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Skilled Jobs That Do Not Require a Bachelor's Degree: A New Approach to the Identification of Middle-Skill Occupations in the U.S.¹

Introduction

This research brief presents a new approach to the identification of middle-skill jobs, or relatively skilled occupations that do not typically require a bachelor's degree for entry. I call this group of occupations Skilled Non-College Occupations (SNCOs). In comparison to empirical studies and measurement frameworks that use alternative definitions of middle-skill jobs, my findings show that SNCOs represent a much smaller proportion of jobs in the United States than prior research has shown. This new definition of middle-skill occupations is an attempt to provide a more accurate understanding of the nature of skilled non-college occupations in the U.S. Knowing the size and composition of this group of occupations has important policy implications for postsecondary education.

This study offers a new approach to measuring middle-skill jobs that reveals a much smaller proportion of these jobs in the U.S. than is commonly assumed.

KEY FINDINGS

- Estimates of middle-skill jobs in the U.S. rely on inconsistent and methodologically flawed frameworks resulting in differences of up to 40 percentage points in employment estimates of middle-skill jobs.
- A new measurement framework for middle-skill jobs is proposed: A skilled non-college occupation (SNCO) is an occupation that has a knowledge, skills, training and experience index above a certain threshold, and typically requires less than a bachelor's degree.
- SNCOs in the U.S. represent a much smaller mass of employment compared to existing definitions of middle-skill jobs. The combined employment of Skilled Non-College Occupations (SNCOs) accounted for 16.2 percent of all jobs in 2016.
- SNCOs encompass a wide variety of occupations and industries that defy current stereotypes of middle-skill jobs.
- Employment in SNCOs is concentrated in a relatively small number of detailed occupations.
- The correlation between median occupational wages and the skills scores is quite low.
- The wage distribution of SNCOs is relatively more egalitarian than the wage distributions of comparison groups, including all occupations, skilled occupations and non-college occupations.
- SNCOs include a significant proportion of workers that are potentially underemployed in terms of educational attainment.

¹ This Research Brief is a summarized and slightly modified version of Scaglione (2018), available at wcer.wisc.edu/docs/working-papers/Working_Paper_No_2018_7.pdf.

A Policy Dilemma: Competing Definitions of Middle-Skill Occupations

A consensus has emerged in the scholarly literature around the empirical observation that job creation in the U.S. has followed a pattern of polarization since the 1980s (Autor, Katz, & Kearney, 2006; Autor, 2010; Autor & Dorn, 2012; Autor, 2015). This pattern arises when most jobs created are either relatively low-paying, low-skill jobs, filled by individuals with relatively low levels of educational attainment, or relatively high-paying, high-skill jobs, filled by individuals with four-year college degrees or higher. One of the main implications of this observation is that the opportunities for individuals without a four-year college degree to be employed in relatively “good,” middle-wage jobs have been declining in the U.S. over the last three decades. As a result, dominant policy recommendations derived from this approach have primarily focused on expanding the mass of college-educated workers (Autor, 2010; Goldin & Katz, 2008).

There is, however, a different way to define and measure middle-skill jobs that challenges the widespread call for more college-educated workers. In this view, the main problem regarding middle-skill jobs is not the relative decline observed in the story of job polarization, but rather that the supply of middle-skill jobs is significantly larger than the supply of specialized middle-skilled workers. According to widely cited estimates provided by the National Skills Coalition, middle-skill jobs accounted for 53 percent of all jobs in the U.S. in 2015, yet only 43 percent of workers were trained to the “middle-skill level” (National Skills Coalition, 2017). Proponents contend that this resulting “skills gap” can be remedied mostly by expanding specific vocational education and training programs, rather than focusing on a general expansion in the number of job applicants with four-year college degrees (Kochan, Finegold, & Osterman, 2012).

The problem of documenting the prevalence of middle-skill jobs is complicated by the fact that different authors refer to different things when they use the expression “middle-skill jobs.”

