SLDS Issue Brief

Best Practices for Calculating Employment and Earnings Metrics

Longitudinal records that link students' education data to data from workforce and employment programs provide states with valuable information about the factors that lead individuals to successful careers. Agency leaders, policymakers, and researchers use these data to calculate employment metrics, which help quantify outcomes such as rates of employment and expected earnings for workers. These metrics can be used to evaluate the impact of different education and training programs so that states can allocate resources to programs effectively and so that citizens can make informed decisions to advance their careers.

Although many states are still in the early stages of defining and using employment metrics, increased state interest in education and workforce outcomes, as well as federal reporting requirements for the 2014 Workforce Innovation and Opportunity Act (WIOA), indicate that the need for such metrics will continue to grow.

This brief provides a short introduction to the most common sources of employment data used in calculating employment metrics. It then describes several frequently used employment metrics, the data elements they require, and how they are calculated. Finally, it discusses how states can use employment metrics to answer policy questions or meet reporting requirements related to workforce outcomes, as well as challenges and considerations to address. This is the second in a series of publications focused on the collection and use of workforce data for SLDS work.

Summary of Employment Data Sources

States collect employment and workforce data from a number of sources. Each data source has advantages and limitations in the types of data it provides and the population it covers. Most states use a combination of the sources below to gain the most comprehensive information possible about their workforces.

For more information about these data sources and how their records can be linked in an SLDS, see the first brief in this series, *Sources and Linking Strategies for Employment Data*.

State unemployment insurance tax

The most frequently used source of employment and wage data, state unemployment insurance tax records are generally maintained by state departments of labor, commerce, or revenue. Data in these records typically include **quarterly wages**, **industry of employer**, and the **address of employer** headquarters. Some states collect the number of hours employees work, which can allow for calculation of hourly wages. However, most states do not collect this information from employers. Although they cover a majority of workers in a state, unemployment insurance tax records do not include some significant categories such as federal and military employees, most self-employed workers, and individuals who live in one state but work in another. They also do not include information about occupations or specific work sites in cases where employers have multiple offices.

State unemployment insurance claims

State unemployment insurance claims data are collected when individuals apply for unemployment insurance. They can include more detailed information than unemployment insurance tax records, including **education levels** and more detailed personal data that can be used for record matching. These records cover only those individuals who have applied for claims.

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For more information on the IES SLDS Grant Program or for support with system development, please visit http://nces.ed.gov/programs/SLDS.

State income tax

Income tax records from state departments of revenue contain wage data for most individuals who are employed or otherwise have a source of income. They also contain information about a person's **marital status**, **dependents**, and **address of residence**, including for individuals who work outside the state.

Federal Employment Data Exchange System (FEDES)

FEDES is a national data exchange combining employment information from the federal Office of Personnel Management, the U.S. Department of Defense, and the Defense Manpower Data Center. It provides data about **federal and military employees** that are not generally available from state agencies, but there are restrictions on how these data can be used and reported. For example, employment data from the U.S. Department of Defense can be used only for federal reporting purposes.

Wage Record Interchange System (WRIS and WRIS 2)

The U.S. Department of Labor's WRIS and WRIS 2 are multistate exchanges that allow sharing of unemployment insurance tax data for **out-of-state workers**, including individuals who have moved out of a state or who live in one state but work in another. Like FEDES, WRIS and WRIS 2 restrict the use of shared data to specific purposes. As of September 2016, the U.S. Department of Labor is planning an exchange program to replace WRIS 2 that will better align with WIOA's data-sharing requirements.

Common Employment Metrics

Following are some of the metrics commonly used by states to measure employment outcomes.

Employment rate and quarterly wages

Employment at a given time period is generally determined by the presence of quarterly wage data for an individual for that time. Quarterly wages are the amount of money earned by an individual during a three-month period. A threshold for wages earned may be necessary to determine whether an individual is considered employed for that quarter—low quarterly wages can indicate part-time or temporary employment.

Wages are often aggregated and averaged according to additional worker data such as age, gender, race or ethnicity, occupation, level of education attained, academic major, degree or credential type, cohort graduation year, or workforce program participation. This metric is used to estimate and compare earnings for workers with different characteristics.

If employment records show the number of hours worked during the quarter, earnings can also be reported as hourly wages.

