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Both the size of an occupational cluster and the concentration of workers in it who have postsecondary education and/or training matter because even occupational clusters with a relatively small percentage of jobs requiring postsecondary education and training can produce many postsecondary positions. Consider the sales and office support occupations cluster, which is expected to have 36.1 million jobs in 2031. Overall, this cluster ranks only sixth out of nine in the proportion of jobs that require postsecondary education and/or training. However, because sales and office support occupations make up such a large number of jobs, this occupational cluster will add the most net new jobs between 2021 and 2031 that require postsecondary education and training.

On the other hand, some small clusters produce many jobs that require postsecondary education and training. Education occupations are an example — education will be only the seventh-largest occupational cluster in 2031, but almost all jobs in this cluster will require postsecondary education and training.

## The fastest-growing occupations require more workers with postsecondary education and training.

Between 2021 and 2031, the five fastest-growing occupational clusters by rate of employment growth will be healthcare support; healthcare professional and technical; science, technology, engineering, and mathematics (STEM) and social sciences; community services and arts; and managerial and professional office.

Notably, four of these clusters are among those requiring the highest levels of postsecondary attainment. Healthcare support is the exception. While it is growing faster than any other occupational cluster, in 2021 it had only the seventh-highest proportion of postsecondary attainment among its workers.

Between 2021 and 2031, the relative sizes of the occupational clusters will stay mostly the same. The most significant change is that the education occupational cluster is getting smaller compared to the others. It will fall from the fifth-largest cluster in 2021 to the seventh-largest in 2031 (Table 4).

**TABLE 4. Employment in the healthcare professional and technical and STEM and social sciences occupational clusters will overtake the education cluster by 2031.**

| | 2021 | | 2031 | | Difference 2021–2031 | | | |
|---|---|---|---|---|---|---|---|---|
| | Total employment (thousands) | Rank | Total employment (thousands) | Rank | Change in employment (thousands) | Rank | Rate of growth | Rank |
| Blue-collar | 35,700 | 1 | 38,500 | 1 | 2,800 | 1 | 8% | 8 |
| Sales and office support | 34,600 | 2 | 36,100 | 2 | 1,500 | 5 | 4% | 9 |
| Food and personal services | 23,800 | 3 | 26,400 | 3 | 2,600 | 2 | 11% | 6 |
| Managerial and professional office | 19,500 | 4 | 22,000 | 4 | 2,500 | 3 | 13% | 5 |
| Healthcare professional and technical | 9,400 | 6 | 10,800 | 5 | 1,400 | 6 | 15% | 2 |
| STEM and social sciences | 9,400 | 7 | 10,700 | 6 | 1,300 | 7 | 14% | 3 |
| Education | 9,600 | 5 | 10,600 | 7 | 1,000 | 8 | 10% | 7 |
| Healthcare support | 7,600 | 8 | 9,600 | 8 | 2,000 | 4 | 26% | 1 |
| Community services and arts | 5,100 | 9 | 5,800 | 9 | 700 | 9 | 14% | 4 |
| **Total** | **154,700** | | **170,500** | | **15,800** | | **10%** | |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

## The largest occupational clusters include the most entry-level jobs, demand less education, and grow more slowly than other groups.

Between 2021 and 2031, there will be 18.5 million job annualized openings. Some 13 million of these annualized openings — about 72 percent of the total — will require at least some college education. By educational attainment, there will be:[83]

- 1.3 million annual job openings, or 7 percent of the total, for workers with less than a high school diploma;
- 4.7 million annual job openings, or 25 percent, for workers with a high school diploma;
- 3.3 million annual job openings, or 18 percent, for workers with at least some college but no degree;
- 2.5 million annual job openings, or 13 percent, for workers with an associate's degree;
- 4.3 million annual job openings, or 23 percent, for workers with a bachelor's degree; and
- 2.4 million annual job openings, or 13 percent, for workers with a graduate degree.

The larger occupational clusters and lower-skilled and lower-wage occupations generally have more annual job openings (Figure 5). Most of these vacancies occur because of job churn (when workers leave a job) rather than because new jobs are being created. Therefore, occupations that employ large numbers of young workers — such as retail sales and food and personal services — generate large numbers of annual openings as the young workers move on from their low-level jobs, often by gaining higher levels of education.

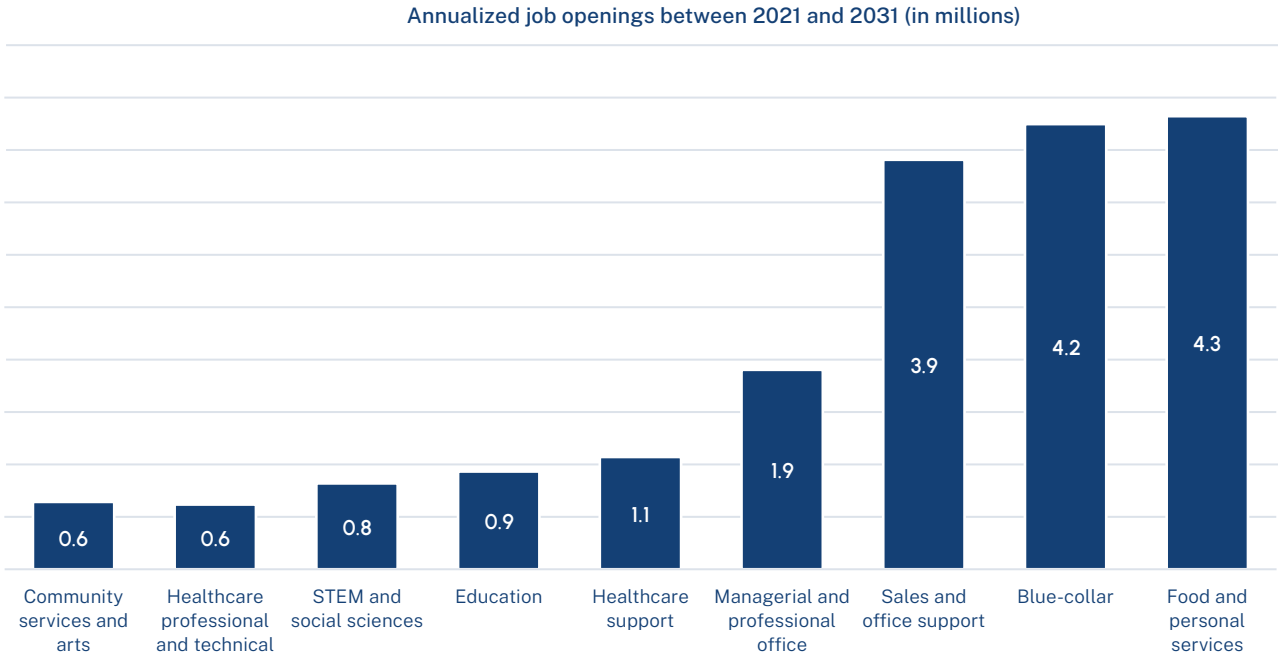
In analyzing changes in occupations, it is helpful to separate them into two categories, the managerial and professional services group and the blue-collar and skilled-trades group. Occupations in the managerial and professional services group historically require higher levels of educational attainment than blue-collar and skilled-trades occupations. That will not change in the next decade (Figure 6).

### The Managerial and Professional Economy

The managerial and professional economy consists of five of the major occupational clusters: the science, technology, engineering, and mathematics (STEM) and social sciences; education; healthcare professional and technical; community services and arts; and managerial and professional office clusters. By 2031, jobs in the managerial and professional economy will be

83 The following percentages do not sum to 100 percent due to rounding.

**FIGURE 5. The food and personal services and blue-collar occupational clusters will have the most annualized job openings between 2021 and 2031.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

held overwhelmingly by highly-educated workers. Only 3 percent of workers with these jobs will have less than a high school diploma, 7 percent of workers will have a high school diploma but no further education, and 17 percent of workers will have some college but no degree.

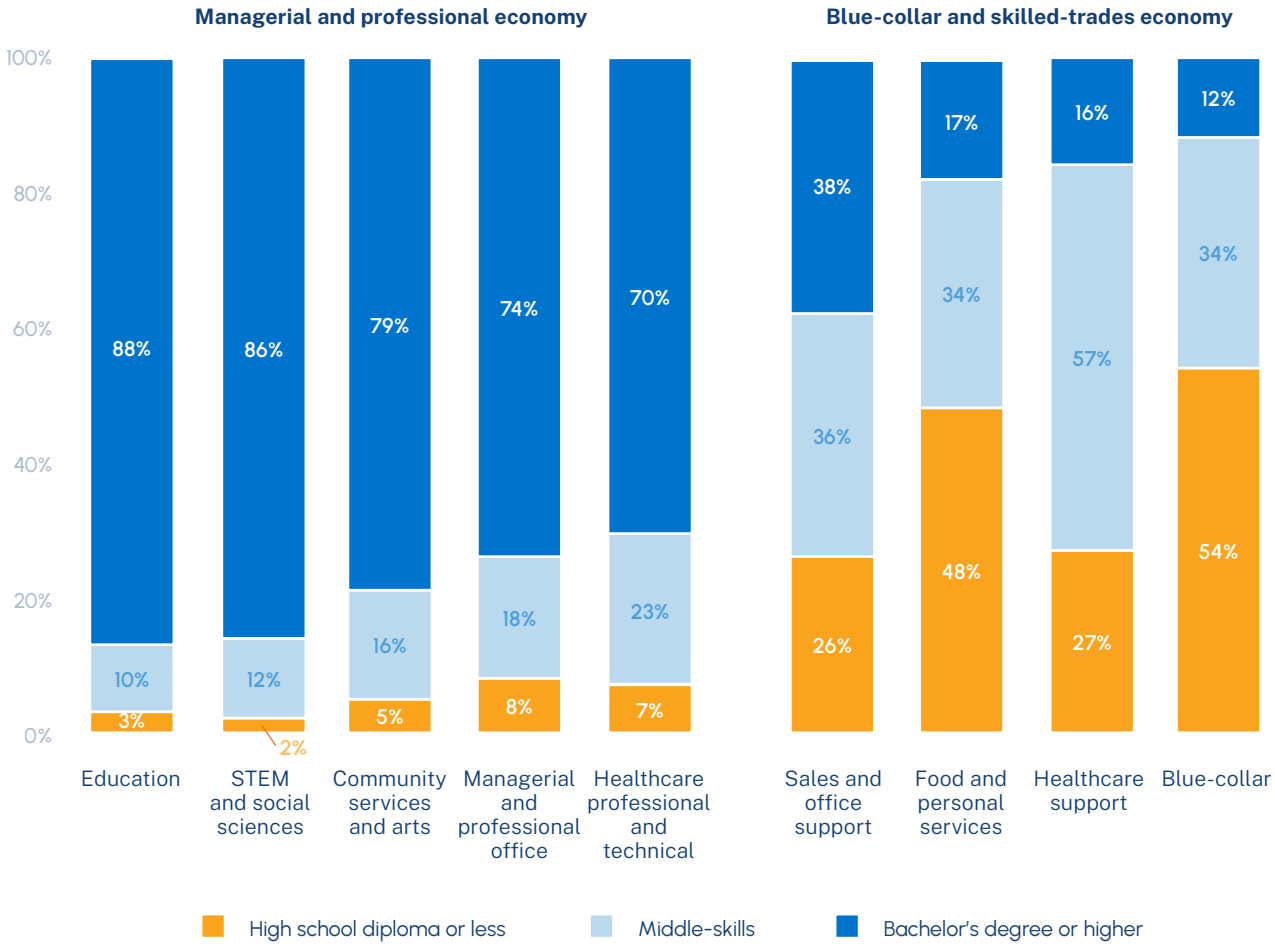
However, for the nation as a whole, 23 percent of workers with an associate's degree will find jobs in the managerial and professional economy, but so will 56 percent of workers with a bachelor's degree and 82 percent of workers with a graduate degree.

## The Blue-Collar and Skilled-Trades Economy

The blue-collar and skilled-trades economy consists of four major occupational clusters: the sales and office support, healthcare support, food and personal services, and blue-collar clusters.

In 2031, jobs in this sector will employ 97 percent of workers with less than a high school diploma, 93 percent of workers with a high school diploma but no further education, 83 percent of workers who have some college but no postsecondary credential, and 77 percent of workers with an associate's degree. Workers who have at least a four-year degree have less

**FIGURE 6. Occupations in the managerial and professional sector of the economy will have the greatest proportion of postsecondary-educated workers in 2031.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit LLC; and Lightcast.

Note: Columns may not sum to 100 percent due to rounding.

of a presence in the blue-collar and skilled-trades economy, which will employ 44 percent of workers with a bachelor's degree but only 18 percent of workers with a graduate degree.

Interestingly, the nearly even distribution of bachelor's degree holders between the managerial and professional economy and the blue-collar and skilled-trades economy indicates the versatility of a four-year degree. For example, the sales and office support occupational cluster has a large number of overall jobs and a significant number of positions that require postsecondary education and/or training, but these occupational categories, overall, will continue to have the bulk of jobs for workers with lower levels of educational attainment.

Our figures show that a bachelor's degree makes four-year college graduates strong candidates for employment in both the managerial and professional sector and the blue-collar and skilled-trades sector. But at all other education levels, jobs tilt heavily toward employment in either the blue-collar and skilled-trades economy (high school or less) or the managerial and professional economy (some college and above).

## The Future of Work: More Education Will Be Key

The opportunities for employment by level of educational attainment will shift significantly between now and 2031. Job opportunities for workers with lower levels of educational attainment will get even more concentrated in a limited number of occupations.

Almost all workers with less than a high school education will need to find employment within just three occupational clusters. Of all jobs available to these workers, nearly half (48 percent) will be blue-collar occupations, over a third (36 percent) will be in food and personal services, and 11 percent will be in sales and office support. The remaining 5 percent of annual job openings will be scattered throughout the other six occupational clusters (Table 5).

The opportunities for high school graduates with no additional education will be concentrated in the same three occupational groups. Blue-collar (41 percent) and food and personal services (24 percent) represent the lion's share of opportunities for high school graduates. However, high school graduates will find more annual openings than their less-than-high-school counterparts in sales and office support (21 percent) and in the other six occupational clusters (a combined 14 percent).

**TABLE 5. Jobs for workers with a high school education or less in 2031 will be concentrated in the blue-collar, food and personal services, and sales and office support occupational clusters.**

| PERCENT IN OCCUPATIONAL CLUSTERS IN 2031 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Occupational Clusters** | **Less than high school** | **High school graduates** | **Some college** | **Associate's degree** | **Bachelor's degree** | **Graduate degree** | **Total employment** |
| Blue collar | 48% | 41% | 27% | 24% | 9% | 3% | 21% |
| Sales and office support | 11% | 21% | 28% | 24% | 25% | 11% | 25% |
| Food and personal services | 36% | 24% | 19% | 15% | 8% | 3% | 19% |

| PERCENT IN OCCUPATIONAL CLUSTERS IN 2031 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Occupational Clusters** | **Less than high school** | **High school graduates** | **Some college** | **Associate's degree** | **Bachelor's degree** | **Graduate degree** | **Total employment** |
| Managerial and professional office | 2% | 4% | 8% | 8% | 22% | 24% | 11% |
| Healthcare professional and technical | 0.2% | 1% | 2% | 2% | 9% | 20% | 6% |
| STEM and social sciences | 0.2% | 1% | 2% | 3% | 11% | 15% | 5% |
| Education | 0.4% | 2% | 4% | 7% | 8% | 15% | 6% |
| Healthcare support | 2% | 6% | 9% | 14% | 3% | 1% | 3% |
| Community services and arts | 0.3% | 1% | 2% | 2% | 6% | 7% | 4% |
| | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: Columns may not sum to 100 percent due to rounding.

## Middle-Skills Workers

Workers with at least some postsecondary education and/or training have more opportunities in the labor force. That can be seen in the employment prospects for middle-skills workers, those with more education than a high school diploma, but less than a bachelor's degree, including those with associate's degrees and some college coursework but no degree.

For middle-skills workers, sales and office support occupations will provide the most jobs (28 percent of jobs will require at least some college, and 24 percent will require associate's degrees). Blue-collar jobs (27 percent will require workers to have at least some college and 24 percent will require associate's degrees) and food and personal services occupations (19 percent will require some college, and 15 percent will require associate's degrees) will remain very common. But these workers have access to other occupations that are mostly foreclosed to high school-or-less workers.

Relatively few workers with a bachelor's or graduate degree enter blue-collar and food and personal services occupations. Seventeen percent of jobs that require bachelor's degrees will be in either blue-collar or food and personal services occupations, and six percent of jobs

that require graduate degrees will be in those clusters in 2031. Sales and office support will remain important for workers with a bachelor's degree because 25 percent of jobs requiring a bachelor's degree will be in this cluster. However, only 11 percent of jobs that require a graduate degree will be in this cluster.