These competing perspectives are not based on different theories attempting to explain a well-defined empirical phenomenon, but on contested empirical observations supposedly based on the same empirical object of study (i.e., middle-skill jobs). The problem gets more complicated, however, once we realize that different authors refer to different things when they use the expression “middle-skill jobs” –not only between approaches, but often within the same general approach. Some researchers use educational attainment as the primary distinction among low-, middle- and high-skill jobs, while others use wages, estimates of occupation-specific skill needs, or a combination of these variables. However, approaches that have attempted a more systematic study and multivariate measurement of middle-skill jobs have been so far unable to come up with a rigorous unified definition.

This state of affairs is problematic because empirical definitions of middle-skill jobs have decisive implications on our understanding of the dynamics of the labor market, which in turn may inform workforce development and postsecondary education policies that impact large sectors of the population. Analyses of middle-skill jobs also impact critical decisions made by individual colleges and universities about which academic programs are “high-demand” and approaches to career advising that emphasize some occupations over others.

Existing Approaches to Defining Middle-Skill Occupations

Middle-skill occupations are generally defined as those occupations that demand medium to relatively high skills but require less than a four-year college degree for entry, as measured by educational attainment, wages, or occupation-specific skill demands. There are three main approaches to identifying middle-skill occupations that use these variables to produce vastly different estimates of middle-skill jobs. Table 1 presents a summary of the primary existing approaches to defining middle-skill occupations. Estimates of middle-skill jobs as a proportion of U.S. jobs can vary by as much as 40 percentage points, depending on which approach is used.

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Table 1. Three Different Approaches to the Identification of Middle-Skill Occupations

	National Skills Coalition (2014)	Holzer (2015)	Rothwell (2015)
Method	“Middle-skill occupations” are <i>major occupations</i> with the majority of workers in middle-skill detailed occupations. These are detailed occupations that require an associate’s degree; postsecondary non-degree award; some college, no degree; or a high school degree and one of the following: apprenticeship, long-term on-the-job (OJT) training, moderate term OJT, and work experience.	“Middle-wage occupations” are detailed occupations with median hourly wages between 75 and 150 percent of the median hourly wage.	“Skilled technical occupations” are detailed occupations that require a high level of knowledge in a technical domain and do not require a bachelor’s degree for entry.
Data Source	Occupational Employment Statistics and Bureau of Labor Statistics Employment Projections.	Occupational Employment Statistics.	O*NET, Occupational Employment Statistics, and Bureau of Labor Statistics Employment Projections.
Estimates	53% of all jobs in 2015	37% of all jobs in 2013	12% of all jobs in 2014

The first and most commonly cited method for defining middle-skill occupations, proposed by the National Skills Coalition, employs levels of required education, on-the-job training and work experience. In this definition, a detailed middle-skill occupation requires a level of education above a high school diploma and below a bachelor’s degree; or a high school diploma and one of the following: apprenticeship, long-term on-the-job training, moderate term on-the-job training, and work experience. Middle-skill occupations are then estimated at the most aggregated level of major occupations. This method yielded an estimated employment share of 53 percent for middle-skill occupations in 2015. However, this method sacrifices precision when it moves from the detailed to the major level of occupational aggregation, leading to potentially significant distortions in the employment estimates of the different skill levels (see Heinrich, 2018).

The second method, utilized by Harry Holzer in a study prepared for the Brookings Institution in 2015, approaches middle-skill occupations through a definition of a range of median occupational wages. “Middle-wage occupations” are detailed occupations with median hourly wages between 75 and 150 percent of the overall median hourly wage (Holzer,

2015). While Holzer acknowledges that “middle-wage” and “middle-skill” jobs are not always identical, “middle-wage” jobs are nonetheless treated as a valid approximation to middle-skill jobs throughout the study report. This method yielded an estimated employment share of 37 percent for middle-wage occupations in 2013, significantly below the National Skills Coalition estimate.

