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Health Training Pathways at California's Community Colleges

Technical Appendices

CONTENTS

Appendix A: Data Sources and Sample Construction	2
Appendix B: Analysis of Student Outcomes	4
Appendix C: Analysis of Wage Returns	10

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Appendix A: Data Sources and Sample Construction

Data Sources

The data used in this report come from the California Community College Chancellor's Office (CCCCO). The Chancellor's Office Management Information System (COMIS) is longitudinal dataset that includes information on all students enrolled in colleges across the California Community College system. This dataset includes detailed information on student characteristics, including demographics, measures of economic and academic disadvantage, and disability, along with course enrollment, financial aid receipt, and award completion. We have these records for all students between the fall term of 1993 and the spring term of 2015.

Additionally, the data system has information on each course (title, credit status, transfer status, basic skills status, and subject) and award that a student completes. All courses and awards include information that designates a specific field of study called a Taxonomy of Program (TOP) code. The TOP system of numerical codes is used to collect and report information on programs and courses in different colleges throughout the state that have similar outcomes. The TOP codes were designed to aggregate information about programs and all courses and awards are coded with a 6-digit TOP code. We use TOP codes to identify health awards, a 2-digit TOP code of "12" indicates a health award, and we use 6-digit TOP codes to identify more specific health programs, such as medical assisting, licensed vocational nursing, or registered nursing.

The analysis of labor market returns relies on administrative wage data from the state's Unemployment Insurance (UI) system that is merged with student records from the COMIS data files. Data from the UI system include quarterly wage records and industrial sector of employment defined by 6-digit NAICS codes. Only jobs that are covered by UI are included in these official wage data; that excludes self-employed, contract, seasonal, and informal work, as well as military employment. We have UI records from the first quarter of 2000 through the fourth quarter of 2014. Students with employment in a covered industry in California have a record that includes the total of wages earned in the quarter for each covered industry in which any wages were earned.

Sample Construction

The basic criteria for being included in our analysis requires that a student have enrollment records sometime during the primary study time period, which includes school years 1999/2000 through 2014/2015 and also have an SSN recorded for their student ID. Unique student identifiers are not maintained across the entire CCCCCO system, only within individual colleges. Fortunately, the COMIS data provides a pseudo-SSN (scrambled and de-identified) that can be used to link students across multiple colleges so that we can track enrollment across the entire CCC system. Because we are interested in potential career pathways, we want to ensure that we capture enrollment and awards students may complete across multiple community colleges campuses. Thus we exclude students who do not have a valid SSN match. For our sample period, this exclusion criteria results in about 13% of records with any enrollment being dropped from our sample.

To investigate pathways in health fields, we start with a sample of students who earned their first observed health award sometime between fall term 1999 and summer term 2010. We follow students for six years—measured as 24 terms including winter and summer terms—starting the term after their complete their first health award to see whether those students go on to earn another health degree. While some students do earn additional degrees outside of a health field—we focus our examination of pathways only on health awards. We exclude students who transfer to a four year college after the completion of their first health award because beyond observing them transfer, we have no other information regarding their enrollment or degree completion.

We classify all awards into three categories—short-term certificates, long-term certificates, and associate degrees. Short-term and long-term certificate groups are based on the length of time, measured in terms of units and assuming full-time course loads, it takes to complete the degrees. Short-term degrees take less than 1 year to complete and include certificates requiring less than 30 units to complete. Long-term degrees are defined as those requiring between 1 and 2 years to complete and include certificates requiring 60 or more units and those requiring 30-59 units. Associate degrees can be either associate of art or science and typically take 2 or more years to complete.

Defining Health Training Pathways

While there is no set definition of what constitutes a career pathway or stackable degree, we operationalize stacking credentials as earning a higher-level subsequent degree within six years of completing a first award. So this would include students who complete a short-term health certificate and go on to earn either a long-term certificate or associate degree in a health field or those who first earn a long-term certificate and then complete an associate degree.

In about 15 percent of cases, we observe students completing two health awards on the same date or within the same term. Most often these awards are also completed in the same program i.e. a student earns a long-term certificate and an associate degree both in registered nursing (based on award TOP code). Because the two awards are completed concurrently or within such a short period of time, we do not consider this an instance of stacking credentials. In these cases, we assign the student the highest level award completed and use other subsequent awards, if any, to identify degree stacking.

We also examine course enrollments—both prior to completing a first health award and after the initial award to identify which students seem to return to the community college system in pursuit of an additional health degree. Students who complete 2 or more units in any health program in the three years following their first health degree are flagged in the group we consider to be pursuing another health award, possibly along a career pathway. Among students who do pursue another award by enrolling and earning additional units in health programs, we determine whether they finished another health award within six years—and because we are interested in stacking credentials along a pathway—we require a subsequent health award(s) to be a higher level award from the first in order for the student to be identified as successfully completing a health pathway. We exclude any students who we observe completing subsequent health awards without completing any additional course work within the community college system and also exclude those that complete a subsequent health award more than six years after their first.

Finally, to focus more explicitly on pathways that offer a clear progression of skills linked to successive credentials and certification, we go beyond just the level of first and subsequent health awards and focus on the specific health programs in which students complete awards. Due to the large number of different possible combinations and degrees available in health programs across the community college system, we identify the most common specific combinations of award levels and programs that we observe students completing. To do this, we first looked across all students who earned a short- or long-term credential as their first award and went on to earn a higher level health degree within six years of the first. This led to the identification of the four most common starting points on a pathway that we use in our analysis of pathway completion.

Common Variable Definitions

We use a number of variables—some of which we construct and others that are defined and created by the CCCC— to assess the socioeconomic and course-taking characteristics of health CTE students. Definitions are provided for in Table A1.