The data can also be analyzed by the overall relationship between occupations and education requirements. For example, the type of occupation that requires primarily a bachelor's degree will likely have opportunities for workers with a graduate or an associate's degree as well. Similarly, occupations that predominantly require a high school diploma also would probably offer opportunities for workers with less than a high school diploma or people who have some college credit but no degree.

By 2031, occupations will be easily sorted into either the managerial and professional economy or the blue-collar and skilled-trades economy. Starting with sales and office support occupations, the largest share of job opportunities in 2031 (30 percent) will be available to bachelor's degree holders (Table 6). This occupational category also offers significant opportunities for workers with less education — workers with a high school diploma or some college. Healthcare support occupations will offer significant opportunities for workers with an associate's degree or some college credit. As might be expected, STEM jobs will predominantly be available only for workers with a bachelor's degree or higher. However, 12 percent of jobs in STEM will be available for workers with an associate's degree or some college but no degree.

**TABLE 6. By 2031, job openings will be easily sorted into either the managerial and professional economy or the blue-collar and skilled-trades economy.**

| PERCENT IN OCCUPATIONAL CLUSTERS IN 2031 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Less than high school | High school graduates | Some college | Associate's degree | Bachelor's degree | Graduate degree | Total |
| **Blue-Collar and Skilled-Trades Economy** | | | | | | | |
| Blue-collar | 14% | 40% | 20% | 14% | 10% | 2% | 100% |
| Sales and office support | 3% | 23% | 21% | 15% | 30% | 8% | 100% |
| Food and personal services | 12% | 36% | 21% | 13% | 14% | 4% | 100% |
| Healthcare support | 2% | 24% | 26% | 32% | 13% | 3% | 100% |

| PERCENT IN OCCUPATIONAL CLUSTERS IN 2031 | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Less than high school | High school graduates | Some college | Associate's degree | Bachelor's degree | Graduate degree | Total |
| **Managerial and Professional Economy** | | | | | | | |
| Managerial and professional office | 1% | 7% | 10% | 8% | 44% | 29% | 100% |
| Healthcare professional and technical | 0.4% | 3% | 10% | 16% | 33% | 38% | 100% |
| STEM and social sciences | 0.1% | 2% | 5% | 7% | 46% | 40% | 100% |
| Education | 0.2% | 2% | 5% | 5% | 35% | 52% | 100% |
| Community services and arts | 1% | 5% | 9% | 7% | 43% | 36% | 100% |
| | **6%** | **22%** | **17%** | **13%** | **26%** | **16%** | **100%** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: Rows may not sum to 100 percent due to rounding.

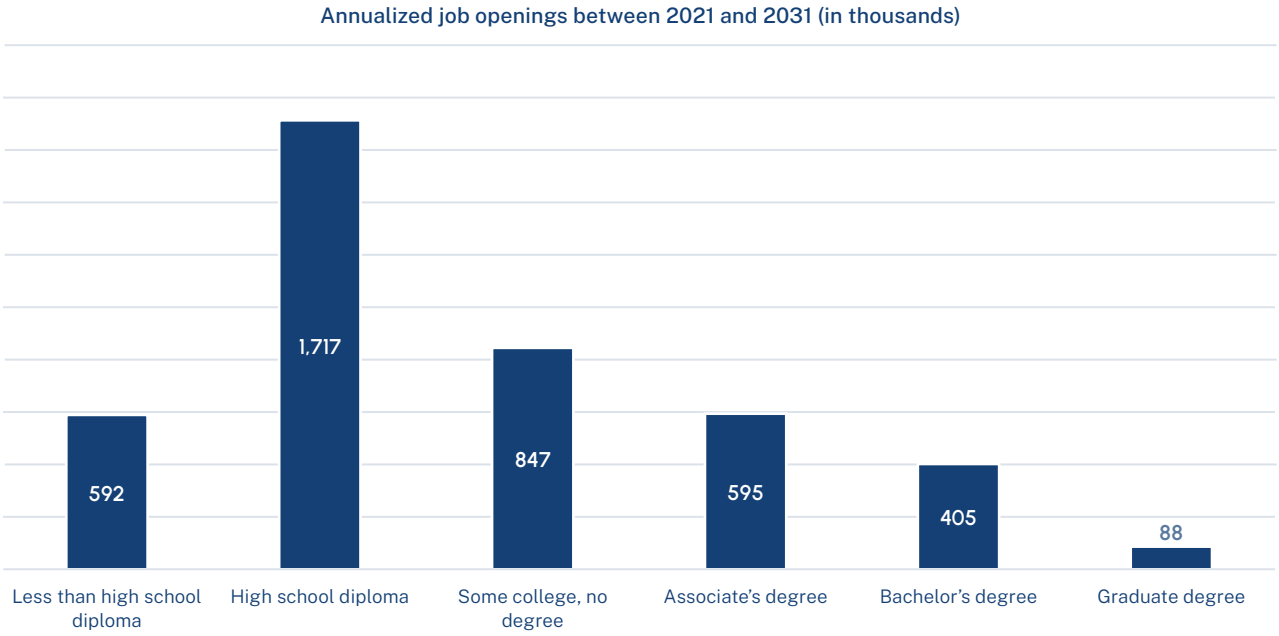
## A Detailed Look at Annual Job Openings and Educational Demand by Occupation

The following sections consider job openings and educational requirements in each of the nine major occupational clusters. Our analysis also includes the job outlooks for the most significant occupational groups that make up each of the occupational clusters.

## Blue-Collar Occupations

In 2021, the blue-collar occupational cluster accounted for 35.7 million jobs, or 23 percent of all jobs. It is the largest occupational cluster in the labor force, and will continue to be so in 2031, as it will grow to 38.5 million jobs. The blue-collar occupations cluster is comprised of five occupational groups — transportation and material moving occupations; production occupations; construction and extraction occupations; installation, maintenance, and repair occupations; and farming, fishing, and forestry occupations.

**FIGURE 7. Blue-collar occupations will have the most annualized job openings for workers with a high school diploma and training.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

Blue-collar occupations include more than half the jobs found in four industries—construction (75 percent), natural resources (65 percent), transportation and utilities services (59 percent), and manufacturing (55 percent). These industries collectively employ 72 percent of all blue-collar workers. The wholesale and retail trade services industry is another large employer of blue-collar workers, employing 11 percent of them, mostly in transportation and material moving jobs.

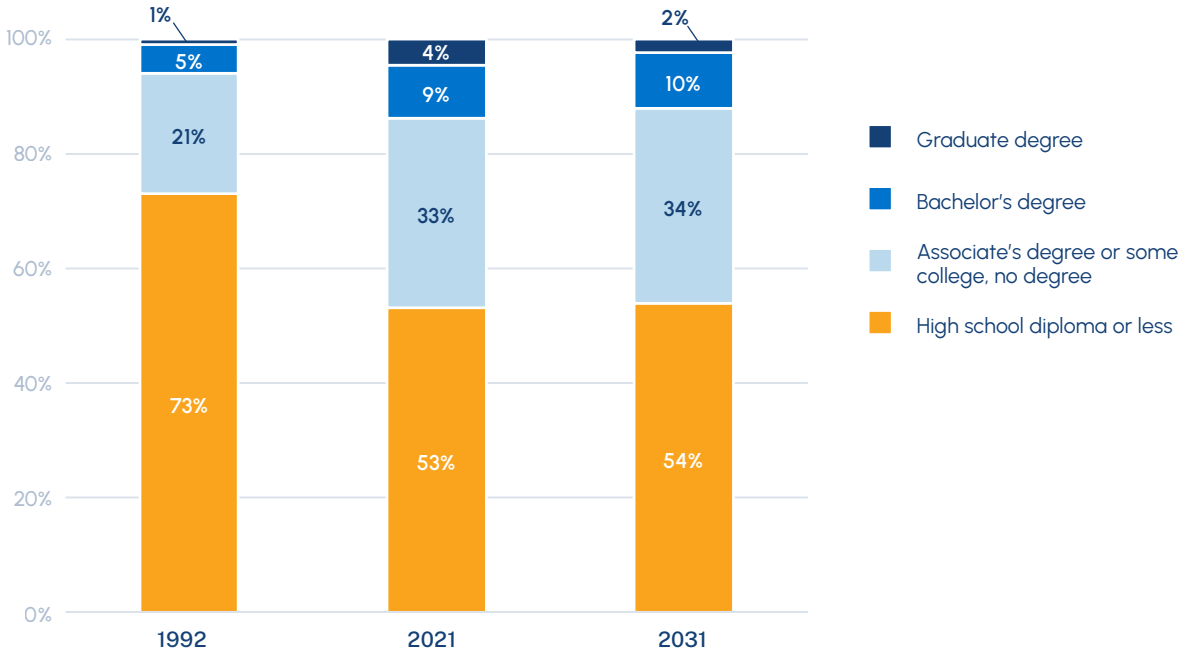
Overall, a little more than half of blue-collar positions still do not require training beyond high school (Figure 7).

Education requirements for blue-collar positions changed rapidly from 1992 to 2021. In 1992, 27 percent of blue-collar jobs required training beyond high school. In 2021, that share had risen to 47 percent. But the required upskilling in blue-collar occupations will pause over the next decade. In 2031, the share that is required to have postsecondary education will be 46 percent, or almost exactly the same share as in 2021 (Figure 8).

## Transportation and Material Moving Occupations

The transportation and material moving occupations group is the largest in the blue-collar cluster, providing 13.4 million jobs in 2021. This is more than one-third of all blue-collar jobs and 9 percent of all US jobs, making it the third-largest of the 22 occupational groups. The

**FIGURE 8. Workers without college training will have a similar share of blue-collar jobs in 2031 as they had in 2021.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

number of jobs in this group will increase to 14.6 million by 2031. Jobs that fall into this group include bus and truck drivers, taxi/rideshare drivers, material moving operators, air traffic controllers, flight attendants, and water transportation workers.

Three-quarters of workers in this occupational group are employed in just three industries, so these occupations tend to rise and fall with overall economic output and consumption. In 2021, 39 percent of these workers were employed in the transportation and utilities services industry, 20 percent in the wholesale and retail trade services industry, and 15 percent in the manufacturing industry. As the economy grows and the demand for goods increases, employment increases for truck drivers, pilots, and other transportation workers that move products to consumer outlets. In fact, a dip in freight shipping is often considered a sign of an impending recession.[84]

Autonomous vehicles will be an obvious disrupter to these occupations, but smaller-scale automation is already changing these occupations. Goods-to-person delivery

84 Premack, "The 'Bloodbath' in America's Trucking Industry Has Officially Spilled Over to the Rest of the Economy," 2019.

systems and warehouse storage and retrieval systems increasingly are replacing tasks for some jobs in this group.

### Production Occupations

This occupational group includes a wide array of jobs — from machinists, welders, and power plant operators to bakers, butchers, and food-processing workers. This group accounted for 9.1 million jobs in 2021, which was 25 percent of blue-collar jobs and 6 percent of all US employment. The group is expected to grow slowly, to 9.3 million jobs in 2031.

As might be expected, this occupational group is tied closely to the manufacturing industry. In fact, 72 percent of jobs that fall into this group are in manufacturing. Likewise, 40 percent of the jobs in the manufacturing industry are jobs in this occupational group.

### Construction and Extraction Occupations

In 2021, the construction and extraction occupations group included 6.4 million jobs, or about 18 percent of all blue-collar jobs. Jobs that fall within this occupational category include carpenters, laborers, electricians, ironworkers, and miners.

The construction and natural resources industries are the major employers of this occupational group. The construction industry alone employs 82 percent of these workers. While the natural resources industry employs only 4 percent of them, it is particularly consequential to those with mining jobs. The growth prospects for economic output and employment are strong in construction but much weaker for mining.

The construction industry has bounced back significantly after being hit hard by the COVID-19 recession, and it will be one of the fastest-growing industries through 2031, although there are increasing concerns about shortages of skilled labor. Overall, this occupations group will add 660,000 net new jobs, bringing the total number of jobs to 7.1 million by 2031.

### Installation, Maintenance, and Repair Occupations

This occupational group provided 6.2 million jobs in 2021, which was about 17 percent of all jobs in blue-collar occupations. Some of the jobs that fall within this occupational group include mechanics; line workers; general maintenance and repair workers; and heating, ventilation, and air conditioning (HVAC) technicians.

As of 2021, nearly three-quarters (74 percent) of workers that fall within this occupational group were employed in just five industries — personal services (20 percent), manufacturing (16 percent), wholesale and retail trade services (15 percent), construction (12 percent), and transportation and utilities services (11 percent). While this occupational group is not clearly tied to any single industry, it is most relevant to the personal services industry because it comprises roughly 15 percent of that industry's workforce.

Occupations in this group tend to grow at a steady rate compared to overall job growth, so we do not expect the share of jobs in this occupation to change between now and 2031. The overall number of jobs in this group will increase to 6.7 million by 2031. One bright spot is that solar panel installation is estimated to be one of the fastest-growing occupational categories over the next decade in eight states — California, Florida, Hawaii, Minnesota, Missouri, New Jersey, New Mexico, and North Carolina.[85]

### Farming, Fishing, and Forestry Occupations

The farming, fishing, and forestry occupations group includes all agricultural, fishing and hunting, logging, and conservation-related jobs. Covering 650,000 jobs in 2021, this occupational group accounted for just 2 percent of blue-collar workers. That small share of employment is a sobering reminder that the days of an agriculture-based economy in the US are long past. In fact, the farming, fishing, and forestry occupations group has the smallest number of jobs among the 22 occupational groups.

The only industry that has a sizable presence of workers from this occupational group is the natural resources industry.[86] However, mining — rather than farming, fishing, and forestry — will drive most of the growth in output for the natural resources industry. In fact, farming, fishing, and forestry accounts for only 24 percent of the forecasted increase in gross output for the industry.

The outlook going forward for this occupational group is relatively grim. The jobs in this group are expected to grow very slowly to a total of about 710,000 jobs by 2031.

## Sales and Office Support Occupations

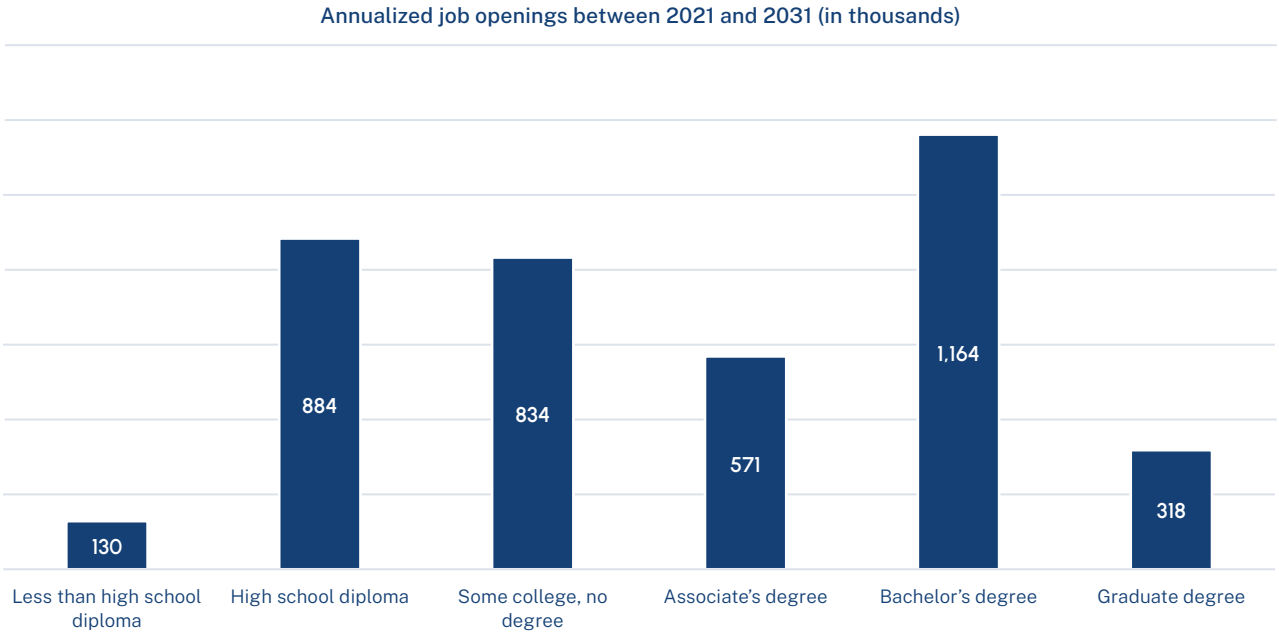
The sales and office support occupational cluster is the second-largest occupational cluster, covering 34.6 million jobs in 2021 — or about a quarter of US employment. This cluster is so large because it is made up of the two largest occupational groups in the US workforce — sales occupations and office support occupations. Office and administrative support jobs were the largest part of this cluster in 2021 and will continue to be so in 2031, constituting 60 percent of its positions. Overall, the number of jobs in this cluster is expected to grow to 36.1 million by 2031.