Finally, the third and most rigorous existing method for identifying middle-skill jobs was proposed by Jonathan Rothwell in 2015 in a study prepared for the U.S. National Academies of Sciences, Engineering, and Medicine. Rothwell’s approach focuses on the knowledge required to perform specific tasks by detailed occupations using the Occupational Information Network (O*NET) database. The O*NET database contains a rich and complex set of surveys that describe work and worker characteristics by detailed occupations, including knowledge requirements. Rothwell proposes an index or score using a subset of the O*NET *knowledge* requirements survey to measure technical knowledge or skill, and confines his analysis to detailed occupations that require a high degree of technical knowledge (i.e., a knowledge score above a threshold defined by Rothwell) and do not require a bachelor’s degree for entry (Rothwell, 2015). The combined employment of these “skilled technical” occupations represented 12 percent of the total U.S. workforce in 2014.

Empirical measures of work requirements provided by O*NET are not without flaws or limitations (see Handel, 2016), but Rothwell’s approach represents an improvement over attempts to approach the required average knowledge and skills with measures like educational attainment or wages. There are, however, two important limitations in Rothwell’s approach. The first limitation is the focus on “technical work,” which leaves out many occupations that require above-average levels of strictly non-technical knowledge, skills, on-the-job training and work experience, but do not typically require a bachelor’s degree for entry. The second limitation, which is a consequence of the first one, is the exclusive use of the O*NET knowledge requirements in the construction of the index that attempts to measure “technical knowledge or skill,” thus excluding potentially relevant measures like the O*NET skill requirements.

Toward A New Empirical Definition

My new proposed definition of skilled non-college occupations (SNCOs) is inspired by the empirical approach proposed by Rothwell (2015) in his definition of skilled technical work. It follows Rothwell’s general method of (1) computing skills index by detailed occupations using O*NET data, (2) setting a lower bound score of the skills index that defines the “skilled” occupations (i.e., all detailed occupations with a skills score above the lower threshold are considered “skilled”), and (3) selecting the occupations that typically require less than a bachelor’s degree for entry.

However, this new definition departs quite significantly from Rothwell’s approach in that it attempts to include all kinds of workers, as opposed to Rothwell’s focus on technical workers, and employs a skills index that incorporates four different O*NET-based scores—namely knowledge, skills, training and experience—in contrast with Rothwell’s reliance on a skills index based on a single O*NET-based score of *technical knowledge*. The proposed new index is referred to as the KSTE (Knowledge, Skills, Training, and Experience) index.

This new definition of middle-skill jobs moves beyond frameworks that solely focus on educational attainment and wages by focusing on education and a diverse range of occupational skills needs: knowledge, skills, training and experience.

Data Sources

The data for this study comes from three sources: the O*NET dataset, the Occupational Employment Statistics (OES) dataset, and the Bureau of Labor Statistics Employment Projections program (EPP) dataset.

The O*NET dataset is comprised by a set of surveys that include, among others, measures of different job requirements, like the specific set of skills required to perform a specific job, by detailed occupations. This study uses the Knowledge, Skills, Education, Training and Experience surveys of the O*NET database. All employed O*NET data are reported by job incumbents, except for the Skills data, imputed by job analysts. The OES dataset include data on employment and wages by detailed occupations and industries, at the national, state and metropolitan levels. OES data are collected at the establishment level and provide the most accurate publicly available measures of occupational employment and wages in the U.S. Lastly, the EPP data provides a measure of educational attainment typically required by detailed occupations.

Methodology

My proposed definition of skilled non-college occupations relies heavily on a new skills index and also depends, more conventionally, on a standard categorization of the occupations that typically require less than a bachelor's degree for entry.

Constructing the skills index: There are three methodological steps in the construction of the new skills index, namely: (1) the computation of normalized summary scores of the O*NET Knowledge, Skills, Training and Experience dimensions; (2) the evaluation of correlations between the summary scores and the final selection of the summary scores, or components, to be included in the final index; and (3) the assignment of weights to each component and the final assemblage of the composite skills index. Knowledge and Skills dimensions are much more direct and precise empirical proxies of skills than the Training and Experience dimensions, and thus required a more prominent presence in the new skills index. In the case of the latter O*NET dimensions. Training is more directly tied to the target occupation than Experience, which refers to experience that may have been accumulated in other related occupations, thus justifying assigning a higher weight to Training relative to Experience. A detailed description of the construction of the KSTE index is presented in Scaglione (2018, pp. 11-14).