Data elements

- **Quarterly wages**
- Cohort demographics of interest (e.g., **age**, **gender**, **race/ethnicity**, **major/program**, **credential type**)

Calculation and business rules

Calculations related to employment and quarterly wages can be performed for a predefined cohort of individuals to answer questions about workforce outcomes for different populations. Cohorts might include all workers, workers of a specific gender or race/ethnicity, high school graduates, postsecondary graduates, students who leave or drop out of school, workers with a specific credential, or other groups of interest to policymakers. Cohorts are defined for a period of time, such as individuals who graduated in a given year or workers who earned a credential within the past five years.

Because of the difficultly in collecting and matching employment data for the entire workforce, some states prefer terminology such as "percent of individuals matched to employment" rather than "employment rate." Regardless of the terms used, these calculations should be accompanied by a description of the data sources and their limitations.

With the addition of unemployment insurance tax data from multistate exchanges such as WRIS and WRIS 2, out-of-state workers can also be included in employment rate and wage calculations. Many states are interested in measuring continuous employment, often defined as full-time equivalent employment sustained over a given time period, possibly with the same employer. Additionally, postsecondary

In-state employment rate

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Number of cohort members with one or more state unemployment insurance tax records during a specified quarter

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Number of cohort members

In-state quarterly wages

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Sum of wages from all unemployment insurance tax records for every cohort member for a given quarter

*Quarterly wages are frequently reported as a **mean** (the sum of wages for all cohort members divided by the number of cohort members) or a **median** (the "midpoint" wage that is higher than wages for half of the cohort members and lower than wages for the other half).*

National continuous employment rate

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Number of cohort members with one or more in- or out-of-state unemployment insurance tax records for each quarter during a specified time period (optionally, with the same employer)

Number of cohort members

In-state annual wages

=

Sum of wages from all unemployment insurance tax records for every cohort member for the four quarters in a year

*Quarterly wages are frequently reported as a **mean** (the sum of wages for all cohort members divided by the number of cohort members) or a **median** (the "midpoint" wage that is higher than wages for half of the cohort members and lower than wages for the other half).*

institutions are often interested in their graduates' earnings and whether they remained within the state or moved out of state for additional education or employment.

Sustained wages in multiple sequential quarters

While quarterly wages offer a snapshot of employee earnings, combining wage data from multiple, sequential quarters provides more information about worker tenure and earnings over time. Comparing wages for sequential quarters shows workers who are consistently employed by the same employer and supports more accurate earnings estimates for short-term or seasonal work. Like wages in a single quarter, this metric can be calculated for different types of workers based on additional demographic data.

Data elements

- **Quarterly wages** for multiple sequential quarters
- Cohort demographics of interest (e.g., **age**, **gender**, **race/ethnicity**, **credential conferred**)

Calculation and business rules

The best practice for calculating wages over multiple quarters is to add actual wage data from sequential quarters rather than multiplying wages from a single quarter (see the box below on Calculating Annualized Wages).

Employment by industry

This metric shows the number of individuals employed in a given industry. It can be used to determine high-growth industries and labor market demand in a state. It can also be combined with median wage data and credentials information to show career paths and earnings for individuals with different types of degrees or academic majors. The metric generally requires a system of coding employers by industry, such as the North American Industry Classification System (NAICS). Most state unemployment insurance tax records include NAICS codes for the employer.

Note that employment by industry is not the same as employment "in field," which indicates whether or not individuals are employed in positions that align with their academic areas of study or credentials. Such a calculation would require additional information about the individuals' education and workforce training histories. It would also require more detailed occupational information, such as the U.S. Department of Labor's Standard Occupational Classification (SOC) system code, which are rarely included in state workforce records.

Data elements

- Industry classification (e.g., **Employer NAICS code**)

Calculating Annualized Wages

Although workforce data sources usually gather and report wage data by quarter, many employment outcomes stakeholders such as state lawmakers, students, and families will find it easier to understand metrics that report annual earnings. There are two general approaches to converting quarterly wage data into annual wages.

1. Sum quarterly wages for four sequential quarters

This calculation provides a more accurate estimate of annual wages, but it requires wage data for the same individuals for four consecutive quarters. This method is preferred when the necessary data are available. The time needed to gather these data and the challenge of linking records for the same individuals over time can affect the timeliness and comprehensiveness of the metric.

2. Multiply quarterly wages by four

This method is helpful for estimating annual wages when data are available for a single quarter or for non-sequential quarters. The calculation can be performed quickly, but it may not accurately reflect annual earnings for short-term workers or for industries where wages vary seasonally, such as retail and construction.