Two-thirds of all workers in the sales and office support occupational cluster are concentrated in just four industries — wholesale and retail trade services (38 percent), professional and business services (10 percent), financial services (10 percent), and healthcare services (9 percent). Sales and office support jobs constituted 63 percent of wholesale and retail trade services positions and 43 percent of positions in financial services in 2021.

85 Projections Managing Partnership, *Short-Term Occupational Projections (2018–2020)*.

86 In every other industry, less than 1 percent of workers fall into this occupational group, but in the natural resources industry, 37 percent of workers fall into this occupational group.

**FIGURE 9. Sales and office support occupations will have the most annualized job openings for workers with a bachelor's degree.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

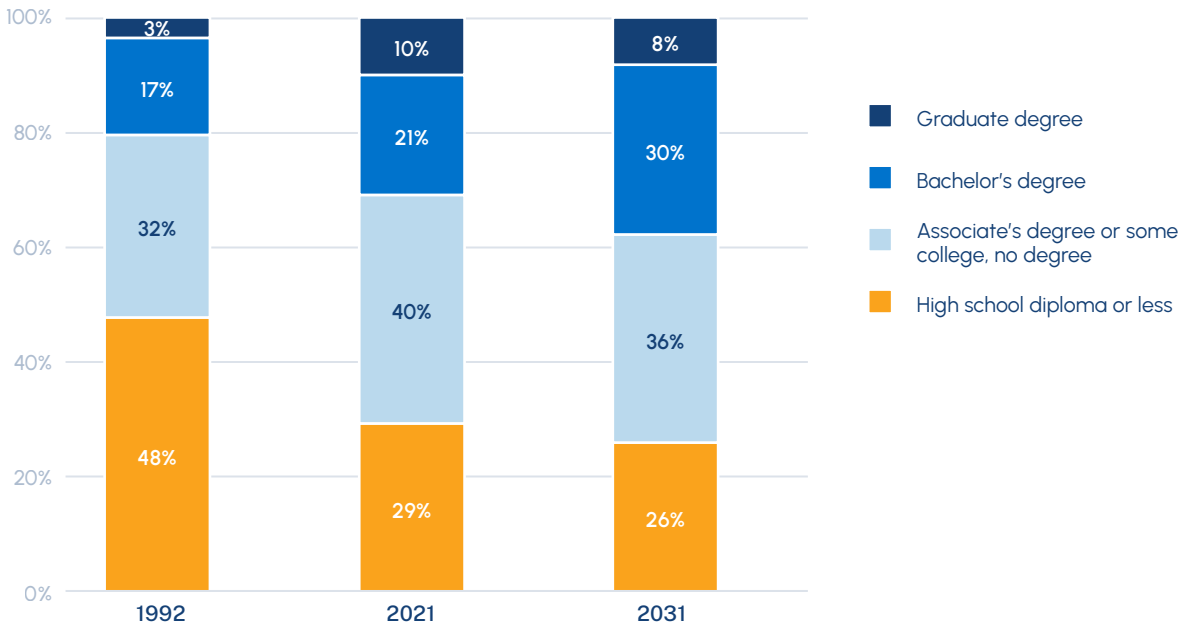
The overall size of the sales and office support occupational cluster helped it land first among the clusters in the share of workers with bachelor's degrees, associate's degrees, and some college but no degree. Over the next decade, there will be job openings for workers at many levels of educational attainment, but the largest share will have a bachelor's degree, followed by workers with either a high school diploma or some college, but no degree (Figure 9).

Overall, the share of jobs in sales and office support requiring at least some college will increase from 71 percent to 74 percent between 2021 and 2031. Most of this increase will be for workers with a bachelor's degree or graduate degree, as their overall share of employment will increase from 31 percent to 38 percent, while the share of jobs for middle-skills workers will decrease from 40 percent to 36 percent (Figure 10).

## Office and Administrative Support Occupations

Covering 20.5 million jobs in 2021, or about 13 percent of US employment, the office and administrative support occupations group is the largest in the US economy. It will continue to grow through 2031, when this group will include 21.1 million jobs. Such jobs as secretaries and administrative assistants, clerks, bookkeepers, and customer service representatives fall within this occupational group.

**FIGURE 10. Sales and office support jobs will increasingly go to workers with a bachelor's or graduate degree between 2021 and 2031.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

Office and administrative support occupations jobs are well-represented in most industries. In eight of the 13 industries analyzed in this report, at least 10 percent of the jobs are part of this occupational group. It is the largest single occupational group in the financial services industry, where office and administrative support occupations represent more than one in four jobs (28 percent).

This occupational group is not overly tied to a single industry (although the wholesale and retail trade services industry employs 17 percent of all workers in office and administration support), but workers in these jobs will face similar threats from automation regardless of the industry in which they work.

Computer technology is increasingly capable of managing the information storage, management, and distribution tasks associated with many of these occupations. This does not necessarily mean that these jobs will be eliminated, but their duties and training could be realigned.

### Sales Occupations

In terms of employment, the sales occupations group is the second-largest of the 22 occupational groups in the US economy. It covered 14.2 million jobs, or more than 9 percent, of the 155 million jobs in 2021. Examples of jobs within the sales occupations group include cashiers, insurance agents, real estate brokers, and retail salespersons. The total number of jobs in this group will grow to 15 million by 2031.

While every industry employs workers from this occupational group, sales occupations are, unsurprisingly, tied most closely to the wholesale and retail trade services industry. In fact, more than two-thirds (68 percent) of sales jobs are in this industry alone. The financial services industry, which employs 9 percent of these workers, comes in a distant second place.

Sales positions follow quite closely the fluctuations in GDP and consumer spending. For example, the number of sales representative jobs tends to grow during the holiday shopping period as retailers create short-term positions to handle the temporary increases in sales volume.

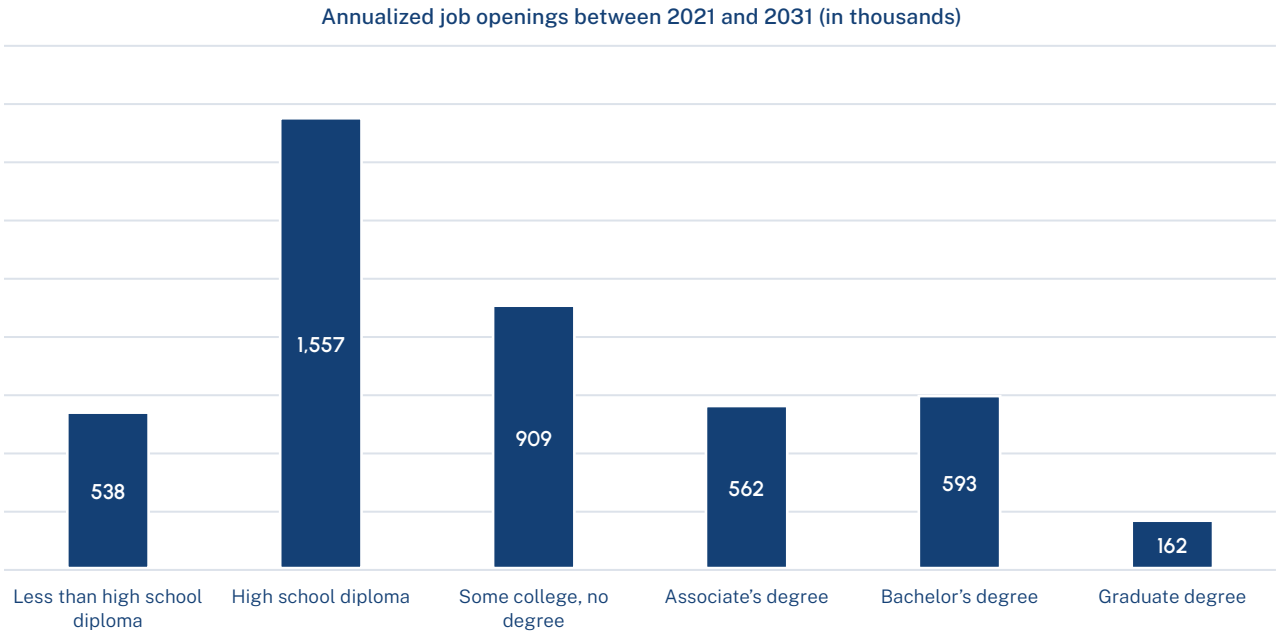
While sales occupations include a plethora of relatively low-skilled positions, such as cashiers, they also include jobs with diverse educational profiles. That is because sales workers are employed in every industry, including many that are very sophisticated. For example, financial service sales jobs require technical expertise, and automobile sales jobs require a knowledge of cars. As automation and e-commerce change the face of the wholesale and retail trade services industry, the skills needed by these workers will continue to shift.

## Food and Personal Services Occupations

Food and personal services occupations, the third-largest occupational cluster, provided 23.8 million jobs in 2021, or 15 percent of all US jobs. It will continue to have roughly that proportion of US jobs through 2031. The food and personal services occupations cluster is composed of four occupational groups — food preparation and serving, personal care and services, building and grounds cleaning and maintenance, and protective services occupations. Because of its size, this occupational cluster will have the second-most annual job openings between 2021 and 2031 for workers with a high school diploma or less, trailing only blue-collar occupations (Figure 11).

As of 2021, nine out of 10 workers in this occupational cluster worked in just five industries. The leisure and hospitality services industry includes by far the largest share with 37 percent, followed by government and public education services (17 percent), healthcare services (14 percent), professional and business services (14 percent), and personal services (9 percent).

**FIGURE 11. The food and personal services occupational cluster will be one of the main sources of jobs for workers with a high school diploma and training from 2021 to 2031.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

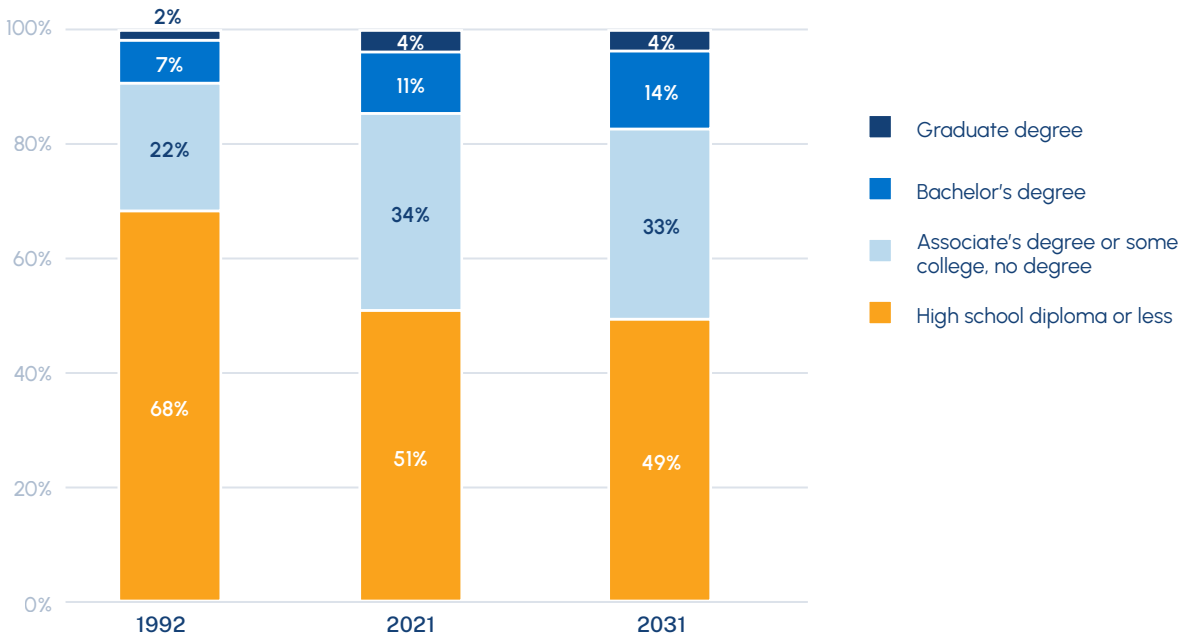
The net new jobs created will increase total employment in this occupational category to 26.4 million. The share of jobs requiring postsecondary education and training will rise from 49 percent in 2021 to 51 percent in 2031 (Figure 12). This increase continues a long trend of expanding demand for postsecondary education and/or training in this industry. In 1992, only 32 percent of the industry's workforce had postsecondary education and/or training. Between 2021 and 2031, the share of jobs in this occupational cluster for middle-skills workers will fall slightly from 34 percent to 33 percent, and the share of jobs for workers with at least a bachelor's degree will increase from 15 percent to 18 percent.

## Food Preparation and Serving Occupations

The food preparation and serving occupations group is the fourth-largest of the 22 occupational groups, employing 11.8 million workers in 2021. This occupational group includes nearly half of all workers (49 percent) in the food and personal services occupational cluster and almost 8 percent of all US workers. Examples of jobs in this group are cooks, chefs, waiters, and bartenders.

The leisure and hospitality services industry is tightly connected to this occupational group. As of 2021, about 81 percent of food preparation and serving occupation jobs were found in that

**FIGURE 12. Over half of food and personal services workers in 2031 will have postsecondary education and/or training.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

industry, and nearly half of all jobs in that industry (47 percent) belong to this occupational group. The number of food preparation and serving jobs tends to correlate positively with the overall state of the economy. During a recession, jobs in this occupational group tend to decline, and sales volume shifts from higher-to lower-cost restaurants (such as fast-food establishments) as consumers cut back on spending. The number of jobs in this occupational group will grow to 13.2 million by 2031.

## Personal Care and Services Occupations

As of 2021, the personal care and services occupations group provided 3.5 million jobs—15 percent of all jobs in the food and personal services cluster and 2 percent of all US employment. Jobs that fall within this occupational group include fitness instructors, childcare workers, hairdressers, and cosmetologists.

The two industries that employed the largest share of workers from this occupational group in 2021 were the healthcare services industry (40 percent) and the personal services

industry (33 percent). The leisure and hospitality services industry employed the third-largest share (14 percent).

Demographic changes will shape future job prospects for this occupational group. More home-care aides will be needed to care for the aging population, and opportunities will grow at the other end of the demographic spectrum because of expanding preschool services for children. Jobs in this occupational group will grow to 3.9 million in 2031.

The extent of job losses in these occupations has been mild compared with losses in other occupations requiring similar education levels, thus making personal care and services occupations fairly recession-proof. Personal care occupations, by definition, are highly interpersonal.

### Building and Grounds Cleaning and Maintenance Occupations

Jobs in the building and grounds cleaning and maintenance occupations group include maids, janitors, groundskeepers, and pest-control workers. This occupational group provided 4.9 million jobs in 2021, which was 20 percent of the jobs in the food and personal services occupations cluster and 3 percent of all US employment.

The professional and business services industry is by far the largest employer of workers in this occupational group, employing 40 percent of them in 2021. While seven of the 13 industries include at least 3 percent of members of this occupational group in their workforces, its strong concentration in the professional and business services industry reflects the growing tendency for businesses to use outside contractors for building and grounds maintenance. Households also are increasingly outsourcing these functions as the population grows older. Total employment in this occupational sector will rise to 5.3 million in 2031.

### Protective Services Occupations

In 2021, there were 3.7 million jobs in the protective services occupations group. In context, that amounts to 15 percent of all food and personal services occupations jobs, or about 2 percent of all US employment. Police officers and detectives, firefighters and inspectors, security guards, private investigators, and correctional officers all fall within this occupational group.

The government and public education services industry is by far the largest employer of workers in this occupational group, employing two-thirds of them in 2021. But that leaves one-third of these workers in the private sector. In particular, the professional and business services industry alone employs nearly one-fifth of these workers (18 percent). Total employment in the protective services occupational group will reach 4 million in 2031.