Determining educational attainment typically required for entry: Our primary source of required educational attainment by occupation is provided by the EPP, at the Bureau of Labor Statistics. The EPP assigns educational attainment categories to detailed occupations based on analyses of quantitative information from the American Community Survey and O*NET, and qualitative information from interviews of persons who are “knowledgeable about education and training requirements for the occupations,” including “employers, workers in the occupation, training experts, and representatives of professional and trade associations and unions, among others” (Sommers & Morisi, 2012, p. 17).

Linking different datasets: A single dataset was created combining the 2016 values of (1) OES estimates of occupational employment and wages, at the national, state and metropolitan levels, and broken down by industry at the national level; (2) O*NET-based occupational K, S, T and E summary scores and the final KSTE index; and (3) EPP education level typically required for entry by occupation and EPP projected employment by occupation. The final dataset may be regarded as an extension of the OES dataset, preserving the complex structure of the OES dataset and adding O*NET and EPP data.

A New Empirical Definition of Skilled Non-College Occupations

The proposed definition of skilled non-college occupations is based on a relative measure of skills. An occupation is said to be “skilled” if its KSTE score is above a definite threshold, with the expression “skilled” being a shorthand for “relatively more skilled.” The expression “non-college” refers here to the levels of educational attainment that are below a four-year college degree, following a well-established convention in labor economics (see, for instance, Abel & Deitz, 2016). The KSTE index threshold was set at the average KSTE level for all occupations, based on the fact that the mean and median KSTE values for all occupations is virtually identical, and the notion that a simple above-average criterion is preferable in terms of simplicity and clarity.

Thus, a *skilled non-college occupation* (SNCO) is defined as an occupation that meets the following two criteria:

1. its KSTE score is above the average KSTE score, and
2. it typically requires less than a bachelor’s degree for entry.