Calculation and business rules

The first two digits of a six-digit NAICS code correspond to broad economic sectors, with each subsequent digit corresponding to more detailed subsectors and industry categories. Employment by industry can be reported at different levels of detail by aggregating employment data according to either the more general two-digit code or the full six-digit code.

Employment by industry

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Distinct count of individuals with one or more unemployment insurance tax records with a given NAICS code during a specified time period

Employment by location

Presenting employment levels by location helps to highlight geographic factors and trends related to different industries or types of workers. This metric is very important for states using employment data to understand opportunities for economic development as well as the migration of their skilled or credentialed workforce. Among other uses, this metric can help illustrate the industries operating in different parts of the state, regions of high workforce demand or growth, proximity of education institutions and training programs, and distances between workers' residences and places of employment. Because location data available from unemployment insurance tax records usually refer to an employer's main office or headquarters, other data sources may be required to accurately determine workers' employment at field offices or other locations. In some situations, the location is merely the location of the place where the report is made, which could even be outside the state for a firm that operates in multiple states.

Data elements

- **Employer location**

Calculation and business rules

When aggregating employment and wage information by geographic region or by specific employer, care must be taken to protect individual privacy. Metrics for employers or regions with small numbers of employees should not be published to avoid the possibility of identifying employees. The U.S. Department of Labor restricts the reporting of employment and wage data when a single employer accounts for a large number of jobs in a region.

Employment by location

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Distinct count of individuals with one or more unemployment insurance tax records from employers located in a given geographic area during a specified time period

Handling Multiple Employment Records in the Same Time Period

Individuals who hold more than one job or who change jobs during a given time period can have multiple employment records for that period. Most earnings calculations will add together an individual's reported wages from all employers for a given time period. For metrics such as employment by industry, states often define a worker's primary industry or employer as the one for which the individual earns the highest wages or works the greatest number of hours during the specified period.

Employment while in school

This metric tracks outcomes for individuals who are working while also enrolled in high school or a postsecondary education program. It can give education and training programs helpful information about the needs of their students, who might be juggling full- or part-time employment alongside coursework. It can also provide context for employment or earnings calculations that are affected by some members of the cohort working part time or not at all due to being in school.

Metrics in Action: Outcomes for Community College Graduates

The Iowa Department of Education Division of Community Colleges and Workforce Preparation and Iowa Workforce Development work to calculate and report outcomes for Iowa community college graduates. Graduate information includes the type of degree earned and the Classification of Instructional Programs (CIP) code for their academic program. The state uses student data from the National Student Clearinghouse to identify graduates who go on to enroll in a four-year college or university. It compares these data to employment records to determine how many individuals are continuing their education and how many are entering the workforce with their community college credential.

For each cohort year, the state reports the total number of community college graduates, the number of those graduates who enroll in continuing postsecondary education within two years, the number who can be matched to employment records, and the number who cannot be matched either to continuing education or to employment records. The state also reports median wages for graduates who are employed, as well as the number of graduates who already held an associate's degree or higher before receiving their most recent credential.

Data elements

- **Quarterly wages**
- **Enrollment entry and exit dates**

Calculation and business rules

This metric requires matching employment records with education enrollment records for the same time period to identify individuals who are working and attending school at the same time. In addition to producing a count of individuals employed while in school, this metric can be combined with quarterly wage data to compare earnings for workers who are and are not enrolled in an education program.

High school graduate and/or dropout employment

Comparing workforce outcomes for students who completed high school to those who dropped out provides important information about the economic value of a high school degree. This metric requires linking high school enrollment data to employment and wage data. Its reliability can be significantly affected by how difficult it is to link K12 education to workforce records, which use different data elements to uniquely identify individuals.

A related metric is **employment by highest attainment**, which examines workforce outcomes for individuals with

Metrics in Action: Accounting for Enrollment

The record-matching processes that allow states to calculate employment metrics for individuals who are in school can also be used to separate them from a broader cohort of workers. Kentucky typically excludes individuals who are enrolled in postsecondary programs from its employment outcomes reports because lower wages for students working limited hours can skew employment rates or average earnings for a larger group.

When reporting employment and wages for a cohort of graduates, Kentucky uses the federal fiscal year beginning October 1 rather than the July 1 fiscal year defined by many education institutions. Starting the reporting period in October accounts for the fact that many graduates spend the weeks or months after graduation in May looking for full-time employment in their fields. This timeline helps ensure that employment metrics for the first quarter or first year after graduation more accurately reflect outcomes for graduates once they have started their careers.