TABLE A1

Definition of key variables used in analysis of student outcomes

Variable name	Definition
Disabled	Derived data element constructed by CCCCCO, indicates whether a student was ever reported with a primary disability during their academic career. Primary disabilities include mobility, visual, hearing, or speech impairment; intellectual, learning, or mental health disability; brain injury, ADHD, autism spectrum or other.
Limited English Proficiency	Derived data element constructed by CCCCCO, indicates a student was either enrolled at some time in their academic career in a basic skills English as Second Language (ESL) course or was identified as needing ESL services.
Academically Disadvantaged	Derived data element constructed by CCCCCO, indicates student had enrollment or been flagged as needing basic skills instruction or was reported on academic probation or dismissal at least once in their academic career.
Low-income	Identified as receiving CalWORKs assistance or a Pell Grant at least one term during their academic career.
Economically Disadvantaged	Composite variable indicating whether student had ever been identified as receiving CalWORKs or other cash assistance (SSI or GA), received Pell Grants, or been categorized as economically disadvantaged for the purposes of colleges receiving VTEA funds.
Took basic skills course in 3 year prior to 1 st health degree	Completed a course classified as basic skills in at least one term in the three years prior to completing 1 st health degree
GPA a in 3 year prior to 1 st health degree	Average GPA across all terms in the three years prior to earning 1 st health degree.
Ever took full-time course load after 1 st health degree	Completed at least 12 semester units in at least one term after completion of the first health degree

SOURCE: California Community College Chancellor's Office Management Information Systems Data Mart, Data Element Dictionary. Accessible at <http://extranet.cccco.edu/Divisions/TechResearchInfoSys/MIS/DED.aspx>

Appendix B: Analysis of Student Outcomes

Completion of Health Training Pathways

To examine differences in the successful completion of health training pathways, we estimate linear probability models that control for individual student-level characteristics including course-taking behaviors and financial aid receipt. The dependent variable is a dichotomous variable that indicates whether a student who attempted a health pathway—as measured by completion of additional health units within three years of earning their first health award—successfully earned a subsequent higher-level health award in a different health program within six years. We include year and college dummy variables in all models to adjust for differences beyond those covariates that are already included.

We restrict this analysis to students who completed their first observed health award in one of the four most common programs in which students begin health training pathways; these include short-term MA, CNA, and EMS certificates and long-term LVN certificates. A student is identified as completing a training pathway if they complete a higher-level health degree in a different health program within six years of that first award. We drop students who transfer to a four-year college after completing their first health award and also those who had missing values for any of the covariates. We also exclude students who were younger than 18 or older than 54 at the time they completed their first health award.

Table B1 provides summary statistics for three groups of students: those who completed any short-term or long-term certificate as their first health award during our sample period, students who completed one of the four short-term or long-term certificates in the most common pathways as their first health award, and the students included in the sample we use to analyze health pathway completion. Overall, the different groups have similar characteristics, although a higher share of women are in our analytic sample relative to the broader group of students who complete short- or long-term awards. In addition, students who complete an EMS certificate as their first health award are under-represented in our analytic sample relative to their share of all students, while those completing CNA or MA certificates as their first award are over-represented.

TABLE B1
Summary statistics, completion model sample

	All students completing short- or long-term first health degrees	All students completing short- or long-term first awards in most common health pathways	Students attempting most common health pathways (analytic sample)
Stacker Group			
One and done (no subsequent health units)	67.1%	59.4%	n/a
Attempted pathway, do not complete higher-level health award	12.5%	14.9%	51.9
Completed pathway	8.8%	12.8%	48.1
Other (complete subsequent award of same level or in same program)	11.5%	12.9%	n/a
Demographics			
Female (%)	65.0%	60.4%	71.2%
Age at 1 st health degree (mean)	30.6	29.2	29.0
Race/ethnicity			
Non-Hispanic white	49.4%	53.0%	49.5%
Latino	23.7%	24.3%	25.1%
African-American	7.2%	6.7%	6.1%
Asian Pacific Islander	18.4%	14.3%	17.7%
Other	1.3%	1.6%	1.7%
Education level at 1st health degree			
No high school diploma	3.4%	3.8%	2.9%
High school diploma	64.0%	67.4%	68.2%
GED/Other diploma	12.8%	11.4%	12.4%
Associate degree	8.2%	6.7%	7.6%
Bachelor degree or higher	10.7%	9.2%	8.9%
Markers of Disadvantage			
Disabled	7.2	7.5	10.9%
Limited English	8.0%	5.8%	6.1%
Academically Disadvantaged	60.8%	60.2%	64.8%
Ever received CalWORKs	5.7%	5.8%	6.0%
Ever received Pell Grant	35.3%	34.6%	44.3%
Course-taking behavior			

	All students completing short- or long-term first health degrees	All students completing short- or long-term first awards in most common health pathways	Students attempting most common health pathways (analytic sample)
Took basic skills course in 3 year prior to 1 st health award	40.7%	37.9%	43.7%
GPA a in 3 year prior to 1 st health award (mean)	2.5	2.1	2.6
Ever took full-time course load after 1 st health award	51.4%	52.8%	74.9%
Received financial aid at least one term after 1 st health award	36.5%	39.7%	55.0%
Received financial aid majority of terms enrolled after 1 st health award	21.1%	21.5%	31.8%
First award type			
1 st health award – short-term certificate in CNA	9.8%	17.7%	23.6%
1 st health award – short-term certificate in MA	6.6%	11.9%	18.0%
1 st health award – short-term certificate in EMS	26.7%	48.4%	31.3%
1 st health award – long-term certificate in LVN	12.1%	22.0%	27.1%
Year			
Year – complete 1 st health award - 2000	7.7%	7.5%	5.3%
Year – complete 1 st health award - 2001	7.8%	7.7%	6.9%
Year – complete 1 st health award - 2002	8.9%	8.7%	7.1%
Year – complete 1 st health award - 2003	10.0%	10.9%	9.5%
Year – complete 1 st health award - 2004	10.8%	11.4%	11.0%
Year – complete 1 st health award - 2005	11.3%	11.6%	10.6%
Year – complete 1 st health award - 2006	11.2%	11.3%	12.6%
Year – complete 1 st health award - 2007	10.3%	9.6%	11.8%
Year – complete 1 st health award - 2008	10.4%	10.2%	13.1%
Year – complete 1 st health award - 2009	11.5%	11.1%	12.1%
Sample Size	43448	23,936	5,756

SOURCES: Author calculations from COMIS data.