These workers will need an ever-expanding and changing skill set to deal with new

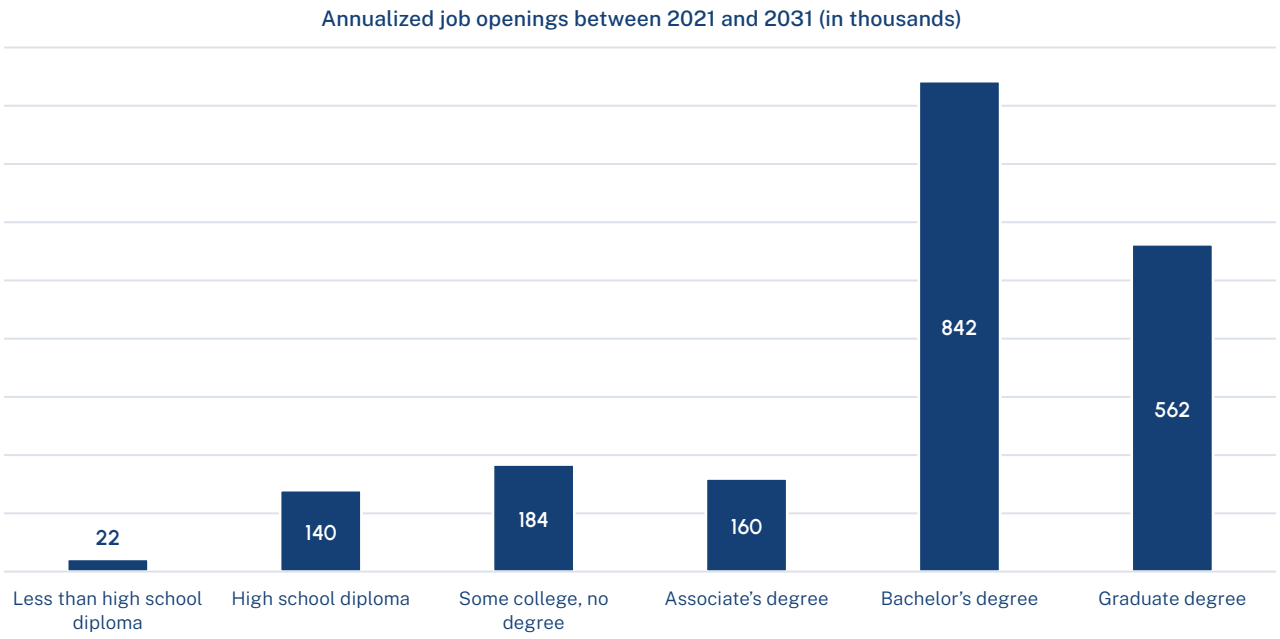
technologies. Although many police departments may not formally require a college degree from police officer candidates, they are increasingly expecting one. The average educational level of police officers has risen steadily over the past few decades.[87]

## Managerial and Professional Office Occupations

Managerial and professional office occupations are the fourth-largest of the nine occupational clusters, consisting of 19.5 million jobs in 2021. Overall, this occupational cluster makes up about 13 percent of US employment, a proportion that will remain about the same through 2031. The managerial and professional office cluster comprises three occupational groups: management; business and financial operations; and legal occupations.

This occupational cluster is important to all 13 industries because at least 10 percent of the jobs in each industry fall into this category. The financial services industry and the professional and business services industry have a particularly large percentage of their workers in this cluster (45 percent and 31 percent, respectively). Overall, four industries

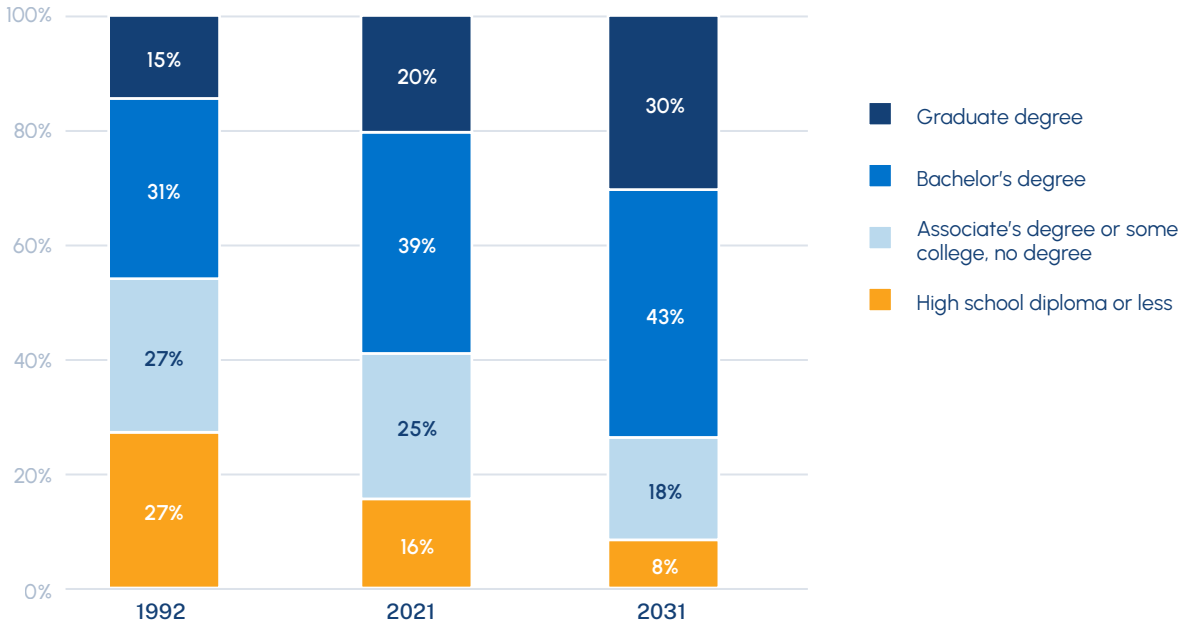
**FIGURE 13. Managerial and professional office occupations will have the most annualized job openings for workers with a bachelor's degree.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

87 Carter and Sapp, "The Evolution of Higher Education in Law Enforcement," 2006.

**FIGURE 14. Almost three-quarters of workers in managerial and professional office occupations will have a bachelor's degree or above in 2031.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

collectively employ more than half of the workers in this occupational cluster. The professional and business services industry employs the most (21 percent), with financial services employing 14 percent, and manufacturing and government and public education services each employing 11 percent.

Much of the growth in these occupations will result from the increasing complexity of the business landscape. Many businesses will hire professional and business services consultants to help them navigate ever more complicated occupational networks, logistics chains, and regulations while coping with fast-paced economic and technological changes. Most of these workers will need at least a bachelor's degree (Figure 13). As a result, total employment in managerial and professional office occupations will increase to 22 million.

The share of jobs in this occupational cluster requiring postsecondary education and/or training will increase from 84 percent in 2021 to 92 percent in 2031 (Figure 14). This increase is due to the growing share of jobs in this cluster for workers with at least a bachelor's degree (from 59 percent to 73 percent). The share of jobs for middle-skills workers is expected to decline (from 25 percent to 18 percent).

## Management Occupations

Management occupations include positions that carry general responsibility for strategy and day-to-day decision making at a policy level. Numbering 8.9 million jobs, this occupational group makes up nearly half (45 percent) of the jobs in the managerial and professional office occupations cluster, or 6 percent of all US employment. Business executives, school principals, and fast-food restaurant managers are among the many jobs that fall into this group.

Management jobs are pretty evenly dispersed throughout the 13 industries. In fact, only five industries have fewer than one in 10 workers from this category — government and public education services (9 percent), personal services (8 percent), transportation and utilities services (8 percent), healthcare services (7 percent), and wholesale and retail trade services (7 percent). At the other end of the spectrum, the financial services industry has the greatest share, with 20 percent of its workforce belonging to this occupational group. Management jobs will continue to grow — to 10 million jobs by 2031.

The educational attainment of managerial and professional office workers varies by the type of industry. On average, 86 percent of all managers have education or training beyond high school.[88]

## Business and Financial Operations Occupations

Business and financial operations workers have authority over particular functions, such as purchasing, billing, human resources, public relations, and marketing. Financial operations occupations include appraisers; budget, credit, and financial analysts; loan officers; and tax preparers and examiners. Consisting of 9.4 million jobs in 2021, this occupational group makes up 6 percent of all US employment and 48 percent of all workers in the managerial and professional office cluster.

As of 2021, about half the workers in this occupational group (52 percent) were employed in three industries. The professional and business services industry employs the largest share: 26 percent. It is followed by financial services, which employs 15 percent, and wholesale and retail trade services, which employs 12 percent.

Automation is likely to pose a threat to financial services jobs that involve repetitive financial computations. Clerical jobs could be affected by payroll software that calculates and deposits employment taxes and purchasing software that prompts employees to answer questions and then forwards the information for expense reimbursement.

88 Georgetown University Center on Education and the Workforce analysis of data from the US Census Bureau, American Community Survey (ACS), 2013–2017.

The jobs least likely to be automated are knowledge-based management positions. Consequently, there is a low probability of automation for financial directors and business project management professionals but a high probability of automation for financial accounts managers and accounting technician jobs.[89]

Technological changes are requiring shifts in skills, even among these highly technical occupations. For example, human resources (HR) departments are relying less and less on the human element. New digital tools and algorithms have automated parts of the job-hiring process and payroll functions, allowing HR officers to take on a more strategic role. Freed from many routine tasks, they can spend less time vetting job candidates and more time developing talent acquisition strategies.[90]

## Legal Occupations

Jobs in the legal occupations group include lawyers, paralegals, judges, court reporters, and mediators. This occupational group covers 1.3 million jobs, or less than 1 percent of US employment.

The legal occupations group is tied tightly to the professional and business services industry, which employs two-thirds of workers in legal occupations. The government and public education services industry employs 18 percent of workers in this group, and the financial services industry employs 6 percent of them. Taken together, these three industries employ 91 percent of all workers in legal occupations.

Almost every job that falls within this occupational group requires postsecondary education and/or training. By and large, graduate education is a prerequisite for becoming an attorney or a judge.[91] Court reporters generally need to be licensed in their state, and many hold middle-skills credentials (41 percent will need a certificate in 2031).[92] Many paralegals hold bachelor's degrees or paralegal certificates.

Even with their advanced education, however, the jobs of lawyers and paralegals may be imperiled by software. AI-based products are able to perform much of the document review traditionally performed by entry-level lawyers,[93] and software has automated many routine case management tasks traditionally performed by paralegals.[94] The total number of jobs in legal occupations will grow to 1.4 million in 2031.

89 Horton, "The Robots Are Coming," 2015.

90 Bogert et al. "Humans Rely More on Algorithms Than Social Influence as a Task Becomes More Difficult," 2021.

91 There are some exceptions. Virginia, Vermont, California, and Washington offer an apprenticeship pathway, so law school attendance is not a prerequisite for taking the bar exam. Furthermore, some states do not require elected judges to have a background in the law.

92 See Appendix B.

93 Winick, "Lawyer-Bots Are Shaking Up Jobs," 2017.

94 Davis, "Technology Has Not Replaced Need for Paralegals," 2018.

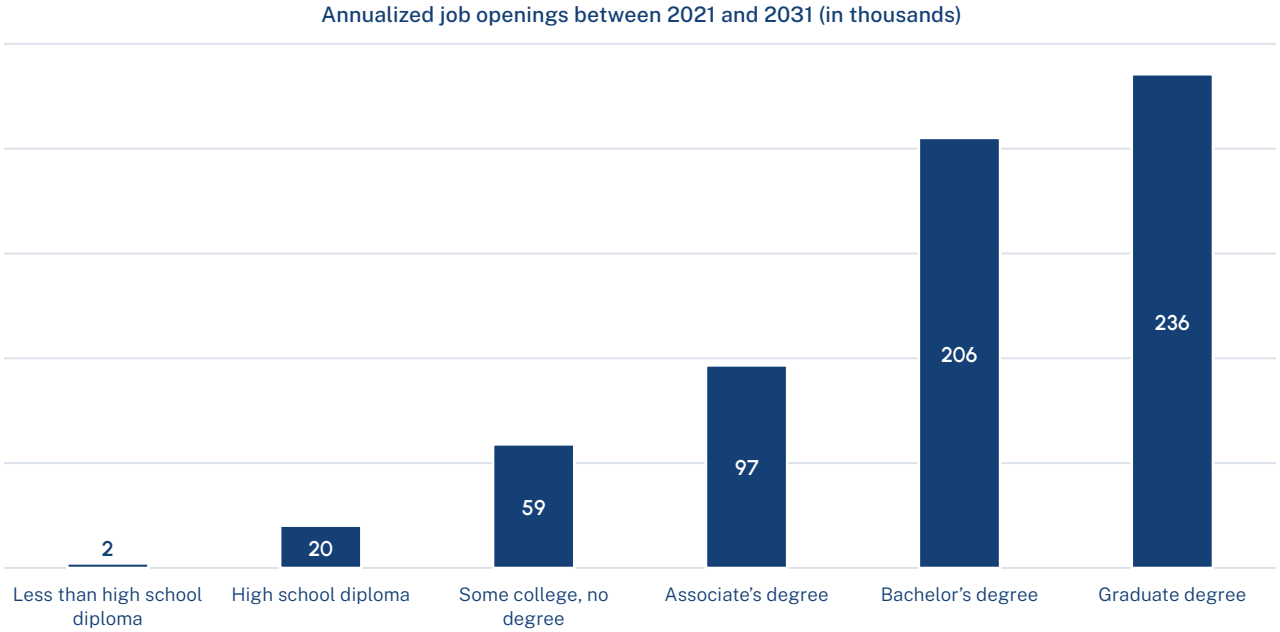
## Healthcare Professional and Technical Occupations[95]

Covering 9.4 million jobs, or 6 percent of US employment, the healthcare professional and technical occupations cluster is the sixth-largest of the nine occupational clusters. Like the education cluster, this cluster is composed of a single occupational group. Examples of jobs in this occupational cluster include registered nurses, physicians and surgeons, dentists, dental hygienists, radiologic technologists, pharmacy technicians, and therapists.

The healthcare services industry employs the majority of workers (83 percent) that fall within this cluster. The second-and third-largest employers of these workers are the government and public education services industry (5 percent) and the professional and business services industry (3 percent). The remaining workers are dispersed across the other 10 industries.

Demand for these services will grow as the population ages and as advances in pharmaceuticals, medical technology, and healthcare practices make it possible to treat more diseases. Currently, healthcare spending is about 21 percent of gross domestic product (GDP),

**FIGURE 15. Healthcare professional and technical occupations will have the most annualized job openings for workers with a graduate degree.**



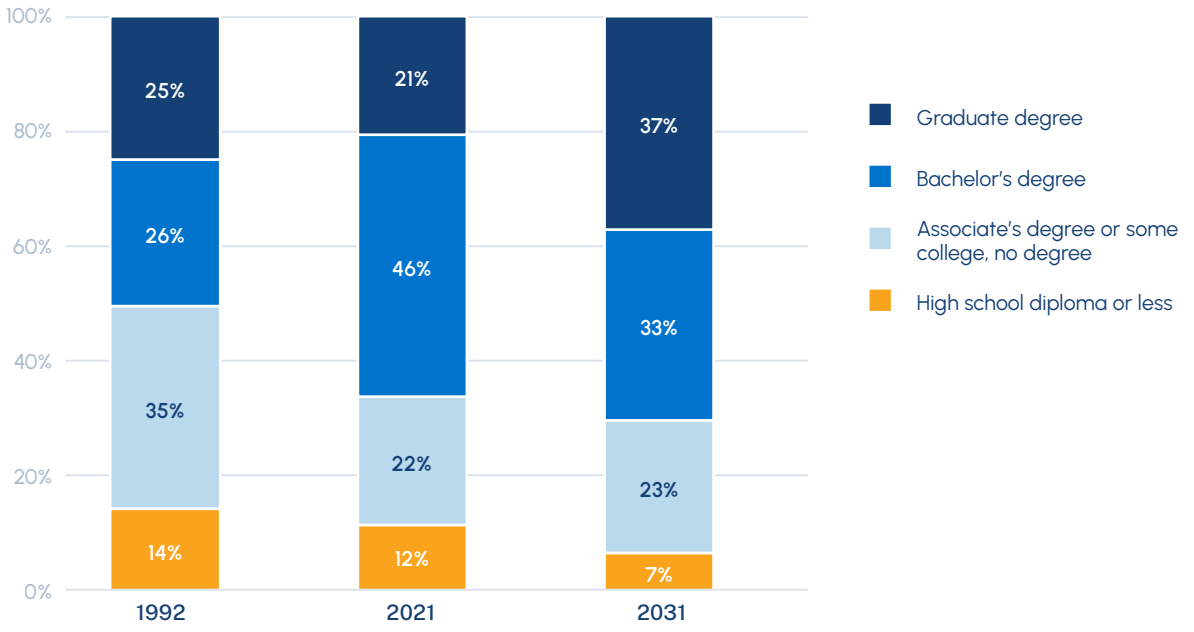

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

95 This occupational group is called Healthcare Practitioners and Technical Workers by the US Bureau of Labor Statistics.

and it is growing rapidly.[96] While all healthcare occupations will grow, registered nurse and health technologist occupations will account for most of the growth in healthcare employment through 2031, with each likely to expand by more than half a million jobs. Total employment in the healthcare professional and technical occupations cluster will increase to 10.8 million by 2031, and it will become the fifth-largest occupational cluster, overtaking education. Most job openings will require workers with at least a bachelor's degree, but many will require a graduate degree (Figure 15).