Metrics in Action: The Impact of Attendance in High School on Wages

In analyzing employment data for its public high school graduates, Kentucky found that although individuals who do not attend college generally face lower wages and limited employment opportunities, better daily attendance in high school is related to better outcomes. Among high school graduates who did not attend college, those with fewer than five unexcused absences during their senior year earned higher wages and were more likely to earn at or above full-time minimum wage than their counterparts with more absences.[1]

Workforce outcomes for high school graduates, one, two, and three years after graduation

	One Year After Graduation (Class of 2011-12)		Two Years After Graduation (Class of 2010-11)		Three Years After Graduation (Class of 2009-10)	
Senior Year Attendance	Average Annual Wages	Percent Earning at or Above Full-Time Minimum Wage	Average Annual Wages	Percent Earning at or Above Full-Time Minimum Wage	Average Annual Wages	Percent Earning at or Above Full-Time Minimum Wage
Fewer than 5 unexcused absences	$8,494	20.5	$11,138	34.4	$12,742	41.7
5–9 unexcused absences	$7,753	18.2	$10,550	30.7	$11,641	38.5
10–14 unexcused absences	$7,535	16.2	$9,086	26.4	$11,096	34.3
15–19 unexcused absences	$6,190	12.4	$7,555	22.9	$8,796	29.9
20 or more unexcused absences	$5,817	10.1	$7,175	19.8	$9,650	29.7

[1] McGrew, C. (2014). *No College = Low Wages*. Frankfort, KY: Kentucky Center for Education and Workforce Statistics. Retrieved September 14, 2016, from *https://kcews.ky.gov/Reports/NoCollegeLowWagesJuly2014.pdf*.

different levels of education. Employment rates and median wages can be aggregated for groups of workers based on the highest level of education they completed to demonstrate the value of different degree types.

Data elements

- **Quarterly wages**
- **Cohort graduation year**
- **Enrollment exit date**
- **Exit reason**
- **Credential type**
- **Diploma or credential award date**
- Enrollment in program types of interest (e.g., **career and technical education**, **Advanced Placement**, **dual credit**)

Calculation and business rules

There are a number of ways to define cohorts for this metric depending on the data available. For example, if schools do not indicate a student has dropped out using **exit reason** or a similar data element, dropouts might be defined by a combination of high school entry and exit dates and the absence of a credential awarded. Data from additional sources or cohorts might be needed to identify students who re-enroll in high school later or complete high school equivalency programs.

Additionally, several years of data for each cohort are required to capture different education credentials—such as associate's, bachelor's, and advanced degrees—as well as employment trends.

Full-time or part-time employment

Distinguishing between full-time and part-time workers helps provide context for discussions of gainful employment, estimated earnings, and employment opportunities available. Calculating this metric requires a threshold for number of hours worked or other criteria that define full- and part-time employment. Very few states collect hours of employment in unemployment insurance tax records, so most must develop a method of estimating full- or part-time employment.

Data elements

- **Employment in multiple sequential quarters**
- **Quarterly wages**

Calculation and business rules

Many states use a minimum earnings threshold—such as the amount of money earned by someone working full time at minimum wage—to determine which workers are likely to be employed full time. Some states estimate full-time employment using a combination of wage thresholds and employment for multiple quarters of the year.

In-state full-time equivalent employment

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Number of cohort members with one or more unemployment insurance tax records during a specified quarter whose combined wages are equal to or greater than full-time minimum wages for the same period

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Number of cohort members

In-state full-time equivalent quarterly wages

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Sum of wages from all unemployment insurance tax records for a given quarter for a cohort member whose wages are equal to or greater than full-time minimum wage for the same period

*Quarterly wages are frequently reported as a **mean** (the sum of wages for all cohort members divided by the number of cohort members) or a **median** (the "midpoint" wage that is higher than wages for half of the cohort members and lower than wages for the other half).*

In-state full-time equivalent annual wages

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Sum of wages from all unemployment insurance tax records for the four quarters of a year for a cohort member whose wages are equal to or greater than full-time minimum wage for the same period

*Quarterly wages are frequently reported as a **mean** (the sum of wages for all cohort members divided by the number of cohort members) or a **median** (the "midpoint" wage that is higher than wages for half of the cohort members and lower than wages for the other half).*

Developing Metrics Across States

Many states are developing and calculating employment metrics in order to answer similar questions about their workforce and the education and training systems supporting workers. Members of the SLDS Data Linking Workgroup's subgroup on Employment Outcome Indicators—who include representatives from state education, labor, and data management agencies involved in cross-agency data analysis—have identified four common policy questions that states can answer using employment metrics.