NOTES: Restricted to students who completed their first observed short- or long-term health award between 2000 and 2009. Students are categorized in the 'one and done' category if they did not complete any additional units in health courses within three years of earning their first health award. These students can complete additional units in non-health courses after their first health award. The second column is limited to students who completed either a short-term CNA, MA, EMS degree or a long-term LVN degree as their first health award. The third column is restricted to students who attempted a health pathway by completing one of the four common first degrees and completed additional units in health courses after earning their first health award. We also restrict our analytic sample to students aged 18 – 54 at the time of their first health award. Students who earned a second health degree, but not in a higher-level award category than their first are excluded from our analytic sample.

Table B2 includes full results from the linear probability regression models. Model 1 is the main model we use in the report to describe successful completion of a health training pathway. The additional model results include some slight modifications to variables capturing financial aid receipt and enrollments. The differences across the model specifications do not change the outcomes of our findings in terms of the most important factors driving pathway completion.

TABLE B2

Linear probability model for students attempting most common health pathways

Dependent variable: Complete health pathway	Model 1	Model 2	Model 3
Female	0.0924***	0.0920***	0.0926***
Age at 1 st health degree	-0.00157*	-0.00188**	-0.000137
Race/ethnicity (reference category is White)			
Latino	-0.0396**	-0.0372**	-0.0302**
African-American	-0.0596***	-0.0638***	-0.0524**
Asian Pacific Islander	0.0347**	0.0350**	0.0296**
Other	-0.0729*	-0.0721*	-0.101**
Education level at 1st health degree (reference category is HS diploma)			
No high school diploma	-0.0512**	-0.0475*	-0.0390
GED/Other diploma	-0.0159	-0.0179	-0.0146
Associate degree	0.0655***	0.0684***	0.0701***
Bachelor degree or higher	-0.00271	6.60e-05	0.00915
Markers of Disadvantage			
Disabled	-0.0470**	-0.0462**	-0.0592***
Limited English	-0.0311	-0.0332	-0.0235
Academically Disadvantaged	-0.0525***	-0.0513***	-0.0408***
Ever CalWORKs	-0.0537**	-0.0531**	-0.0576***
Ever Pell Grant	0.0134	0.0179	0.00279
Course-taking behavior			
Took basic skills course in 3 year prior to 1 st health award	-0.0129	-0.0129	-0.0186
GPA a in 3 year prior to 1 st health award	0.0509***	0.0511***	0.0432***
Ever took full-time course load after 1 st health award	0.263***	0.265***	
Number of terms attended full-time after 1 st health award			0.111***
Received financial aid at least one term after 1 st health award	0.0388*		0.0148
Received financial aid majority of terms after 1 st health award		0.0342	
Award type (reference category is EMS)			
1 st health degree – short-term certificate in CNA	0.363***	0.360***	0.314***
1 st health degree – short-term certificate in MA	0.374***	0.375***	0.386***
1 st health degree – long-term certificate in LVN	0.221**	0.218**	0.290***
Year fixed effects	X	X	X
College fixed effects	X	X	X
Constant	0.0262	0.0416	-0.0107
Observations	5,756	5,761	5,756
R-squared	0.363	0.363	0.430

SOURCE: Author calculations from COMIS data.

NOTES: Standard errors available upon request. *** p<0.01, ** p<0.05, * p<0.1.

We also include additional sample characteristics across student groups of interest including racial/ethnic groups, low-income status, and academic disadvantage for our analytic sample (Table B3).

TABLE B3

Sample means for student groups of interest

	White	Hispanic	Black	Asian	Low-Income	Not Low-Income	Academically disadvantaged	Not academically disadvantaged
Sample size	2847	329	1446	1017	2595	3166	3734	2027
Complete Pathway	48.1%	41.5%	44.7%	56.1%	53.4%	43.5%	45.5%	52.6%
Race/Ethnicity								
White	1	0	0	0	40.7%	56.6%	44.3%	58.9%
Hispanic	0	1	0	0	32.0%	19.4%	29.0%	18.0%
Black	0	0	1	0	8.7%	3.9%	7.4%	3.7%
Asian	0	0	0	1	16.9%	18.3%	17.5%	18.0%
Other	0	0	0	0	1.7%	1.7%	1.8%	1.4%
Other demographics								
Female	67.8%	82.8%	73.2%	73.3%	82.0%	62.3%	73.0%	67.7%
Age at first health degree	29.1	31.7	27.7	29.8	29.0	29.0	28.8	29.3
Education level, before first health award								
High School dropout	2.8%	3.4%	3.7%	1.7%	2.9%	2.8%	3.2%	2.2%
GED	9.3%	18.6%	12.3%	19.2%	70.0%	66.7%	69.3%	66.2%
High School diploma	71.9%	64.2%	72.8%	52.7%	15.5%	9.9%	14.8%	8.0%
Associates degree	7.1%	7.7%	6.6%	10.3%	8.8%	6.7%	7.6%	7.9%
Bachelor's degree	8.9%	6.0%	4.6%	16.1%	2.8%	13.9%	5.2%	15.6%
Markers of disadvantage								
Disabled	9.8%	19.8%	12.4%	8.1%	13.3%	8.8%	10.4%	11.8%
Limited English Proficient	1.5%	5.2%	8.9%	15.6%	7.5%	4.9%	8.0%	2.5%
Academic Disadvantage	58.2%	78.8%	74.8%	64.1%	76.2%	55.5%	100.0%	0.0%