The share of jobs requiring postsecondary education and training will rise slightly from 88 percent in 2021 to 93 percent in 2031 (Figure 16). The share of jobs for middle-skills workers will increase slightly from 22 percent to 23 percent, while the share of jobs for workers with a bachelor's degree will decrease from 46 to 33 percent. The change in postsecondary requirements is driven largely by the increased share of jobs for workers with a graduate degree, which will grow from 21 percent to 37 percent.

**FIGURE 16. Almost all healthcare professional and technical jobs will require at least some postsecondary education and training by 2031.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

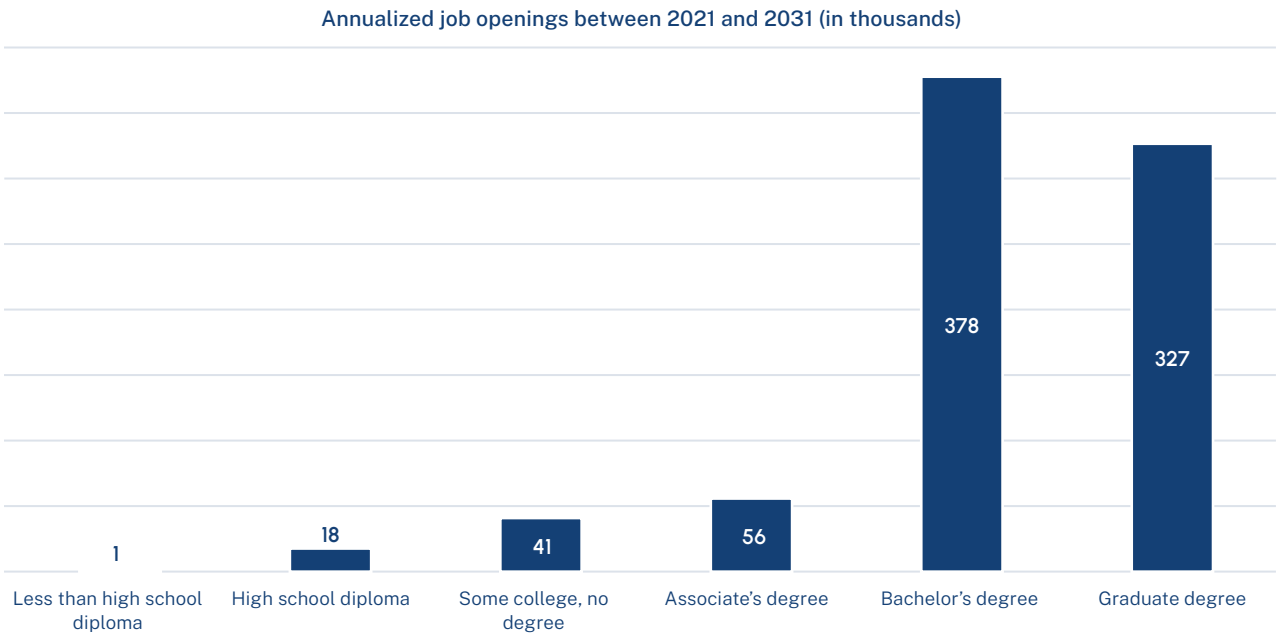
96 Georgetown University Center on Education and the Workforce analysis of National Healthcare Expenditure data, 2022.

## Science, Technology, Engineering, and Mathematics (STEM) and Social Sciences Occupations

The STEM and social sciences occupations cluster covered 9.4 million jobs in 2021, or roughly 6 percent of US employment, making it the seventh-largest of the nine occupational clusters. This cluster is composed of three occupational groups — computer and mathematical science occupations; architecture and engineering occupations; and life, physical, and social sciences occupations.

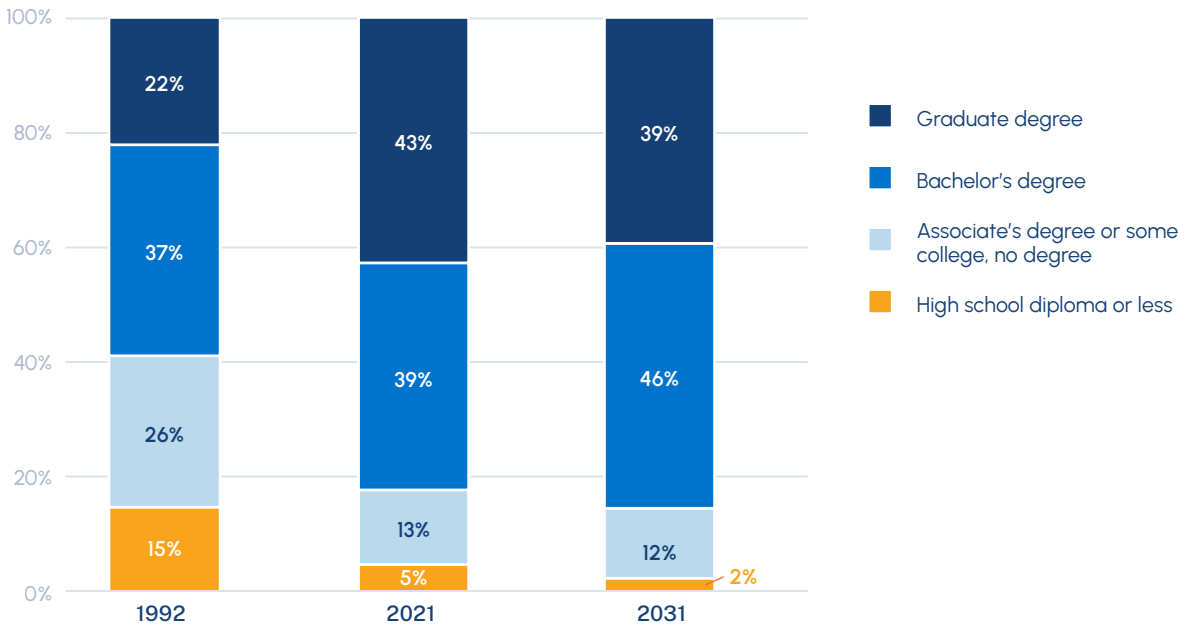
As of 2021, three industries employed two-thirds of the workers in this occupational cluster. The professional and business services industry employs the most with 35 percent, followed by manufacturing (21 percent), and government and public education services (11 percent). These occupations will grow relatively quickly: total employment in the STEM and social sciences cluster will increase to 10.7 million in 2031, meaning it will become the sixth-largest occupational cluster. As might be expected, almost all annual openings in this occupational cluster over the next decade will go to workers with at least some postsecondary credential (Figure 17).

**FIGURE 17. STEM and social sciences occupations will have the most annualized job openings for workers with a bachelor's degree.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

**FIGURE 18. The share of STEM and social sciences jobs will increase the most through 2031 for workers with a bachelor's degree.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

The share of jobs requiring postsecondary education and training will rise from 95 percent in 2021 to 98 percent in 2031 (Figure 18). The share of jobs for workers with a graduate degree will decline from 43 percent to 39 percent. The share of jobs for middle-skills workers will decrease from 13 percent to 12 percent, while the share of jobs for workers with a bachelor's degree will rise from 39 percent to 46 percent.

## Computer and Mathematical Science Occupations

The computer and mathematical science occupations group accounted for 5.1 million jobs in 2021, or 3 percent of all US employment. This is the largest occupational group within the STEM and social sciences occupational cluster, constituting 55 percent of all jobs in the cluster in 2021. Jobs in this category include mathematicians and statisticians, operations research analysts, computer programmers, and database administrators.

The professional and business services industry is the largest employer of these workers, employing 41 percent of them in 2021. Large numbers of these workers are also employed

in the following industries: financial services (12 percent), government and public education services (10 percent), and manufacturing (10 percent).

This occupational category will grow in every industry because of its integral role in broad-based technology updates. The expansion will be driven by demands for sophisticated internet and intranet capabilities, connection with mobile computer and communications technologies, use of electronic healthcare records, and computer-related security. Total employment in the computer and mathematical science occupation group will increase by 18 percent to 6.1 million in 2031.

### Architectural and Engineering Occupations

Architectural and engineering occupations covered 2.7 million jobs in 2021, roughly 2 percent of US employment or 29 percent of jobs in STEM and social sciences occupations. Jobs in this group include architects, drafters, surveyors, chemical engineers, civil engineers, industrial engineering technicians, and mechanical engineering technicians.

Two industries employ nearly three-quarters of the workers in this occupations group. As of 2021, the manufacturing industry employed 46 percent, and the professional and business services industry employed 27 percent.

The architects, engineers, and technicians who make up this occupational group plan and design solutions to complex problems. This type of work requires creativity and human interaction rather than repetitive low-level cognitive or physical tasks. Total employment in the architectural and engineering occupations group will increase by about 9 percent, to 3 million by 2031.

### Life, Physical, and Social Sciences Occupations

The life, physical, and social sciences occupations group has the highest level of postsecondary education and training requirements of any of the 22 occupational groups. This might be expected as highly skilled jobs such as medical scientists, physicists, astronomers, chemists, and economists all fall into this category. However, this group also includes many middle-skills jobs, such as chemical technicians, food science technicians, and petroleum technicians. In 2021, this group accounted for 1.5 million jobs. This group covers roughly 16 percent of all STEM and social science jobs and about 1 percent of US employment.

Six industries employed a collective 93 percent of all life, physical, and social scientists in 2021. In order of employment share, those industries were professional and business services (24 percent), government and public education services (23 percent), manufacturing (18 percent), healthcare services (15 percent), private education services (8 percent), and natural resources (4 percent). The fastest-growing industries, professional and business services

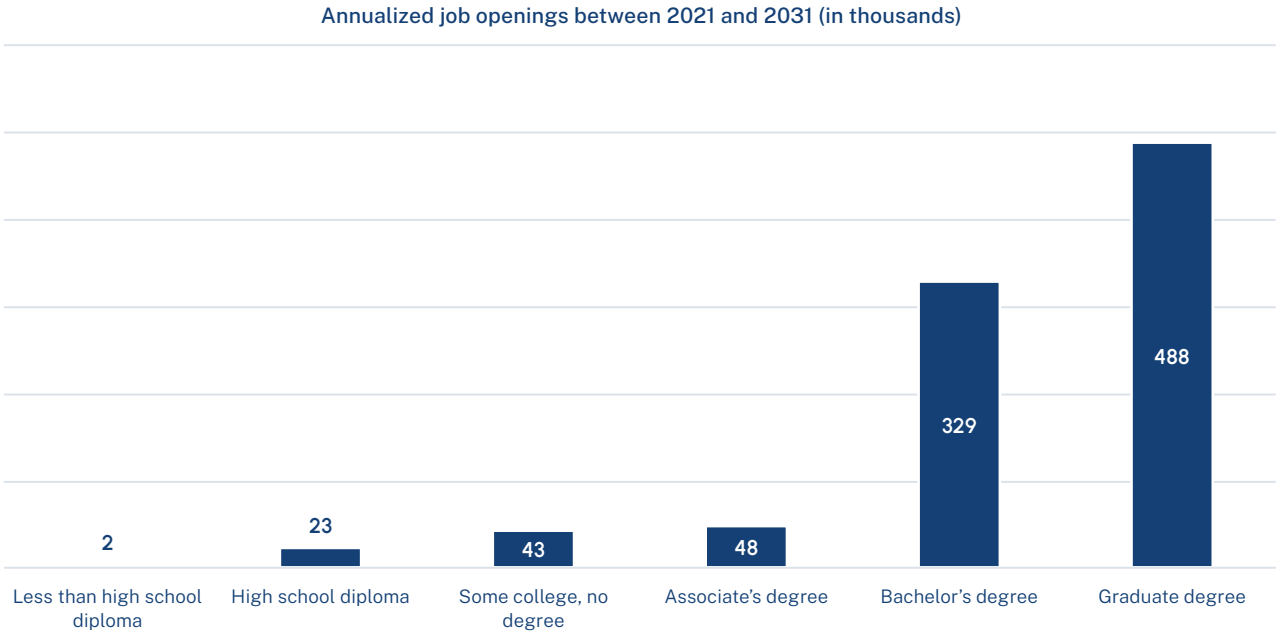
and healthcare services, will continue to expand opportunities for these workers. Total employment in the life, physical, and social sciences occupation group will increase by 11 percent, to 1.7 million jobs by 2031.

## Education Occupations

The education occupations cluster included 9.6 million jobs in 2021, or 6 percent of US employment, making it the fifth-largest of the nine occupational clusters. This cluster is not divided into occupational groups. Preschool and K–12 teachers dominate the jobs in this cluster, which also covers teaching jobs at the postsecondary level as well as jobs in library sciences and employment training.

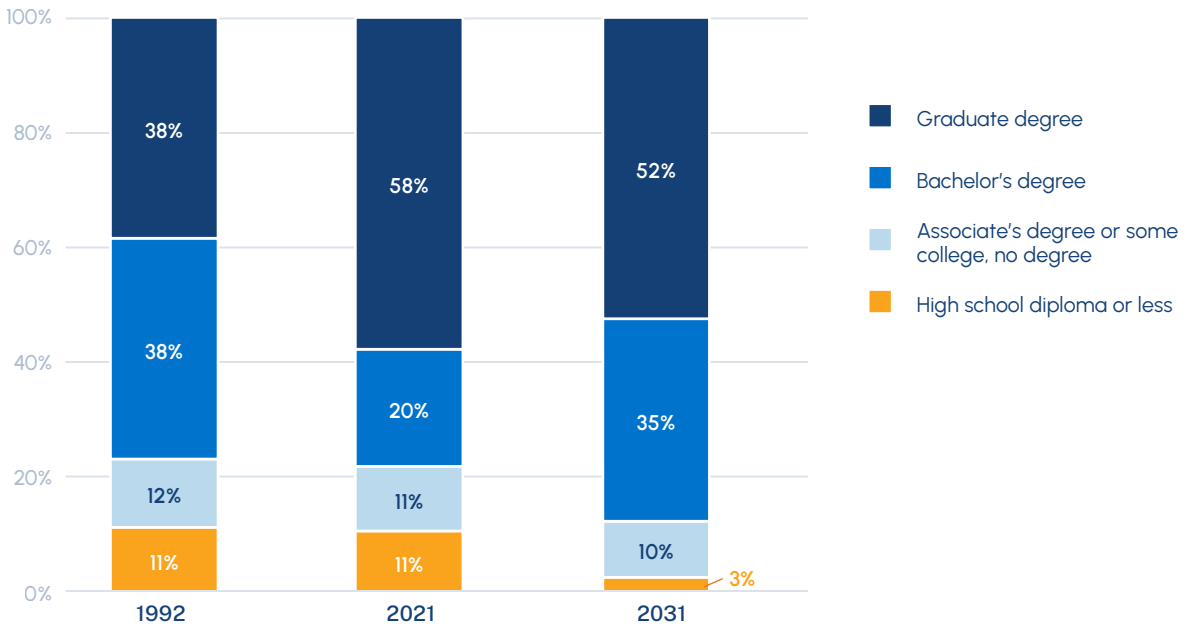
As might be expected, the vast majority of education workers are in the government and public education services industry, which employs 59 percent of them, followed by the private education services industry, which employs 29 percent of them. In fact, they are such a large part of the government and public education services industry that they constitute a third of the jobs in that industry. The healthcare services industry also employs a notable number — 7 percent of all education workers.

**FIGURE 19. Education occupations will have the most annualized job openings for workers with a graduate degree.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

**FIGURE 20. Workers with a bachelor's degree will gain the largest share of education jobs from 2021 to 2031.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

Workers in the education sector earn wages below average for their education level, but education jobs are remarkably resilient, and the workers who fill them have high levels of education, frequently a graduate degree (Figure 19). Education was one of the few occupations that continued to gain jobs during the record-setting job losses of the Great Recession.[97] The total number of jobs in education occupations will increase to 10.6 million by 2031.

The share of workers in education occupations with postsecondary education and/or training will rise from 89 percent in 2021 to 97 percent in 2031 (Figure 20). The share of jobs for middle-skills workers will decrease from 11 percent to 10 percent. The share of workers with a graduate degree will decline from 58 percent in 2021 to 52 percent in 2031. However, jobs that require a bachelor's degree will increase from 20 percent to 35 percent.

97 Carnevale et al., *The Economic Value of College Majors*, 2015; and US Bureau of Labor Statistics, "Employment Situation Summary," various years.