What percentage of postsecondary or program completers are employed in the state?

Answering this question provides states with an idea of how many individuals who complete postsecondary degrees or

workforce training programs go on to hold jobs in the state. This metric can help determine the added value of the state's publicly funded education and training programs by showing the number of graduates participating in the state's economy. In combination with other data, it can also inform evaluations of how well schools and programs prepare students for the workforce and whether the state might be experiencing a "brain drain"—qualified workers leaving the state.

What are the employment rates of secondary and postsecondary or program completers six months after completion?
This question examines the number of high school and postsecondary graduates who enter the workforce within six months after graduation. It can help states evaluate how well its schools and training programs prepare individuals to find employment, as well as set up comparisons of employment rates between cohorts with different levels of education or training.

What are the average earnings two, five, and ten years after graduation for completers by program?
This question enables a long-term analysis of employment outcomes for individuals who have completed different types of degrees or credentials. Answers to this question are particularly useful for students and workers interested in the return on investment for education and training programs related to their careers.

What is the value add for secondary and postsecondary or program education and training programs?
States can take a number of approaches to answering this question depending on the outcomes and programs of interest. The value of a diploma, degree program, industry credential, or training program is often measured in terms of employment rates and earnings among the individuals who completed them. With appropriate data, states can conduct more detailed analyses comparing outcomes for different demographic groups, individuals with different levels of education or qualifications, and different timeframes.

These four questions are designed to capture information frequently needed by education and workforce program leaders to evaluate the effectiveness of their programs. Answers to the questions are also of interest to students, workers, and families who are making decisions about degree and credential programs that will help them meet career goals. If calculated consistently across states, the answers to these questions can also provide policymakers, program leaders, and citizens with better information about national trends in employment outcomes and opportunities.

More detailed information about the data elements and calculations for these metrics is available in the Common Education Data Standards (CEDS) Connect tool (*https://ceds.ed.gov/connect.aspx*).

Continuing Challenges and Considerations for Employment Metrics

As states increasingly link education and workforce data in ways that allow them to answer vital questions about education and workforce outcomes, they will continue to develop solutions to data linking challenges and new approaches to using the data. Following are examples of ongoing challenges to effective employment and earnings metrics as well as areas for future data work.

Employment outcomes for individuals without postsecondary education records
Due to differences in the data used to identify individuals across education and workforce data sources, it is more difficult to match K12 education and employment records than it is to match postsecondary education and employment records. Many states do not or may be legally prevented from collecting Social Security numbers as part of their K12 student records. Social Security numbers are the primary identifiers used by workforce programs. Many states are developing methods to link K12 and employment records using intermediate data sources—such as driver's license records that contain an individual's name, date of birth, and gender as well as Social Security number. Gaps in the records available and a lack of matching data elements affect the completeness of employment information and the confidence with which conclusions can be drawn from that information.

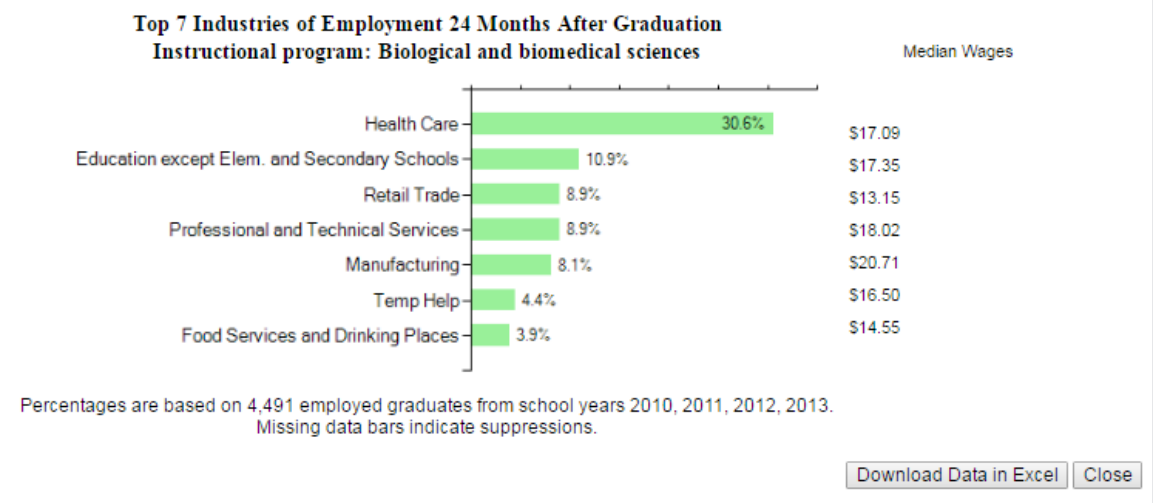
Examining longitudinal metrics
The great benefit of longitudinal data records is the ability to examine outcomes over time. Once states have established several years of longitudinal education and employment data, it is possible to observe trends and changes in many of the metrics outlined in this brief. For example, median wages for workers in different industries often grow at different rates as their careers progress. Relatively high wages for entry-level workers in one industry might level off or fall behind wages in other industries as the workers become more experienced, and vice versa. Long-term data can also help illustrate the relative effect of credentials such as degrees or certifications on employment and earnings as compared to years of experience.