	White	Hispanic	Black	Asian	Low-Income	Not Low-Income	Academically disadvantaged	Not academically disadvantaged
Ever CalWORKs	4.7%	17.5%	7.5%	3.4%	13.6%	0.0%	8.2%	2.3%
Ever Pell Grant	36.6%	62.5%	56.6%	42.5%	98.2%	0.0%	52.0%	30.0%
Course taking behavior								
Took basic skills course in 3 year prior to 1 st health award	37.5%	48.4%	50.4%	50.4%	53.2%	35.8%	54.7%	23.3%
GPA a in 3 year prior to 1 st health award	2.6	2.5	2.5	2.8	2.7	2.5	2.5	2.6
Ever took full-time course load after 1 st health award	73.7%	78.5%	75.7%	76.7%	83.1%	68.2%	77.3%	70.5%
Received financial aid at least one term after 1 st health award	51.1%	65.3%	63.2%	50.1%	81.4%	33.1%	59.4%	46.5%
Received financial majority of terms after 1 st health award	27.3%	45.6%	38.1%	30.8%	55.3%	12.4%	35.1%	25.7%
1st award in pathway								
1st health degree – short-term certificate in CNA	19.4%	32.7%	28.0%	26.0%	27.2%	20.6%	25.4%	20.1%
1st health degree – short-term certificate in MA	16.0%	21.2%	18.3%	22.5%	20.4%	16.3%	16.5%	21.3%
1st health degree – short-term certificate in EMS	42.0%	15.8%	26.1%	13.5%	17.8%	42.3%	28.2%	36.8%
1st health degree – long-term certificate in LVN	22.6%	30.4%	27.6%	38.1%	34.6%	20.8%	29.9%	21.8%

SOURCE: Author calculations from COMIS data.

Appendix C: Analysis of Wage Returns

Our analysis of the return to health credentials utilizes statistical models that relate wages outcomes to student and program characteristics and the timing of credential receipt. The labor market return to credentials can be summarized simply using an ordinary least squares regression. However, as is well-understood in the research literature, these simple correlations are likely biased upwards if high ability individuals are more likely to pursue and complete higher education credentials. To address these concerns, we use student fixed effect models. Because CTE students tend to be older and have relatively long pre-enrollment wage history, their earnings before entering CTE study provide perhaps the best control for unobserved ability. We thus measure the labor market return to credentials relative to a student’s own average wage (simple fixed effect). Theoretically, these student-level controls account for many unobserved, idiosyncratic factors potentially correlated with labor market outcomes. The student fixed effects also subsume any characteristics that do not vary over time, such as race, economic status, prior education level, program choice, region (for most students, who do not move).

Relying on pre-enrollment earnings to control for individual ability is still potentially misleading if entry into CTE is motivated by a dip in earnings. This endogeneity problem could produce overestimated returns to CTE credentials even after controlling for student ability. Following Stevens et al (2015), our prior work (Bohn et al 2016) constructed various control groups of students who based on course taking patterns appear to be “CTE-intending”. We found that models using student fixed effects only and those that employ fixed effects and this control group yielded almost identical results. Because our focus in the present paper is on returns to multiple health awards and relatively few students obtain multiple awards, we opt to not include a control group in this analysis, since it imposes some sample restrictions. However, students who earn only one award serve as a control for those who earn 2 or more. As the report explains, some students never return (in the data we observe) after completing their first health award; others re-enroll but never complete a subsequent credential.

Our regression model thus uses the sample of students who earned a health CTE award between 2003-2009. Although we could observe award attainment as early as the 1990s and as late as 2014, we only have wage data from 2000-2014, and need to observe a wage history substantial enough to reliably estimate returns. The sample is also restricted to students age 18-54 at the time of their first award. We test the robustness of our results to these choices, and find no substantive differences. The baseline specification of our regression model is as follows:

$$\ln(\text{wage}_{it}) = \alpha_i + \gamma_t + \beta \text{Enrolled}_{it} + \sum_k \delta_k \text{Postaward}k_{it} + \sum_j \varphi_j (\text{Age} = j)_{it} + \varepsilon_{it}$$

where subscript *i* denotes individual and *t* denotes quarter, as our wage data is given at the quarter level (school terms are matched to calendar quarters). The logarithm of quarterly wages is the dependent variable, and δ is the coefficient of interest, measuring the percent change in quarterly wages due to credential receipt. *Postawardk* is an indicator that becomes 1 in every quarter after the student receives the *k*th credential. Some students obtain multiple credentials in a single quarter, but we utilize only the “highest” credential obtained each quarter, based on length of program. The presence of multiple post-award indicators in a single model means that each indicator beyond the first measures the wage return for a second, third, and so on, award above and beyond the first. Student-level fixed effects are captured in α , and time effects in γ . These fixed effects imply that wage returns should be interpreted as “within-student”, meaning that the post-award indicator identifies the wage gain to an award relative to a student’s own trajectory. Indicator variables for age at term *t* control for age-earnings profile. *Enrolled* is an indicator variable for whether student *i* is enrolled in term *t*, controlling for depressed wages while in school. This baseline model closely follows the specification in Stevens et al. (2015) and Bohn et al. (2016).