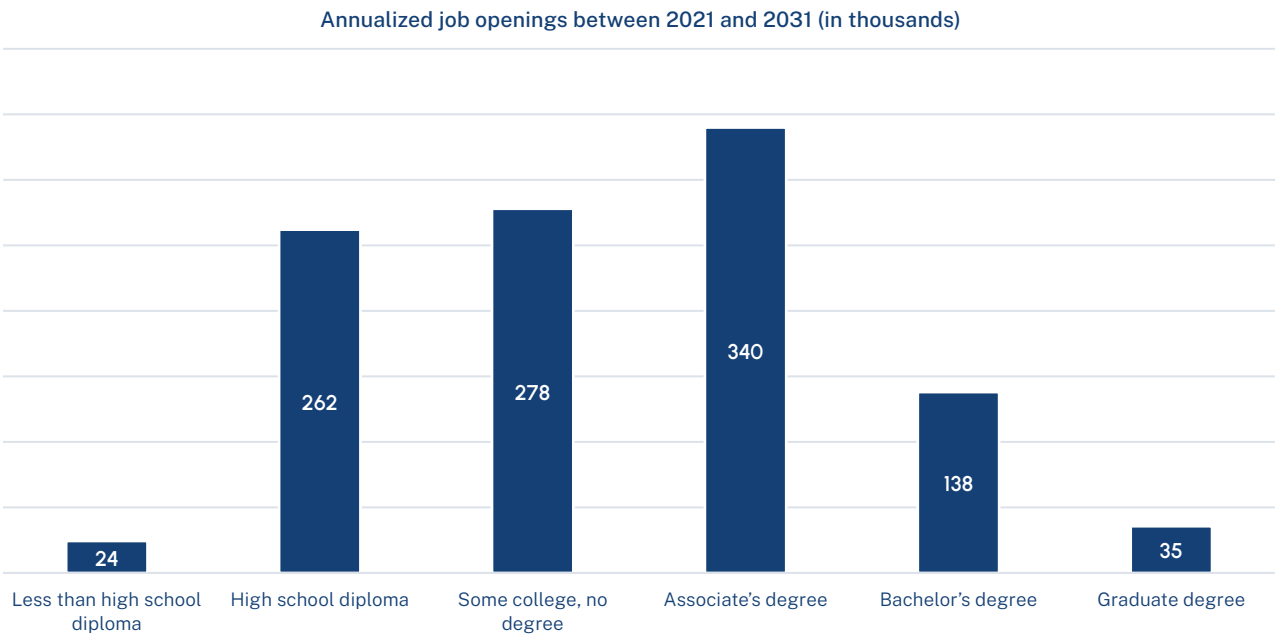
## Healthcare Support Occupations

Healthcare support occupations constitute the eighth-largest of the nine occupational clusters, accounting for 7.6 million jobs in 2021, or 5 percent of US employment. This cluster is composed of a single occupational group. Most jobs in it do not have a defined career path, but they generally support the more technical occupations in healthcare. Jobs that fall into this category include nursing aides and orderlies, home health aides, dental assistants, and medical equipment preparers.

As might be expected, this occupational group is tightly tied to the healthcare services industry. As of 2021, nine out of 10 workers in this cluster were employed in that industry. Like the healthcare industry as a whole, the future of this occupation is shaped by demographic changes. As the population ages, care is increasingly shifting outside institutions and into private homes, increasing the demand for home health aides. As a result, this will easily be the fastest-growing occupational cluster, on a percentage basis, between 2021 and 2031. Total employment will increase by 26 percent, to 9.6 million jobs.

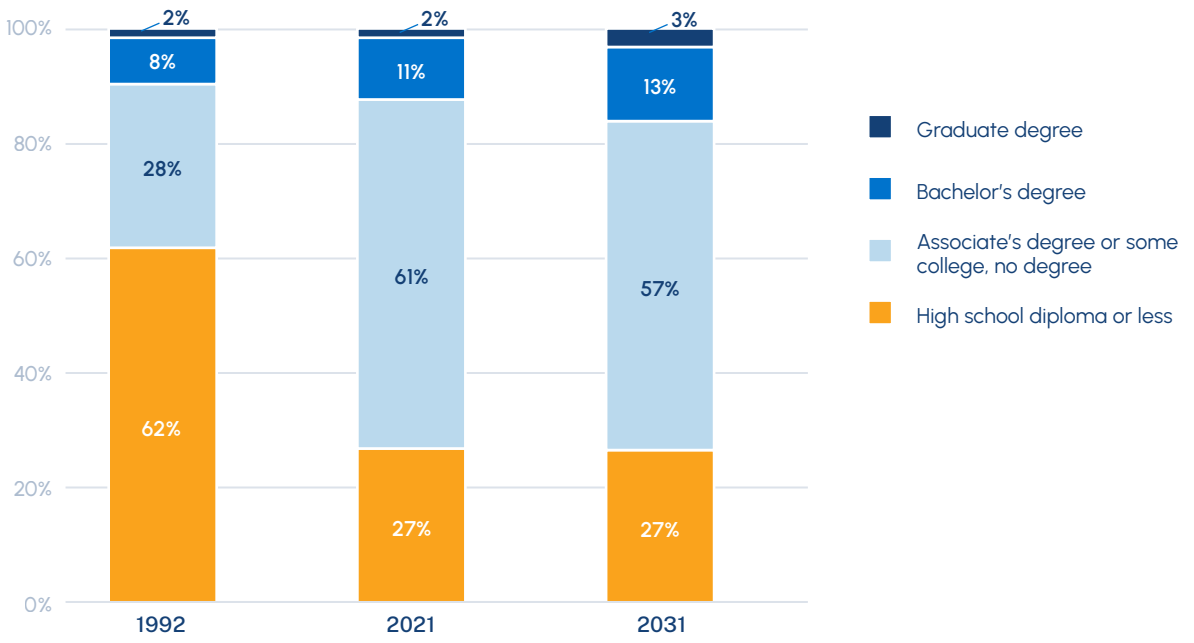
Middle skills are an important educational pathway for this cluster (Figure 21). As of 2021, 61 percent of the workers within this cluster had an associate's degree, or some college but

**FIGURE 21. Healthcare support occupations will have the most annualized job openings for workers with an associate's degree.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

**FIGURE 22. Healthcare support jobs will continue to be dominated by middle-skills workers.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

no degree. This will continue to be the most common educational attainment level needed in this occupational cluster through 2031. Postsecondary certificates are in high demand among these workers.[98]

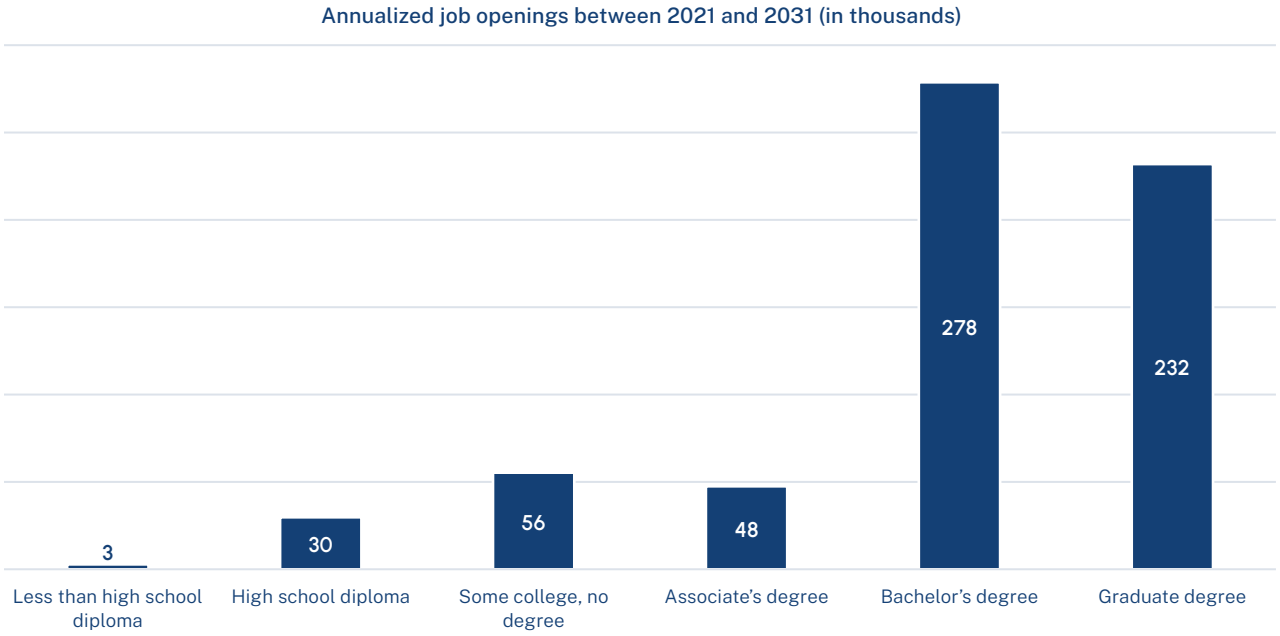
The share of jobs requiring postsecondary education and training will remain unchanged at 73 percent between 2021 and 2031 (Figure 22). The share of jobs that will require at least a bachelor's degree will increase slightly, from 13 percent to 16 percent. Middle-skills workers will be the largest group of workers in this occupation, but the share of jobs for these workers will decline mildly, from 61 percent to 57 percent.

## Community Services and Arts Occupations

The community services and arts occupation cluster is the smallest of the nine occupational clusters in terms of employment. In 2021, this cluster accounted for 5.1 million jobs, or about 3 percent of US employment. This occupational cluster is composed of two occupational groups:

98 Certificates are required in more than half of jobs for medical assistants, dental assistants, phlebotomists, massage therapists, and medical transcriptionists.

**FIGURE 23. Community services and arts occupations will have the most annualized job openings for workers with a bachelor's degree.**



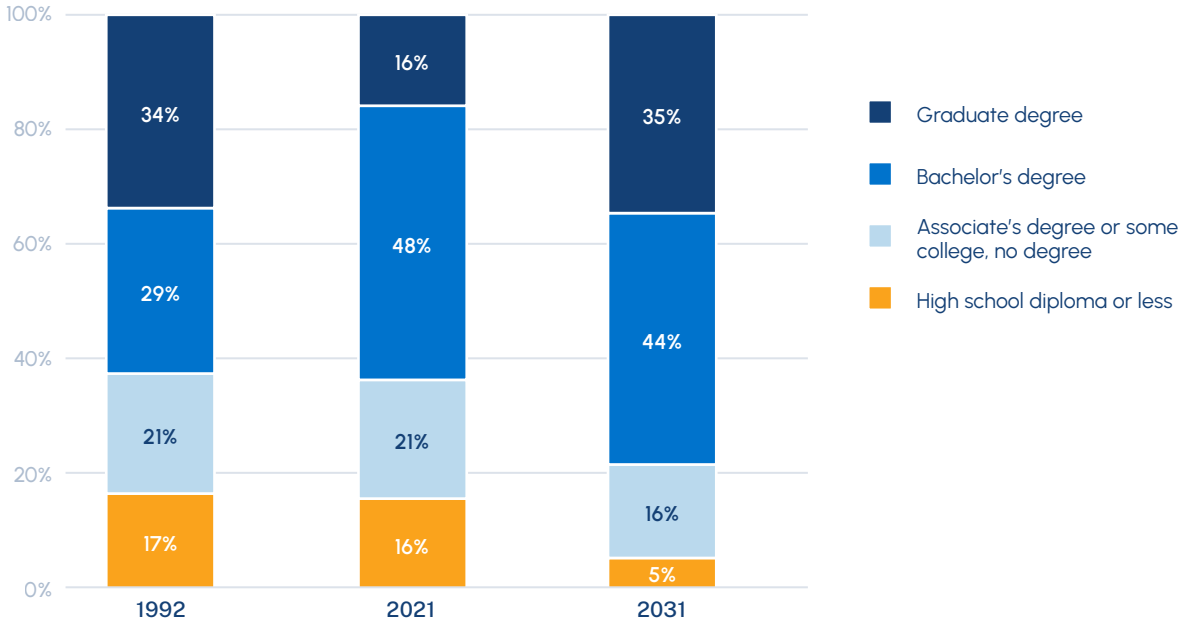

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics.

community and social services occupations; and arts, design, entertainment, sports, and media occupations. Employment in this cluster will increase to 5.8 million by 2031. Most job openings will require at least a bachelor's degree (Figure 23).

As of 2021, three-quarters of workers in the cluster found employment in five industries. The largest employer of these workers (25 percent) was the healthcare services industry. Other large employers of these workers were the government and public education services industry (which employed 15 percent), the personal services industry (14 percent), the professional and business services industry (13 percent), and the information services industry (11 percent).

The share of jobs requiring postsecondary education and training will rise from 84 percent in 2021 to 95 percent in 2031 (Figure 24). The share of jobs that require a graduate degree will increase dramatically, from 16 percent to 35 percent. The share of jobs for middle-skills workers will decrease from 21 percent to 16 percent, while the share of jobs for workers with a bachelor's degree will decrease from 48 percent to 44 percent.

**FIGURE 24. The share of jobs in community services and arts occupations will continue to decline for workers without a postsecondary credential.**




Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: Columns may not sum to 100 percent due to rounding.

## Arts, Design, Entertainment, Sports, and Media Occupations

The arts, design, entertainment, sports, and media occupations group covers a wide array of jobs. Among them are fashion designers, graphic designers, and multimedia artists. Entertainment and sports jobs include actors, dancers, coaches, athletes, and producers. Media occupations include writers, announcers, and public relations workers. This group included about 2.1 million jobs, or just over 1 percent of US employment, in 2021.

Occupations in this group are concentrated in the leisure and hospitality services, information services, professional services, and wholesale and retail trade services industries. These four industries employed nearly half of these workers in 2021. Virtually all the occupations in this group will grow, except jobs in traditional media. Total employment in the arts, design, entertainment, sports, and media occupations group will increase to 2.4 million in 2031.

There will continue to be limited new jobs for radio and television announcers and news analysts, reporters, and correspondents. Job creation and losses in this occupation group — especially those in leisure and hospitality and retail — traditionally correlate with economic

conditions: consumers shy away from buying expensive tickets and luxury clothing during economic downturns and reward themselves with them during a boom.

An artist's stock in trade is creativity, so technology is less of a threat to arts occupations. The human desire for novelty and excitement ensures that human creativity and endearing imperfections remain necessary to keep arts consumers interested.[99] As a result, arts occupations will be less imperiled than many other types of work.[100]

## Community and Social Services Occupations

Jobs that fall into this category include marriage and family therapists, rehabilitation counselors, social workers, and school counselors. This occupational group included 2.9 million jobs in 2021, or about 2 percent of US employment.

Workers in this occupational group are concentrated in the healthcare services (44 percent), personal services (23 percent), and government and public education services (23 percent) industries. The growing need for counseling and social services among the elderly and the growth in healthcare and education has stoked the demand for community and social services occupations. Demand for social workers, in particular, will be quite strong.[101] Consequently, total employment in the community and social services occupation group will increase by about 18 percent by 2031, to 3.4 million jobs.

99 Nevertheless, artificial intelligence has been used to write a novel and create artwork, among other creative endeavors. Some songwriters are using algorithms to identify the ingredients of a pop hit, and music streaming services are using algorithms to create playlists that will entice listeners.

100 Vinopaul, "Why Automation Won't Put Artists Out of Work Just Yet," 2018.

101 US Bureau of Labor Statistics, *Occupational Outlook Handbook*, 2019.

# Conclusion

While we forecast growth across every industry and occupational cluster through 2031, there is a growing mismatch between the skills needed for the jobs that will arise during the next decade and the education and training of the existing workforce. The skills most needed in the decentralized and distributed workplace of the future are the high-level cognitive skills most often learned in postsecondary education and training.

Currently, more than 50 million prime-age[102] workers have jobs that require no more than a high school education, but jobs with this comparatively low level of educational attainment are disappearing quickly. Hundreds of thousands of manufacturing and natural resources jobs were eliminated during the Great Recession, and they will not return. Workers who lack postsecondary education or training will be left behind — unemployed, underemployed, or stuck in low-wage jobs.

The US economy will create 18.5 million annual job openings through 2031, which largely consist of replacement positions that are the result of worker retirements. Collectively, employers filling these jobs will require college degrees or other postsecondary preparation from 72 percent of their new hires. **Postsecondary education and training are quickly becoming the only viable path to the American middle class.**

The workforce is also being fundamentally changed by other factors. The COVID-19 recession was the shortest economic recession on record, officially lasting just two months. Though brief, its impact on jobs will be felt for many years in the future. As a result of the near shutdown of the economy and the resulting shifting of work locales, remote work arrangements could no longer be viewed as a perk offered only to white-collar workers — this time, remote work became a necessity to ensure that the economy was kept afloat.