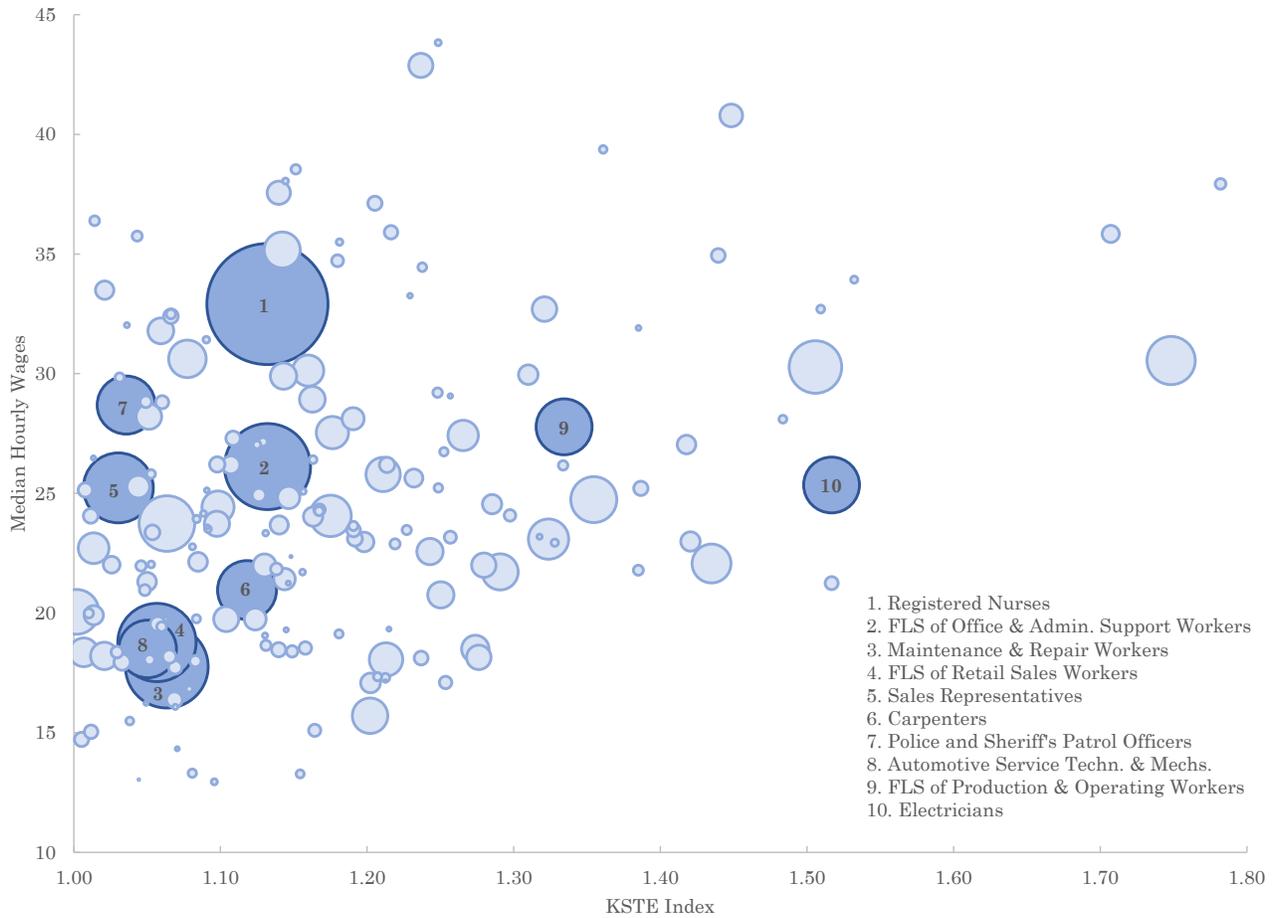
Key Findings

1. **SNCOs in the U.S. represent a much smaller mass of employment compared to existing definitions of middle-skills jobs.** In contrast to studies that estimate that the employment of so-called middle-skill occupations in the U.S. represent one-third to nearly half of total employment, this study estimates that the combined employment of Skilled Non-College Occupations (SNCOs) accounted for 16.2 percent of all jobs in 2016. In non-college occupations (i.e., those typically requiring less than a bachelor’s degree) only one in five jobs belongs to a relatively skilled occupation. In college occupations (i.e., those typically requiring a bachelor’s degree or more), on the other hand, four in five jobs belong to a relatively skilled occupation. This extremely large difference in the general likelihood of getting into a relatively skilled occupation with or without a bachelor’s degree should be a warning sign for advocates of career paths associated with middle-skill jobs.
2. **SNCOs encompass a wide variety of occupations and industries that defy current stereotypes of middle-skill jobs.** Skilled care workers and technicians in the health-care sector, and skilled production workers in manufacturing are part of the group, as expected. Other occupations like first-line supervisors of administrative support workers, police officers and sales representatives in the service sector, add new layers of complexity to the notion of middle-skill jobs.
3. **Employment in SNCOs is concentrated in a relatively small number of detailed occupations.** For instance, nearly half of all jobs in SNCOs is concentrated in the top 10 detailed SNCOs out of a total of 179 detailed SNCOs. This high concentration of employment across occupations, which is also observable across industries, suggests that studies that focus on specific occupations, possibly also within specific industries, may shed more light on the nature and dynamics of SNCOs and the different educational and career paths associated with them.
4. **The correlation between median occupational wages and the skills scores is quite low.** This finding challenges, in principle, the human capital approach, which equates more knowledge, skills, training and/or experience with proportionally higher hourly wages.