Although this model controls for student and period fixed effects, to further highlight the variation across health CTE credentials and to ensure that results are not driven by select subgroups of students or programs, we adjust our model specification in two ways. We first split the coefficient δ according to credential type or program. We also run our baseline model separately according to student, program, or award characteristics.

We first present summary statistics for our baseline student sample used in these wage analyses. We have about 54,000 students in the sample, of which 88% complete only one award. On average, students have 16 quarters of wage data before earning an award, and 27 quarters after. This gives us a relatively long pre- and post-treatment window in which to observe changes in wages as a result of schooling. The about one-fifth of the sample is younger than 25, though there are substantial samples of older students as well. Students who earn one vs two or more awards vary systemically across the type of award obtained initially, naturally, and those who earn multiple awards tend to be younger, but the groups are not substantially different in terms of racial composition or when they entered community college.

TABLE C1
Summary statistics, student sample for wage regressions

	Number of Students				Distribution (%)			
	Total	One Award	Two Award	Three Award	Total	One Award	Two Award	Three Award
Total students	54243	47689	5512	886	100	87.9	10.2	1.6
Award type of First Award								
Associates	30022	28551	1397	71	55.3	59.9	25.3	8.0
Long term certificate	11140	9344	1606	178	20.5	19.6	29.1	20.1
Short term certificate	13081	9794	2509	637	24.1	20.5	45.5	71.9
					100	100	100	100
Award type of Second Award								
Associates	3686	NA	3311	357	56.2	NA	60.1	40.3
Long term certificate	1197	NA	926	237	18.3	NA	16.8	26.7
Short term certificate	1671	NA	1275	292	25.5	NA	23.1	33.0
					100		100	100
Award type of Third Award								
Associates	586	NA	NA	547	56.2	NA	NA	61.7
Long term certificate	135	NA	NA	110	13.0	NA	NA	12.4
Short term certificate	321	NA	NA	229	30.8	NA	NA	25.8
					100			100
Quarters in sample (average)								
Quarters employed before first award	15.8	16.1	13.9	12.9				
Quarters employed after first award	27.3	27.3	27.1	27.4				
Quarters enrolled after first award	3.0	2.4	6.4	9.2				
Median Wages								
Before first award	6208	6262	5714	6059				
After first award/before second	16640	16913	7935	5978				
After second award/before third	15494		15874	8163				
After third	15416			15866				

	Number of Students				Distribution (%)			
	Total	One Award	Two Award	Three Award	Total	One Award	Two Award	Three Award
Year of First Award								
2003	6769	5779	784	168	12.5	12.1	14.2	19.0
2004	7533	6461	864	166	13.9	13.5	15.7	18.7
2005	7904	6863	882	130	14.6	14.4	16.0	14.7
2006	7777	6839	827	97	14.3	14.3	15.0	10.9
2007	7924	7076	725	112	14.6	14.8	13.2	12.6
2008	8274	7367	777	118	15.3	15.4	14.1	13.3
2009	8062	7304	653	95	14.9	15.3	11.8	10.7
Age at start								
18-25	10969	9100	1536	285	20.2	19.1	27.9	32.2
26-30	12382	10977	1200	170	22.8	23.0	21.8	19.2
31-35	8569	7650	779	128	15.8	16.0	14.1	14.4
36-40	6251	5523	613	98	11.5	11.6	11.1	11.1
40+	10460	9241	994	181	19.3	19.4	18.0	20.4
Race								
Asian	11890	10424	1276	165	22.3	22.3	23.6	19.1
Black or African-American	3628	3189	387	44	6.8	6.8	7.1	5.1
Hispanic or Latino	12043	10556	1280	184	22.6	22.6	23.6	21.3
American Indian, Alaska Native	544	471	60	*	1.0	1.0	1.1	*
Pacific Islander, Native Hawaiian	358	312	37	*	0.7	0.7	0.7	*
White	24748	21830	2370	452	46.5	46.6	43.8	52.3
					100	100	100	100
TOP code								
General	125	94	30	*	0.23	0.20	0.54	*
Medical Laboratory Technology	116	105	*	*	0.21	0.22	*	*
Phlebotomy	195	145	41	*	0.36	0.30	0.74	*
Physicians Assistant	295	280	*	0	0.54	0.59	*	0.00
Medial Assisting	2522	1496	854	144	4.65	3.14	15.49	16.25
Clinical Medical Assisting	331	271	53	*	0.61	0.57	0.96	*
Administrative Medical Assisting	413	357	46	*	0.76	0.75	0.83	*
Hospital Service Technology	105	87	*	*	0.19	0.18	*	*
Respiratory Care/Therapy	1790	1623	142	*	3.30	3.40	2.58	*
Cardiovascular Technician	422	386	33	*	0.78	0.81	0.60	*
Electrocardiography	76	*	58	*	0.14	*.03	1.05	*
Surgical Technician	170	148	*	*	0.31	0.31	*	*
Occupational Therapy Technology	203	201	*	*	0.37	0.42	*	*
Speech Pathology	284	272	*	0	0.52	0.57	*	0.00
Pharmacy Technology	642	548	90	*	1.18	1.15	1.63	*
Physical Therapist Assistant	457	446	*	0	0.84	0.94	*	0.00
Health Information Technology	768	578	120	58	1.42	1.21	2.18	6.55
Health Information Coding	374	308	61	*	0.69	0.65	1.11	*
Radiologic Technology	2721	2481	231	*	5.02	5.20	4.19	*
Radiation Therapy Technician	50	50	0	0	0.09	0.10	0.00	0.00
Sonography	252	246	*	*	0.46	0.52	*	*
Sports Medicine	31	*	*	*	0.06	*	*	*