Remote work is now a permanent characteristic of our workforce. Despite the rumblings of a few influential businesses advocating for a return to the old office environment, a great many new jobs are either fully remote or a hybrid model that incorporates the old in-person and the new remote methods of coordinating work.

Rising interest rates to combat persistently-high inflation rates and fears of a pending recession are still tempering post-COVID-19 economic exuberance. Unemployment, however, is still at historically low levels.[103] Job churn suggests some confidence in

102 Prime age is defined as ages 25 to 54.

103 US Department of Labor, Bureau of Labor Statistics, "Employment Situation Summary," various months. The unemployment rate just after the Great Recession peaked at 10 percent in October 2009. By the end of 2015, however, the unemployment rate had fallen to 5 percent. It reached 3.5 percent in October 2019, before the COVID-19 recession. The unemployment rate in 2023 has dipped as low as 3.4 percent (January and April), its lowest rate since 1969.

the employment market as people continue to leave jobs in favor of more lucrative opportunities and better working conditions.

The effect of technology on jobs is also a major concern. We calculate that 28 percent of all tasks in current jobs are subject to being automated by 2031. But that does not mean that the jobs themselves will be eliminated. Historically, jobs have adapted: as some tasks were automated, the responsibilities of the job changed or were expanded. Technology adoption requires training and retraining, often on the job. This need forces continuous upskilling and fuels workers' lifelong learning.

We expect there will be benefits and losses across the labor force because of increased adoption of technology. Jobs that combine repetitive physical and low-level cognitive tasks — such as those performed by farmworkers, property claims examiners, and production workers — are the jobs most likely to be automated. The greatest increases in jobs will come in occupations and industries that require levels of postsecondary education and/or training.

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APPENDIX A

# Postsecondary Vocational Certificates by Detailed Occupations

This table lists detailed occupations, and the extent to which these jobs will require workers to have postsecondary certificates in 2031.

| Managerial and professional office occupations | SOC code | Occupation | Share of jobs that will require a postsecondary certificate in 2031 |
|---|---|---|---|
| Court reporters | 23-2091 | Legal | 41.1% |
| Insurance appraisers, auto damage | 13-1032 | Business operations | 28.8% |

| STEM occupations | SOC code | Occupation | Postsecondary certificate (%) |
|---|---|---|---|
| Cartographers and photogrammetrists | 17-1021 | Architects and technicians | 35.7% |
| Electrical and electronics drafters | 17-3012 | Architects and technicians | 34.1% |
| Civil engineering technicians | 17-3022 | Engineers and technicians | 29.8% |
| Electrical and electronics engineering technicians | 17-3023 | Engineers and technicians | 28.1% |
| Electro-mechanical technicians | 17-3024 | Engineers and technicians | 26.2% |

| Community services and arts occupations | SOC code | Occupation | Postsecondary certificate (%) |
|---|---|---|---|
| Broadcast technicians | 27-4012 | Arts, design, entertainment, sports, and media | 30.9% |
| Radio operators | 27-4013 | Arts, design, entertainment, sports, and media | 26.5% |
| Sound engineering technicians | 27-4014 | Arts, design, entertainment, sports, and media | 25.0% |
| Audio and video equipment technicians | 27-4011 | Arts, design, entertainment, sports, and media | 19.9% |

| Education occupations | SOC code | Occupation | Postsecondary certificate (%) |
|---|---|---|---|
| Teacher assistants | 25-9041 | Education | 30.8% |
| Museum technicians and conservators | 25-4013 | Education | 20.3% |

| Healthcare professional and technical occupations | SOC code | Occupation | Postsecondary certificate (%) |
|---|---|---|---|
| Licensed practical and licensed vocational nurses | 29-2061 | Healthcare practitioners | 43.4% |
| Emergency medical technicians and paramedics | 29-2041 | Healthcare practitioners | 42.6% |
| Magnetic resonance imaging technologists | 29-2035 | Healthcare practitioners | 37.0% |
| Surgical technologists | 29-2055 | Healthcare practitioners | 31.2% |
| Ophthalmic medical technicians | 29-2057 | Healthcare practitioners | 30.4% |
| Opticians, dispensing | 29-2081 | Healthcare practitioners | 26.9% |
| Health technologists and technicians, all other | 29-2099 | Healthcare practitioners | 25.5% |
| Radiologic technologists | 29-2034 | Healthcare practitioners | 23.5% |

| Healthcare support occupations | SOC code | Occupation | Postsecondary certificate (%) |
|---|---|---|---|
| Medical assistants | 31-9092 | Healthcare support | 65.0% |
| Dental assistants | 31-9091 | Healthcare support | 62.5% |
| Phlebotomists | 31-9097 | Healthcare support | 57.1% |
| Massage therapists | 31-9011 | Healthcare support | 56.7% |
| Medical transcriptionists | 31-9094 | Healthcare support | 55.5% |
| Medical equipment preparers | 31-9093 | Healthcare support | 31.2% |
| Healthcare support workers, all other | 31-9099 | Healthcare support | 29.2% |
| Nursing assistants | 31-1014 | Healthcare support | 24.5% |
| Home health aides | 31-1011 | Healthcare support | 20.9% |

| Food and personal services occupations | SOC code | Occupation | Postsecondary certificate (%) |
|---|---|---|---|
| Skincare specialists | 39-5094 | Personal care | 87.3% |
| Hairdressers, hairstylists, and cosmetologists | 39-5012 | Personal care | 79.0% |
| Shampooers | 39-5093 | Personal care | 67.6% |
| Makeup artists, theatrical and performance | 39-5091 | Personal care | 43.5% |
| Fitness trainers and aerobics instructors | 39-9031 | Personal care | 36.0% |
| Cooks, private household | 35-2013 | Food preparation and serving | 33.3% |
| Landscaping and groundskeeping workers | 37-3011 | Building and grounds cleaning and maintenance | 31.2% |
| Animal control workers | 33-9011 | Protective services | 29.6% |
| Barbers | 39-5011 | Personal care | 28.7% |
| First-line supervisors of personal service workers | 39-1021 | Personal care | 27.8% |
| First-line supervisors of landscaping, lawn service, and groundskeeping workers | 37-1012 | Building and grounds cleaning and maintenance | 27.3% |
| Police and sheriff's patrol officers | 33-3051 | Protective services | 23.9% |
| Fire inspectors and investigators | 33-2021 | Protective services | 23.6% |
| Gaming surveillance officers and gaming investigators | 33-9031 | Protective services | 23.3% |
| Chefs and head cooks | 35-1011 | Food preparation and serving | 22.2% |
| Lifeguards, ski patrol, and other recreational protective services workers | 33-9092 | Protective services | 21.6% |

| Sales and office support occupations | SOC code | Occupation | Postsecondary certificate (%) |
|---|---|---|---|
| Bookkeeping, accounting, and auditing clerks | 43-3031 | Office and administrative support | 20.8% |
| Medical secretaries | 43-6013 | Office and administrative support | 19.7% |

| Blue-collar occupations | SOC code | Occupation | Postsecondary certificate (%) |
|---|---|---|---|
| Motorcycle mechanics | 49-3052 | Installation, maintenance, and equipment repair | 82.0% |
| Commercial drivers | 49-9092 | Installation, maintenance, and equipment repair | 72.4% |
| Tool and die makers | 51-4111 | Production | 68.5% |
| Electronic home entertainment equipment installers and repairers | 49-2097 | Installation, maintenance, and equipment repair | 61.6% |
| Crane and tower operators | 53-7021 | Transportation and material moving | 60.6% |
| Aircraft mechanics and service technicians | 49-3011 | Installation, maintenance, and equipment repair | 60.3% |
| Electricians | 47-2111 | Construction and extraction | 59.5% |
| Electrical power-line installers and repairers | 49-9051 | Installation, maintenance, and equipment repair | 59.1% |
| Heating, air conditioning, and refrigeration mechanics and installers | 49-9021 | Installation, maintenance, and equipment repair | 55.1% |
| Mobile heavy equipment mechanics, except engines | 49-3042 | Installation, maintenance, and equipment repair | 54.6% |
| Motorboat mechanics and service technicians | 49-3051 | Installation, maintenance, and equipment repair | 53.7% |
| Plumbers, pipefitters, and steamfitters | 47-2152 | Construction and extraction | 52.2% |
| Automotive service technicians and mechanics | 49-3023 | Installation, maintenance, and equipment repair | 50.5% |
| Electrical and electronics repairers, powerhouse, substation, and relay | 49-2095 | Installation, maintenance, and equipment repair | 50.3% |
| Avionics technicians | 49-2091 | Installation, maintenance, and equipment repair | 50.0% |
| Ship engineers | 53-5031 | Transportation and material moving | 49.8% |
| Machinists | 51-4041 | Production | 49.7% |
| Painters, transportation equipment | 51-9122 | Production | 49.1% |

| | | | |
|---|---|---|---|
| Security and fire alarm systems installers | 49-2098 | Installation, maintenance, and equipment repair | 48.6% |
| Industrial machinery mechanics | 49-9041 | Installation, maintenance, and equipment repair | 48.0% |
| Electronic equipment installers and repairers, motor vehicles | 49-2096 | Installation, maintenance, and equipment repair | 47.4% |
| Motorboat operators | 53-5022 | Transportation and material moving | 47.3% |
| Electrical and electronics repairers, commercial and industrial equipment | 49-2094 | Installation, maintenance, and equipment repair | 45.9% |
| Patternmakers, wood | 51-7032 | Production | 45.9% |
| Watch repairers | 49-9064 | Installation, maintenance, and equipment repair | 45.8% |
| Electrical and electronics installers and repairers, transportation equipment | 49-2093 | Installation, maintenance, and equipment repair | 44.2% |
| Musical instrument repairers and tuners | 49-9063 | Installation, maintenance, and equipment repair | 42.9% |
| Control and valve installers and repairers, except mechanical door | 49-9012 | Installation, maintenance, and equipment repair | 41.8% |
| Recreational vehicle service technicians | 49-3092 | Installation, maintenance, and equipment repair | 41.7% |
| Coil winders, tapers, and finishers | 51-2021 | Production | 40.9% |
| Cooling and freezing equipment operators and tenders | 51-9193 | Production | 40.8% |
| Computer numerically controlled machine tool programmers, metal and plastic | 51-4012 | Production | 40.6% |
| Electric motor, power tool, and related repairers | 49-2092 | Installation, maintenance, and equipment repair | 39.2% |
| Gas plant operators | 51-8092 | Production | 39.1% |
| Model makers, metal and plastic | 51-4061 | Production | 39.1% |
| Cutters and trimmers, hand | 51-9031 | Production | 38.3% |
| Boilermakers | 47-2011 | Construction and extraction | 37.7% |

| | | | |
|---|---|---|---|
| Wind turbine service technicians | 49-9081 | Installation, maintenance, and equipment repair | 36.4% |
| Tool grinders, filers, and sharpeners | 51-4194 | Production | 35.7% |
| Elevator installers and repairers | 47-4021 | Construction and extraction | 35.6% |
| Farm equipment mechanics and service technicians | 49-3041 | Installation, maintenance, and equipment repair | 34.3% |
| Transportation inspectors | 53-6051 | Transportation and material moving | 33.3% |
| Drilling and boring machine tool setters, operators, and tenders, metal and plastic | 51-4032 | Production | 32.6% |
| Installation, maintenance, and repair workers, all other | 49-9099 | Installation, maintenance, and equipment repair | 32.5% |
| Model makers, wood | 51-7031 | Production | 31.6% |
| Signal and track switch repairers | 49-9097 | Installation, maintenance, and equipment repair | 31.6% |
| Computer, automated teller, and office machine repairers | 49-2011 | Installation, maintenance, and equipment repair | 31.0% |
| Segmental pavers | 47-4091 | Construction and extraction | 30.9% |
| Millwrights | 49-9044 | Installation, maintenance, and equipment repair | 30.4% |
| Maintenance and repair workers, general | 49-9071 | Installation, maintenance, and equipment repair | 30.0% |
| Sewers, hand | 51-6051 | Production | 29.6% |
| Reinforcing iron and rebar workers | 47-2171 | Construction and extraction | 29.6% |
| Captains, mates, and pilots of water vessels | 53-5021 | Transportation and material moving | 29.5% |
| Stonemasons | 47-2022 | Construction and extraction | 29.5% |
| Plant and system operators, all other | 51-8099 | Production | 29.3% |
| Structural metal fabricators and fitters | 51-2041 | Production | 29.0% |
| First-line supervisors of construction trades and extraction workers | 47-1011 | Construction and extraction | 28.6% |

| | | | |
|---|---|---|---|
| Welding, soldering, and brazing machine setters, operators, and tenders | 51-4122 | Production | 28.5% |
| Camera and photographic equipment repairers | 49-9061 | Installation, maintenance, and equipment repair | 28.5% |
| First-line supervisors of mechanics, installers, and repairers | 49-1011 | Installation, maintenance, and equipment repair | 27.8% |
| Automotive body and related repairs | 49-3021 | Installation, maintenance, and equipment repair | 27.7% |
| Helpers, pipelayers, plumbers, pipefitters, and steamfitters | 47-3015 | Construction and extraction | 26.8% |
| Cabinetmakers and bench carpenters | 51-7011 | Production | 26.6% |
| Tire repairers and changers | 49-3093 | Installation, maintenance, and equipment repair | 26.4% |
| Locksmiths and safe repairers | 49-9094 | Installation, maintenance, and equipment repair | 26.1% |
| Welders, cutters, solderers, and brazers | 51-4121 | Production | 26.1% |
| Jewelers and precious stone and metal workers | 51-9071 | Production | 25.6% |
| Commercial pilots | 53-2012 | Transportation and material moving | 25.3% |
| Tapers | 47-2082 | Construction and extraction | 25.3% |
| Construction and building inspectors | 47-4011 | Construction and extraction | 25.0% |
| Multiple machine tool setters, operators, and tenders, metal and plastic | 51-4081 | Production | 25.0% |
| Water and wastewater treatment plant and system operators | 51-8031 | Production | 24.5% |
| Sailors and marine oilers | 53-5011 | Transportation and material moving | 24.2% |
| Hoist and winch operators | 53-7041 | Transportation and material moving | 23.5% |
| Locomotive engineers | 53-4011 | Transportation and material moving | 23.2% |

| | | | |
|---|---|---|---|
| Radio, cellular, and tower equipment installers and repairs | 49-2021 | Installation, maintenance, and equipment repair | 22.8% |
| Carpenters | 47-2031 | Construction and extraction | 22.7% |
| Automotive and watercraft service attendants | 53-6031 | Transportation and material moving | 22.7% |
| Insulation workers, mechanical | 47-2132 | Construction and extraction | 22.6% |
| Septic tank servicers and sewer pipe cleaners | 47-4071 | Construction and extraction | 22.1% |
| Dental laboratory technicians | 51-9081 | Production | 22.0% |
| Printing press operators | 51-5112 | Production | 21.6% |
| Telecommunications equipment installers and repairers, except line installers | 49-2022 | Installation, maintenance, and equipment repair | 21.4% |
| Maintenance workers, machinery | 49-9043 | Installation, maintenance, and equipment repair | 21.3% |
| Pile-driver operators | 47-2072 | Construction and extraction | 20.9% |
| Power plant operators | 51-8013 | Production | 20.9% |
| Explosives workers, ordnance handling experts, and blasters | 47-5031 | Construction and extraction | 20.8% |
| Air traffic controllers | 53-2021 | Transportation and material moving | 20.8% |
| Home appliance repairers | 49-9031 | Installation, maintenance, and equipment repair | 20.3% |
| Locomotive firers | 53-4012 | Transportation and material moving | 20.0% |
| Helpers, electricians | 47-3013 | Construction and extraction | 19.8% |
| Hazardous materials removal workers | 47-4041 | Construction and extraction | 19.7% |
| Lathe and turning machine tool setters, operators, and tenders, metal and plastic | 51-4034 | Production | 19.6% |
| Ambulance drivers and attendants, except emergency medical technicians | 53-3011 | Transportation and material moving | 19.6% |

Source: Georgetown University Center on Education and the Workforce analysis of data from the Occupational Information Network (O*NET) 23.2 database, 2019, and Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

APPENDIX B

# Total Jobs by Education and Occupation in 2021

| **OCCUPATONAL CLUSTERS IN 2021** (in thousands) | **Less than high school** | **High school graduates** | **Some college** | **Associate's degree** | **Bachelor's degree** | **Graduate degree** | **Total** |
|---|---|---|---|---|---|---|---|
| Blue-collar | 7,670 | 11,336 | 6,513 | 5,316 | 3,301 | 1,596 | 35,733 |
| Sales and office support | 2,473 | 7,665 | 9,448 | 4,341 | 7,283 | 3,438 | 34,647 |
| Food and personal services | 4,191 | 7,955 | 4,781 | 3,417 | 2,586 | 894 | 23,825 |
| Managerial and professional office | 476 | 2,568 | 2,553 | 2,425 | 7,533 | 3,989 | 19,544 |
| Healthcare professional and technical | 204 | 882 | 1,475 | 622 | 4,296 | 1,949 | 9,427 |
| STEM and social sciences | 107 | 347 | 710 | 514 | 3,704 | 3,998 | 9,379 |
| Education | 67 | 952 | 693 | 404 | 1,953 | 5,550 | 9,619 |
| Healthcare support | 389 | 1,646 | 3,261 | 1,379 | 823 | 122 | 7,619 |
| Community services and arts | 162 | 625 | 717 | 338 | 2,416 | 797 | 5,054 |
| **Total** | **15,738** | **33,975** | **30,151** | **18,755** | **33,895** | **22,333** | **154,847** |
| | **10%** | **22%** | **19%** | **12%** | **22%** | **14%** | **100%** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; Lightcast; and US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS), 1992.