An exploration of the median hourly wages and the KSTE index by individual SNCOs helps illuminate the nature of the general relationship between wages and the KSTE scores. Figure 1 shows almost all the SNCOs, leaving out some small occupations in order to improve the graphical representation of the SNCOs. The 10 largest SNCOs in terms of employment are highlighted and individually identified. The combined employment of these 10 SNCOs, or nearly 6 percent of all SNCOs, represents 48.3 percent of all SNCO employment. The largest 10 occupations show a wide dispersion of median hourly wages, ranging between the \$17.80 of Maintenance and Repair Workers, General, and the \$32.90 of Registered Nurses, concentrated mostly within a relatively narrow range of KSTE scores, which

range between the 1.03 of Sales Representatives, Services, All Other, and the 1.13 of First-Line Supervisors of Office and Administrative Support Workers and Registered Nurses. This high concentration of occupational employment in a relatively narrow range of the KSTE index is also observed across all SNCOs, with 80 percent of all SNCO employment concentrated in occupations with a KSTE index below 1.2.

Figure 1. Median Hourly Wages and KSTE Scores across SNCOs

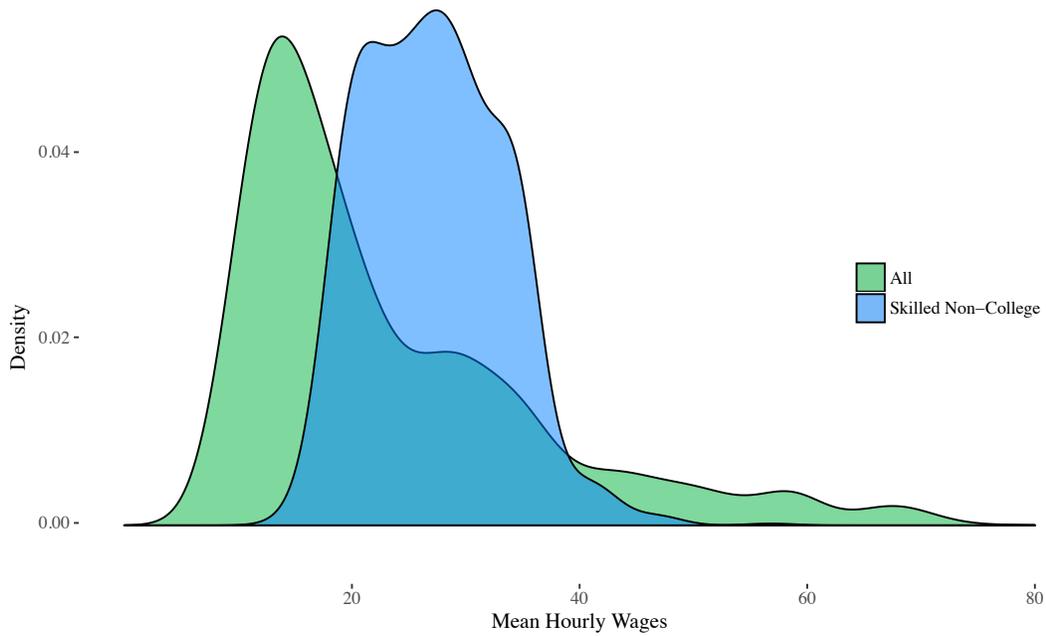


Bubble sizes are proportional to occupational employment. FLS is First Line Supervisors.

Ultimately, the relationship between KSTE scores and wages needs to be explored further in studies that incorporate the KSTE index or similar skills indexes in conventional multivariate analysis of wage determination.

5. **The wage distribution of SNCOs is relatively more egalitarian than the wage distributions of comparison groups including all occupations, skilled occupations and non-college occupations.** As can be seen in Figure 2, the much more compact distribution of mean hourly wages in SNCOs is denser between the low \$20s and the mid \$30s, in 2016 dollars, whereas the more frequent values for all occupations is significantly below that range. The location and shape of the distribution of wages of SNCOs suggests a higher average wage for SNCOs compared to the average wage for all occupations. In effect, the weighted average of the mean hourly wages of SNCOs is \$27.20, 14 percent higher than the weighted average of the mean hourly wages for all occupations, which stands at \$23.90.