	Number of Students				Distribution (%)			
	Total	One Award	Two Award	Three Award	Total	One Award	Two Award	Three Award
General Nursing	70	69	*	*	0.13	0.14	*	*
Registered Nursing	21598	21051	534	*	39.82	44.14	9.69	*
Licensed Vocational Nursing	4432	3180	1101	148	8.17	6.67	19.97	16.70
Certified Nurse Assistant	2357	1657	501	179	4.35	3.47	9.09	20.20
Home Health Aide	78	58	*	*	0.14	0.12	*	*
Psychiatric Technician	2337	2173	151	*	4.31	4.56	2.74	*
Dental Assistant	1659	1379	265	*	3.06	2.89	4.81	*
Dental Hygienist	1378	1370	*	0	2.54	2.87	*	0.00
Dental Laboratory Technician	210	196	*	*	0.39	0.41	*	*
Emergency Medical Services	5084	4099	705	205	9.37	8.60	12.79	23.14
Paramedic	1202	1084	109	*	2.22	2.27	1.98	*
Mortuary Science	261	244	*	*	0.48	0.51	*	*
Health Professions, Transfer Curriculum	527	357	159	*	0.97	0.75	2.88	*
Massage Therapy	161	139	*	*	0.30	0.29	*	*
Other	400	344	41	*	0.74	0.72	0.74	*
					100	100	100	100
Region of College where earned first award								
Northern Coastal	556				1.0			
Northern Inland	1424				2.6			
Greater Sacramento	2562				4.7			
North Bay	3877				7.1			
East Bay	2350				4.3			
Mid Peninsula	2701				5.0			
Silicon Valley	2994				5.5			
Santa Cruz Monterey	1132				2.1			
Central Valley	7089				13.1			
Mother Lode	*				*			
South Central Coast	4942				9.1			
Los Angeles	10376				19.1			
Orange	3976				7.3			
Inland Empire	6654				12.3			
San Diego Imperial	3594				6.6			

SOURCES: Authors' calculations from COMIS data.

NOTES: Any cell with fewer than 30 observations is masked for confidentiality and indicated by an *.

Table C2 presents detailed regression results from our baseline estimates. A simple, naïve comparison of average wages before and after awards indicates a substantial boost in wages to a first credential, on the order of 113 percent (Model 1) but no statistically discernible return to the 2nd or 3rd award. Controlling for the fact that earnings tend to rise over time with age and experience and that earnings prior to an award are lower since students are enrolled in school (Model 2), we estimate a return to a first health CTE credential of 53 percent. Adding controls for student characteristics, both observable and not, we estimate a slightly smaller but still large return of 45 percent to the first award and 7 percent additional return for the second and third (Model 3). We take this estimate as our baseline wage return for health CTE credentials. Model 4 shows that returns vary substantially across type of credential, with associate degrees earning the largest returns regardless of whether it's the first, second or third credential.

As suggested above, these estimates compare students who pursue very different trajectories in the colleges. So we next test the return to credentials depending on the length of the first health credential a student earns (columns 5-6). In these models, returns to each award are relative to a student's prior earnings and differences across credential type are based on the timing and type of award earned by other students with the same first credential (in terms of length, not program). Model 5 makes clear that associate degree students drive much of the return to first awards, though even associate award students who obtain additional credentials see further boost in earnings. In fact, as Model 6 shows, students who first earn an associate degree and then earn another see positive and substantial return even to the second. Those that receive a third credential (of any length) see no statistically discernible additional return to earnings.

Columns 7-8 replicate these models for students whose first award was a long term certificate and columns 9-10 do the same for initial short term certificates.

TABLE C2

Fixed effect models of log quarterly wages

Dependent Variable: Log Quarterly Wages	Sample: All students with 1+ health award				First award is Associates		First award is Long Term Certificate		First award is Short Term Certificate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Enrolled		-0.386**	-0.432**	-0.359**	-0.444**	-0.444**	-0.296**	-0.296**	-0.265**	-0.251**
Postaward 1	1.127**	0.526**	0.445**		0.641**		0.395**		-0.00256	
Postaward 2	-0.0658	-0.0926**	0.0724*		0.163**		0.186**		0.300**	
Postaward 3	0.0206	0.00189	0.0718		-0.142		0.189**		0.189**	
Postaward 1 * Associates				0.675**		0.641**				
Postaward 1 * Long term certificate				0.399**				0.395**		
Postaward 1 * short term certificate				0.0525**						0.00335
Postaward 2 * Associates				0.297**		0.161**		0.208**		0.514**
Postaward 2 * Long term certificate				0.146**		0.0800		0.0760		0.253**
Postaward 2 * short term certificate				0.0665		0.237**		-0.139		-0.00473
Postaward 3 * Associates				0.347**		-0.0328		0.221**		0.446**
Postaward 3 * Long term certificate				-0.0397		-0.151		-0.0669		0.0430
Postaward 3 * short term certificate				0.0453		-0.203		0.277		0.0599
Constant	8.275**	7.221**	7.604**	7.522**	7.558**	7.558**	7.500**	7.501**	7.477**	7.466**
Year-Quarter Fixed Effects		X	X	X	X	X	X	X	X	X
Student Fixed Effects			X	X	X	X	X	X	X	X
Age Fixed Effects		X	X	X	X	X	X	X	X	X
Observations	2,337,284	2,337,284	2,337,284	2,337,284	1,353,167	1,353,167	486,722	486,722	497,395	497,395
R-squared	0.225	0.301	0.539	0.548	0.559	0.559	0.523	0.523	0.501	0.504

SOURCES: Authors' calculations from COMIS data.

NOTES: Full regression statistics available upon request. ** p<0.01, * p<0.05.