Defining additional metrics
With more robust and comprehensive data systems that draw data from a variety of sources, states can begin to answer more sophisticated questions about education and workforce outcomes. As interest and demand for this information grows, states are exploring how to calculate metrics that involve data that were not previously connected.

For example, measuring employment "in field" would provide education and workforce programs with valuable

Metrics in Action: Industries of Employment and Earnings by Instructional Program

Minnesota uses two- and four-digit Classifications of Instructional Programs (CIP) codes to classify postsecondary graduates by their area of study. It then determines the top seven industries of employment for workers in that CIP code and reports the proportion of graduates working in each of those industries, along with the median hourly wages associated with each industry.



Minnesota's interactive graduate employment outcomes reports display information about top industries of employment and average wages for postsecondary graduates based on their areas of study.

Hourly Wage Trend | Annual Wage and Employment | Employment Status

You Selected: July 2010-June 2011, Minnesota Statewide, All Institution Types, All Schools, All Awards Download These Results in Excel

		1 Year After Graduation		2 Years			4 Years	5 Years
CIP	Instructional Program	Graduates	Median Hourly Wage	Median Hourly Wage	Top Industry Of Employment	Top Region Of Employment	Median Hourly Wage	Median Hourly Wage
26	Biological and biomedical sciences	2,291	$15.15	$16.46	Health Care	Twin Cities	$21.50	N/A**
26.01	Biology, General	1,533	$14.57	$15.83	Health Care	Twin Cities	$20.91	N/A**
26.02	Biochemistry, Biophysics and Molecular Biology	215	$15.55	$16.71	Health Care	Twin Cities	$21.00	N/A**

information about the number and wages of individuals who are employed in a job that aligns with their credentials or areas of academic study. Such a calculation requires a means of connecting individuals' employment, industry, and occupational data with data about academic programs of study, such as the U.S. Department of Education's Classifications of Instructional Programs (CIP) codes. Once those connections are developed, the metric can be used to gauge the effectiveness and return on investment for education and workforce training programs designed to prepare workers for a specific occupation or industry.

Adjusting for inflation

When calculating wage-related metrics over time or comparing metrics from different years, it may be necessary to adjust monetary amounts for inflation to ensure accurate comparisons. Designate a consistent method for adjusting historical data for inflation—such as using an inflation calculator based on the Consumer Price Index—and indicate that method in reports and products generated from the data.

Additional Resources

Classification of Instructional Programs (CIP) User Site, U.S. Department of Education, National Center for Education Statistics
https://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55

Common Education Data Standards (CEDS) Connect
https://ceds.ed.gov/connect.aspx
Search the keyword "employ" for links to Connections addressing the four employment outcomes policy questions mentioned in this brief.

Employment Outcome Indicators: SLDS Webinar
https://slds.grads360.org/#communities/pdc/documents/9944

Federal Employment Data Exchange System (FEDES)
http://www.ubalt.edu/jfi/fedes/

Kentucky Center for Education and Workforce Statistics
https://kcews.ky.gov/

Minnesota Employment and Economic Development Data Tools: Graduate Employment Outcomes
http://mn.gov/deed/data/data-tools/graduate-employment-outcomes/

North American Industry Classification System (NAICS), U.S. Census Bureau
http://www.census.gov/eos/www/naics/

Sources and Linking Strategies for Employment Data: SLDS Issue Brief
https://slds.grads360.org/#communities/pdc/documents/11943

Standard Occupational Classification (SOC), U.S. Department of Labor, Bureau of Labor Statistics
http://www.bls.gov/soc/

Wage Record Interchange System (WRIS)
https://www.doleta.gov/performance/wris.cfm