Note: The data in this table represent the stock of jobs. Job stock includes jobs of people who are permanently employed and not seeking to leave their positions, as well as new and replacement job opportunities.

APPENDIX C

# Total Jobs by Education and Industry in 2021

**2021 INDUSTRY TOTAL JOBS** (in thousands)

| | Less than high school | High school graduates | Some college | Associate's degree | Bachelor's degree | Graduate degree | Total |
|---|---|---|---|---|---|---|---|
| Government and public education services | 982 | 2,811 | 2,756 | 2,275 | 7,095 | 7,981 | 23,900 |
| Wholesale and retail trade | 1,893 | 6,815 | 4,468 | 1,881 | 4,648 | 1,195 | 20,900 |
| Professional and business services | 2,109 | 3,917 | 2,355 | 2,185 | 7,381 | 4,652 | 22,600 |
| Healthcare services | 921 | 4,264 | 2,509 | 3,672 | 5,447 | 3,986 | 20,800 |
| Leisure and hospitality services | 2,182 | 4,269 | 2,329 | 1,238 | 2,654 | 628 | 13,300 |
| Manufacturing | 1,357 | 4,052 | 1,662 | 1,334 | 2,695 | 1,100 | 12,200 |
| Financial services | 490 | 1,321 | 1,582 | 990 | 3,676 | 1,341 | 9,400 |
| Construction | 1,692 | 4,065 | 1,336 | 889 | 898 | 221 | 9,100 |
| Personal services | 1,096 | 2,460 | 1,051 | 1,162 | 1,526 | 805 | 8,100 |
| Transportation and utilities | 721 | 2,554 | 1,371 | 865 | 1,220 | 370 | 7,100 |
| Private education services | 207 | 484 | 365 | 307 | 1,246 | 1,491 | 4,100 |
| Information services | 156 | 385 | 346 | 284 | 1,171 | 459 | 2,800 |
| Natural resources | 292 | 411 | 139 | 101 | 186 | 71 | 1,200 |
| **Total** | **14,100** | **37,808** | **22,269** | **17,181** | **39,842** | **24,300** | **155,500** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: The data in this table represent the stock of jobs. Job stock includes jobs of people who are permanently employed and not seeking to leave their positions as well as new job opportunities.

APPENDIX D

# Projected Total Jobs by Education and Occupation in 2031

**OCCUPATONAL CLUSTERS IN 2031** (in thousands)

| | Less than high school | High school graduates | Some college | Associate's degree | Bachelor's degree | Graduate degree | Total |
|---|---|---|---|---|---|---|---|
| Blue-collar | 5,240 | 15,479 | 7,686 | 5,432 | 3,745 | 879 | 38,461 |
| Sales and office support | 1,192 | 8,128 | 7,732 | 5,360 | 10,713 | 2,949 | 36,074 |
| Food and personal services | 3,895 | 9,182 | 5,383 | 3,409 | 3,633 | 947 | 26,449 |
| Managerial and professional office | 251 | 1,607 | 2,117 | 1,824 | 9,493 | 6,703 | 21,996 |
| Healthcare professional and technical | 43 | 670 | 1,029 | 1,469 | 3,578 | 4,001 | 10,788 |
| STEM and social sciences | 18 | 246 | 524 | 771 | 4,950 | 4,212 | 10,720 |
| Education | 20 | 257 | 490 | 542 | 3,748 | 5,560 | 10,618 |
| Healthcare support | 214 | 2,339 | 2,481 | 3,030 | 1,232 | 310 | 9,605 |
| Community services and arts | 29 | 274 | 514 | 434 | 2,540 | 2,000 | 5,791 |
| **Total** | **10,902** | **38,182** | **27,954** | **22,271** | **43,632** | **27,561** | **170,502** |
| | **6%** | **22%** | **16%** | **13%** | **26%** | **16%** | **100%** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: The data in this table represent the stock of jobs. Job stock includes jobs of people who are permanently employed and not seeking to leave their positions as well as new job opportunities.

APPENDIX E

# Projected Total Jobs by Education and Industry in 2031

**2031 INDUSTRY TOTAL JOBS** (in thousands)

| | Less than high school | High school graduates | Some college | Associate's degree | Bachelor's degree | Graduate degree | Total Jobs |
|---|---|---|---|---|---|---|---|
| Government and public education services | 398 | 2,763 | 3,439 | 2,981 | 7,971 | 7,947 | 25,500 |
| Professional and business services | 1,980 | 7,813 | 5,364 | 3,223 | 5,817 | 1,303 | 25,500 |
| Healthcare services | 984 | 3,915 | 4,039 | 5,080 | 6,524 | 4,458 | 25,000 |
| Wholesale and retail trade | 1,722 | 3,169 | 3,162 | 2,629 | 6,880 | 4,237 | 21,800 |
| Leisure and hospitality services | 2,251 | 4,415 | 2,910 | 1,677 | 3,010 | 637 | 14,900 |
| Manufacturing | 1,285 | 3,901 | 2,041 | 1,549 | 2,758 | 1,066 | 12,600 |
| Financial services | 228 | 1,491 | 1,889 | 1,240 | 3,989 | 1,263 | 10,100 |
| Construction | 1,802 | 3,733 | 1,624 | 1,229 | 1,354 | 258 | 10,000 |
| Personal services | 1,032 | 2,475 | 1,499 | 1,318 | 1,689 | 787 | 8,800 |
| Transportation and utilities | 638 | 2,717 | 1,739 | 1,111 | 1,424 | 371 | 8,000 |
| Private education services | 114 | 400 | 501 | 440 | 1,615 | 1,730 | 4,800 |
| Information services | 57 | 379 | 567 | 377 | 1,282 | 437 | 3,100 |
| Natural resources | 315 | 445 | 199 | 146 | 234 | 61 | 1,400 |
| **Total** | **12,806** | **37,616** | **28,974** | **23,000** | **44,548** | **24,556** | **171,500** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: The data in this table represent the stock of jobs. Job stock includes jobs of people who are permanently employed and not seeking to leave their positions, as well as new job opportunities.

APPENDIX F

# Projected Annualized Job Openings by Education and Occupation through 2031

| **OCCUPATONAL CLUSTERS** (in thousands) | Less than high school | High school graduates | Some college | Associate's degree | Bachelor's degree | Graduate degree | Total Annualized openings |
|---|---|---|---|---|---|---|---|
| Blue-collar | 592 | 1,717 | 847 | 595 | 405 | 88 | 4,244 |
| Sales and office support | 130 | 884 | 834 | 571 | 1,164 | 318 | 3,901 |
| Food and personal services | 538 | 1,557 | 909 | 562 | 593 | 162 | 4,322 |
| Managerial and professional office | 22 | 140 | 184 | 160 | 842 | 562 | 1,910 |
| Healthcare professional and technical | 2 | 20 | 59 | 97 | 206 | 236 | 621 |
| Education | 2 | 23 | 43 | 48 | 329 | 488 | 933 |
| STEM and social sciences | 1 | 18 | 41 | 56 | 378 | 327 | 821 |
| Healthcare support | 24 | 262 | 278 | 340 | 138 | 35 | 1,076 |
| Community services and arts | 3 | 30 | 56 | 48 | 278 | 232 | 647 |
| **Total** | **1,315** | **4,651** | **3,252** | **2,476** | **4,334** | **2,448** | **18,475** |
| | **7%** | **25%** | **18%** | **13%** | **23%** | **13%** | |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: The data in this table represent the flow of jobs. Job flow includes newly created jobs and job openings caused by workers who retire or leave the occupation.

Totals across occupations and percentages may not sum due to rounding.

APPENDIX G

# Projected Annualized Job Openings by Education and Industry through 2031

**INDUSTRY ANNUALIZED JOB OPENINGS** (in thousands)

| | Less than high school | High school graduates | Some college | Associate's degree | Bachelor's degree | Graduate degree | Total Annualized openings |
|---|---|---|---|---|---|---|---|
| Healthcare services | 104 | 575 | 568 | 593 | 782 | 622 | 3,244 |
| Leisure and hospitality services | 283 | 877 | 516 | 300 | 412 | 129 | 2,516 |
| Wholesale and retail trade services | 130 | 633 | 491 | 326 | 686 | 233 | 2,500 |
| Government and public education services | 70 | 281 | 243 | 202 | 566 | 523 | 1,884 |
| Professional and business services | 132 | 356 | 254 | 201 | 561 | 350 | 1,853 |
| Manufacturing | 109 | 417 | 258 | 190 | 348 | 173 | 1,496 |
| Transportation and utilities services | 83 | 333 | 197 | 134 | 175 | 64 | 987 |
| Personal services | 59 | 265 | 198 | 153 | 201 | 108 | 985 |
| Construction | 170 | 346 | 169 | 122 | 129 | 48 | 984 |
| Financial services | 17 | 113 | 119 | 94 | 301 | 151 | 795 |
| Private education services | 20 | 72 | 62 | 51 | 186 | 202 | 592 |
| Information services | 11 | 57 | 53 | 43 | 129 | 67 | 359 |
| Natural resources | 45 | 86 | 40 | 25 | 46 | 19 | 261 |
| **Total** | **1,234** | **4,409** | **3,169** | **2,433** | **4,521** | **2,689** | **18,455** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit; and Lightcast.

Note: The data in this table represent the flow of jobs. Job flow includes newly created jobs and job openings caused by workers who retire or leave the occupation.

Totals across industries may not sum due to rounding.

APPENDIX H

# Projected Employment by Occupational Cluster and Occupational Group through 2031

| OCCUPATIONAL GROUPS | Jobs in 2021 | Jobs in 2031 | Net new | Annualized Job openings (in thousands) |
|---|---|---|---|---|
| **Blue collar** | | | | |
| Transportation and material moving | 13,364,000 | 14,643,000 | 1,279,000 | 1,770.7 |
| Production | 9,111,000 | 9,287,000 | 176,000 | 949.7 |
| Construction and extraction | 6,437,000 | 7,100,000 | 663,000 | 741.4 |
| Installation, maintenance, and repair | 6,170,000 | 6,724,000 | 554,000 | 612.7 |
| Farming, fishing, and forestry | 651,000 | 707,000 | 56,000 | 169.2 |
| **Sales and office support** | | | | |
| Office and administrative support | 20,469,000 | 21,083,000 | 614,000 | 2,062.8 |
| Sales and related | 14,178,000 | 14,991,000 | 813,000 | 1,838.6 |
| **Food and personal services** | | | | |
| Food preparation and serving related | 11,773,000 | 13,190,000 | 1,417,000 | 2,475.3 |
| Personal care and services | 3,507,000 | 3,934,000 | 427,000 | 685.0 |
| Building and grounds cleaning and maintenance | 4,885,000 | 5,348,000 | 463,000 | 733.8 |
| Protective services | 3,660,000 | 3,977,000 | 317,000 | 427.5 |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit LLC; and Lightcast.

Note: Numbers may not sum due to rounding.

| OCCUPATIONAL GROUPS | Jobs in 2021 | Jobs in 2031 | Net new | Annualized Job openings (in thousands) |
|---|---|---|---|---|
| **Managerial and professional office** | | | | |
| Management | 8,863,000 | 10,042,000 | 1,179,000 | 904.4 |
| Business and financial operations | 9,424,000 | 10,548,000 | 1,124,000 | 901.7 |
| Legal | 1,257,000 | 1,406,000 | 149,000 | 103.6 |
| **Healthcare professional and technical** | | | | |
| Healthcare professional and technical | 9,427,000 | 10,788,000 | 1,361,000 | 621.1 |
| **STEM and social sciences** | | | | |
| Computer and mathematical | 5,135,000 | 6,071,000 | 936,000 | 466.4 |
| Architecture and engineering | 2,746,000 | 2,984,000 | 238,000 | 207.4 |
| Life, physical and social sciences | 1,498,000 | 1,665,000 | 167,000 | 147.5 |
| **Education** | | | | |
| Education, training, and library | 9,619,000 | 10,618,000 | 999,000 | 932.9 |
| **Healthcare support** | | | | |
| Healthcare support | 7,619,000 | 9,605,000 | 1,986,000 | 1,075.9 |
| **Community services and arts** | | | | |
| Arts, design, entertainment, sports, and media | 2,131,000 | 2,351,000 | 220,000 | 319.5 |
| Community and social services | 2,923,000 | 3,440,000 | 517,000 | 327.5 |
| | **154,847,000** | **170,502,000** | **15,655,000** | **18,474.6** |

Source: Georgetown University Center on Education and the Workforce forecast using data from the US Census Bureau and Bureau of Labor Statistics, Current Population Survey (CPS); US Census Bureau, American Community Survey (ACS); US Bureau of Labor Statistics; IHS Markit LLC; and Lightcast.

Note: Numbers may not sum due to rounding.

APPENDIX I

# Methodological Change in Projections of Annualized Job Openings

Job openings discussed in this report are an annualized flow of job openings available over a 10-year time horizon. Some job openings result from a newly created opportunity. Others result when an individual permanently leaves a job — whether for personal reasons, retirement, injury, or even death. To project openings, the US Bureau of Labor Statistics (BLS) estimates the fraction of separations that occur when workers permanently leave an occupation or the workforce, as opposed to separations that occur when workers move to other job locations or get a promotion. The BLS estimate of openings does not count people who change jobs but stay in the same occupational cluster. The BLS website contains a technical description of the regression analysis and assumptions the agency used to estimate permanent labor force exits and job movement.[1] We agree with the new BLS approach and have adopted it as part of this report. Our projections for total jobs openings and net new jobs do not always align with those of BLS, however.

The current separations methodology represents a significant change in how BLS estimates replacement jobs. Before the 2016 to 2026 projections, it used a cohort-component method to determine job separations. BLS discontinued this method after identifying several statistical and conceptual issues. In actuality, the previous method resulted in the under-representation of the number of job openings because of an incorrect representation of churn in opportunity.

In practical terms, the change in methodology results in higher annual average numbers for job openings based on retirements, separations, and new growth compared to the past. This means we are not making an apples-to-apples comparison when we look at estimates from previous years, as shown by the following table. Note, in particular, the significant changes in job replacements/separations and total job openings.

1 US Bureau of Labor Statistics, "Occupational Separations Methodology," 2022.

**Comparisons of job forecasts from the US Bureau of Labor Statistics** (in millions)

| | Net new jobs, 10-year totals | Job replacements, 10-year totals | Total job openings, 10-year totals | Occupational openings, Annual Average |
|---|---|---|---|---|
| 2021-2031 | 8.3 | | | 19.5 |
| 2020-2030 | 11.9 | | | 18.5 |
| 2019-2029 | 6 | | | 17.5 |
| 2018-2028 | 8.4 | | | 19.7 |
| 2016–2026 | 11.5 | | | 18.7 |
| | | | | |
| 2014–2024 | 9.8 | 36.7 | 46.5 | |
| 2012–2022 | 15.6 | 35 | 50.6 | |
| 2010–2020 | 20.5 | 34.3 | 54.8 | |
| 2008–2018 | 15.3 | 35.6 | 50.9 | |

Source: US Bureau of Labor Statistics, "Employment Projections" news releases, various years.

Compared with previous years, the new methodology results in very different estimates of openings. The new methodology results in significantly improved projections of job replacements and therefore is a better measure of employment demand, in our judgment. However, we caution that this significant correction in the methodology must be considered when making comparisons to past projections.

*After Everything: Projections of Jobs, Education, and Training Requirements through 2031* can be accessed online at: *cew.georgetown.edu/Projections2031*.


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