We provide baseline estimates after excluding students who earn registered nursing credentials, given their predominance in terms of number of students and high wage outcomes. Specifically, we exclude any student who earns an RN credential at any point during our study period (and as first, second, or more). Note that results that exclude RN degrees from the first awards students earn only are similar to the baseline results.

TABLE C3

Fixed effect models of log quarterly wages, excluding registered nursing students

Dependent Variable: Log Quarterly Wages	Sample: All students with 1+ health award				First award is Associates		First award is Long Term Certificate		First award is Short Term Certificate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Enrolled		-0.283**	-0.334**	-0.285**	-0.417**	-0.417**	-0.257**	-0.257**	-0.222**	-0.218**
Postaward 1	0.899**	0.392**	0.298**		0.509**		0.396**		0.0216	
Postaward 2	-0.0621	-0.0805*	0.0363		0.207**		0.0499		0.106*	
Postaward 3	-0.0562	-0.0640	-0.0718*		-0.103		0.0603		-0.00678	
Postaward 1 * Associates				0.536**		0.509**				
Postaward 1 * Long term certificate				0.404**				0.395**		
Postaward 1 * short term certificate				0.0476**						0.0244
Postaward 2 * Associates				0.112**		0.207**		0.0608		0.190**
Postaward 2 * Long term certificate				0.210**		0.228**		0.0501		0.249**
Postaward 2 * short term certificate				-0.0107		-0.0500		-0.129		-0.00602
Postaward 3 * Associates				0.148*		0.207*		0.0813		0.172*
Postaward 3 * Long term certificate				-0.0306		-0.160		0.0402		-0.000888
Postaward 3 * short term certificate				-0.0338		-1.084**		-0.0367		-0.0406
Constant	8.268**	7.142**	7.522**	7.466**	7.511**	7.512**	7.439**	7.439**	7.463**	7.460**
Year-Quarter Fixed Effects		X	X	X	X	X	X	X	X	X
Student Fixed Effects			X	X	X	X	X	X	X	X
Age Fixed Effects		X	X	X	X	X	X	X	X	X
Observations	1,238,077	1,238,077	1,238,077	1,238,077	388,305	388,305	411,159	411,159	438,613	438,613
R-squared	0.146	0.223	0.517	0.524	0.541	0.541	0.519	0.519	0.498	0.499

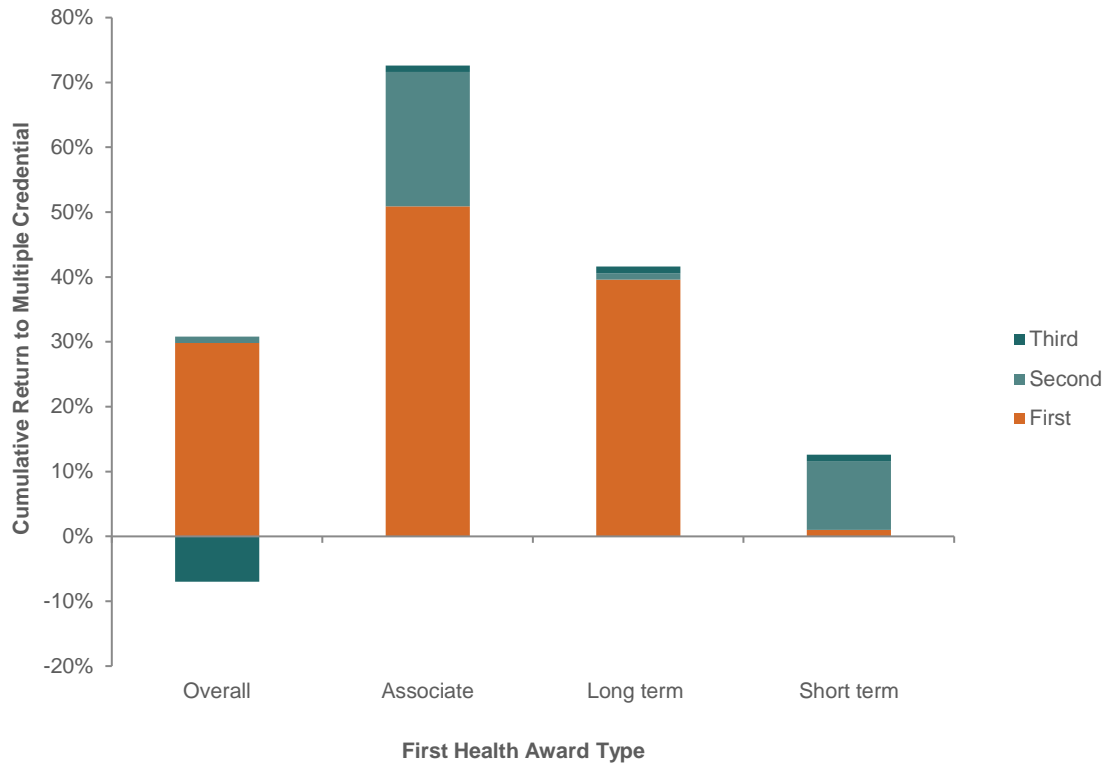
SOURCES: Authors' calculations from COMIS data.

NOTES: Standard errors available upon request. ** p<0.01, * p<0.05.

Using these estimates, we re-create the wage return figures presented in the report, but exclude RN awards.