Figure 2. Density Estimates of Mean Hourly Wages of SNCOs and All Occupations



6. **SNCOs include a significant proportion of workers that are potentially underemployed in terms of educational attainment.** There is a clear mismatch between the aggregated levels of educational attainment typically required by SNCOs and the aggregated levels of educational attainment of workers in SNCOs, as demonstrated in Figures 3 and 4. While more than *two-thirds* of jobs require a high-school degree or less, an estimate of *two-thirds* of the workers in SNCOs report levels of educational attainment above a high school diploma. The aggregated excess of education effectively attained by workers relative to the education required by occupations suggests that a significant proportion of workers in SNCOs are *overqualified* or *underemployed* in terms of educational attainment. This finding is consistent with findings in recent research on the relationship between education, skills and employment in the U.S. (see Abel & Deitz, 2016; Beaudry, Green, & Sand, 2015; Cappelli, 2015; Fogg & Harrington, 2011).

Figure 3. Educational Attainment Typically Required for Entry in SNCOs
(in % of SNCO employment)

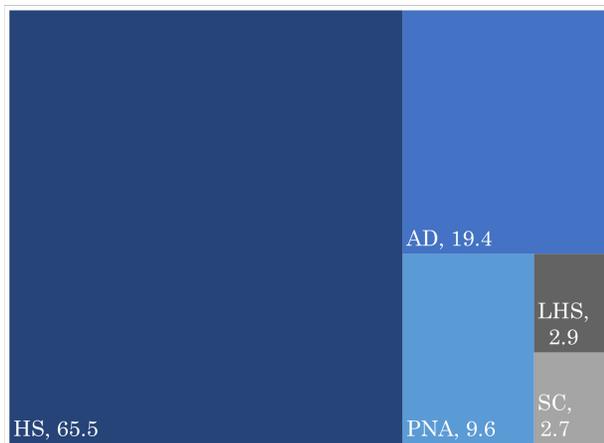
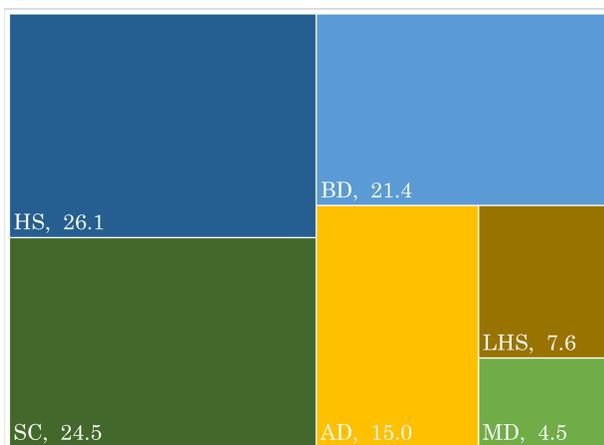


Figure 4. Estimated Educational Attainment of Workers in SNCOs
(in % of SNCO employment)



LHS: Less than high school; PNA: Postsecondary non-degree award (only in Fig. 3); SC: Some college, no degree; AD: Associate's degree; BD: Bachelor's degree; MD: Master's degree.

Recommendations for Future Research

There remain important questions that were not addressed in our initial analyses. These questions refer to the demographics of workers in SNCOs, the dynamics of SNCOs over time and the variation in the dynamics and composition of SNCOs across subnational geographic areas. Additional research questions include:

- What is the composition of SNCOs in terms of age, sex, race and ethnicity and how has it changed over time?
- Have SNCOs expanded or contracted over the last decade, especially since the Great Recession?
- Are SNCOs expected to expand or contract in official employment projections?
- In terms of employment, which SNCOs have expanded or contracted and which ones are projected to grow or decline?
- Do the relative size and composition of SNCOs vary significantly across states and metropolitan areas?

Answers to these important questions, utilizing the new definition of SNCOs, should offer a more accurate understanding of the nature and dynamics of skilled non-college occupations in the U.S. With more nuanced accounts of regional demands for current and projected SNCOs, colleges and universities will be in a better position to design, implement, and promote particular academic programs, especially for vocational programs in two-year technical colleges and professional programs in four-year universities. Finally, a more accurate accounting of the prevalence of low-, middle-, and high-skill jobs should be used by policymakers to inform decisions about economic and workforce development.

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