FIGURE C1

Wage returns to one or more health CTE credential, excluding any registered nursing awards



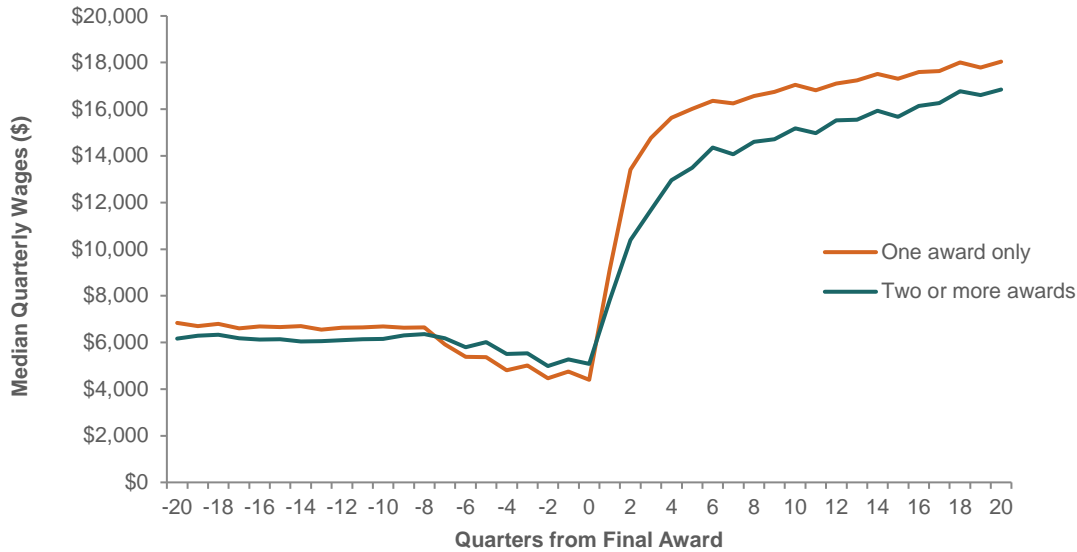
SOURCES: Author calculations from CCCC MIS database.

NOTES: Sample includes students who earned a first health CTE award between 2003-2009 but at no point received a registered nursing credential. Wage returns shown are estimates from a fixed effects regression model of the logarithm of quarterly wages on indicator variables for whether the student was enrolled, earned an award (first, second, and/or third) by type and fixed effects for age, year-quarter, and student. These results should be interpreted as the increase in wages relative to a student's own prior earnings, and in the case of those who earn a second or third award, relative to those who completed only one. Statistically insignificant coefficients are shown for display purposes as 0.01%. See text for details.

In the report, we also show the wage trajectory for students who obtain one award compared to two. There are two ways to compare these trajectories – from the point in time of receiving the first award or from the point in time of receiving the final award (that we observe). The report shows the former, and for the sake of full information, we show the latter here.

FIGURE C2

Wage trajectories for students who earn one or more health CTE credential



SOURCE: Author calculations from CCCCO MIS database.

NOTE: Sample includes students who earned a first health CTE award between 2003-2009. Wages are adjusted for inflation and only include wages for students employed in a given quarter. The number of students in each quarter for the series based on one award only ranges from 21,000-40,000. The student count for the second series ranges from 3,100-5,400.

We next explore the variation in the baseline model estimates according to demographic characteristics and specific pathways. Although student fixed effects subsume all the observable variation in student groups, we run our baseline model separately for the socioeconomic characteristics below. For parsimony, the table shows main coefficient estimates; full statistics are available upon request. It does not appear that our results are driven by students with certain characteristics or from different parts of the state.

TABLE C4

Wage return to multiple credentials, by demographics and program choice

	First award	Second award	Third Award	Observations
Gender				
Male	0.330**	0.0516	-0.0947	609,824
Female	0.488**	0.0792**	0.131	1,724,688
Race/ethnicity				
Asian	0.436**	0.103*	-0.0521	504,912
Black	0.341**	0.104	0.165*	159,841
Hispanic or Latino	0.401**	0.116**	0.135	540,885

	First award	Second award	Third Award	Observations
American Indian	0.412**	0.0451	0.250	22,756
Pacific Islander	0.474**	-0.0979	0.514**	15,358
Two or more	-0.110	0.0119	NA	890
White	0.488**	0.0429	0.0695	1,052,417
Region				
Northern Coastal	0.451**	0.0796*	0.0687	1,415,104
Northern Inland	0.616*	0.0977	0.390*	22,320
Greater Sacramento	0.487**	0.200*	0.302	60,369
North Bay	0.635**	-0.0639	-0.0427	117,572
East Bay	0.358*	-0.110	-0.0725*	169,999
Mid Peninsula	0.597**	-0.0922	-0.446*	101,401
Silicon Valley	0.242*	0.0152	-0.0858	114,529
Santa Cruz Monterey	0.335*	0.0776	0.0420	121,310
Central Valley	0.672*	-0.0151	-0.383*	50,843
Mother Lode	0.587**	0.166*	0.335**	319,107
South Central Coast	0.445	0.816	NA	492
Los Angeles	0.419**	0.0626	0.268	210,083
Orange	0.446**	0.168	-0.0865	459,622
Inland Empire	0.485**	-0.0957	-0.121	173,561
San Diego Imperial	0.326*	0.201*	0.294**	265,403
Specific Pathways				
Subsequent awards higher level but in same program	0.493**	-0.0975*	0.211*	2,112,655
Subsequent awards higher level and in different program	0.461**	0.142**	0.216**	2,182,133
First award is medical assisting	-0.0488	0.483**	0.302**	89,560
First award is Licensed Vocational Nursing	0.383**	0.363**	0.157*	188,960
First award is Certified Nursing Assistant	-0.0912*	0.514**	0.390**	84,383
First award is Emergency Medical Services	-0.00994	0.113	0.00207	202,906

SOURCES: Authors' calculations from COMIS data.

NOTES: Each row is the result from a single regression model, using our baseline specification. For parsimony, only the coefficients of main interest are shown, but full regression results are available upon request. ** p<0.01, * p<0.05. Each model includes students with the specified characteristic who earned their first health CTE award in the sample period.



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