Labor Market Analysis for Program Recommendation: 0708.00/Computer Infrastructure and Support (*AS in AI for Cybersecurity*)

Orange County Center of Excellence, October 2024

FOR LABOR MARKET RESEARCH
ORANGE COUNTY

Summary

Program LMI Endorsement	Endorsed: All LMI Criteria Met	☒	Endorsed: Some LMI Criteria Met	☐	Not LMI Endorsed	☐

Program LMI Endorsement Criteria		
Supply Gap:	Yes ☑	No ☐
	Comments: there is projected to be **1,202 annual job openings** throughout Los Angeles and Orange counties for these cybersecurity occupations, which **is less than the 7,058 awards conferred by educational institutions.** However, these educational programs also prepare students for 21 other related occupations, **which account for 19,652 additional annual job openings. *Because these programs train for a variety of occupations with high demand, there is most likely an undersupply of labor for these cybersecurity occupations.***	
Self-Sufficiency Standard Living Wage[1]:	Yes ☑	No ☐
	Comments: **the majority (70%) of annual job openings** for these cybersecurity occupations **have entry-level hourly wages above the OC living wage of $27.13.**	
Education:	Yes ☑	No ☐
	Comments: though one of these cybersecurity occupations typically requires an associate degree and two typically require a bachelor's degree, **between 37% and 40% of workers in the field have completed some college or an associate degree as their highest level of education.**	
Additional Considerations		
Emerging Occupation(s):	Yes ☑	No ☐
	Comments: Though the occupations included in this report are not emerging, the use of artificial intelligence (AI) in cybersecurity operations is an emerging area that has created a new market for AI-based cybersecurity products and tools.	
OC Resilient Job(s):	Yes ☑	No ☐
	Comments: See Resilient Jobs and US News & World Report Best Jobs	
U.S. News & World Report 2024 Best Jobs List[2]:	Yes ☑	No ☐
	Comments: See Resilient Jobs and US News & World Report Best Jobs	

[1] At the direction of the California Community College Chancellor's Office, the living wage endorsement criteria in this report uses the University of Washington's Center for Women's Welfare Self-Sufficiency Standard, which the COE refers to as a living wage, to determine Orange County's living wage of $27.13, last updated in March 2024.
[2] "100 Best Jobs of 2024," U.S. News & World Report, accessed May 7, 2024, https://money.usnews.com/careers/best-jobs/rankings/the-100-best-jobs.

The Orange County Center of Excellence for Labor Market Research (OC COE) prepared this report to determine whether there is a supply gap in the Los Angeles/Orange County regional labor market related to three middle-skill occupations:

- *Computer Network Support Specialists (15-1231)*
- *Computer Network Architects (15-1241)*
- *Network and Computer Systems Administrators (15-1244)*

Though these occupations are not considered emerging, the rapid development of AI has created a new market for AI-based cybersecurity products and tools. Employers continue to report cybersecurity workforce shortages and have turned to AI to improve efficiency and productivity.[3] AI can help cybersecurity professionals detect cyber-attacks and prioritize actions based on risk level, identify suspicious phishing campaign emails, quickly analyze incident-related data, and more. According to Morgan Stanley, "AI has the potential to be a game-changing tool in penetration testing – intentionally probing the defenses of software and networks to identify weaknesses. By developing AI tools to target their own technology, organizations will be better able to identify their weaknesses before hackers can maliciously exploit them.[4] However, a 2023 employer survey conducted by ISC2, a cybersecurity professional association, found that nearly half of respondents said that there is a shortage of workers with knowledge of AI for cybersecurity.[5]

Postsecondary education academic programs focusing on AI are relatively new and continuously evolving. As of February 2024, there are 167 AI academic programs in the United States.[6] These programs are all offered by four-year colleges and universities and are typically either four-year degrees, a concentration in a broader major like computer science, a minor, or a graduate-level certificate. The first Bachelor of Science degree in AI program began in 2018 at Carnegie Mellon University, a scant six years ago; which is not a significant amount of time to confer degrees and adequately evaluate how well graduates are faring in the job market. Early indications show they may have a competitive edge while job seeking with their new degrees.[7]

Based on the available data, there appears to be a supply gap for these middle-skill cybersecurity occupations. Though the number of awards for these occupations exceeds demand, supply is overstated because the related educational programs train for an additional 21 occupations. When considering the high demand for all 24 occupations, there is most likely an undersupply of labor for the three middle-skill cybersecurity occupations. In addition, typical education requirements for these occupations align with a community college education and typical entry-level wages are above the Self-Sufficiency Standard living wage. **Therefore, due to all regional labor market criteria being met, the COE endorses this proposed program.**

[3] Bob Violino, "How AI and better pay can address the ongoing cyber talent shortage," CNCB, accessed August 2, 2024, https://www.cnbc.com/2023/09/27/how-ai-and-better-pay-can-address-the-ongoing-cyber-talent-shortage.html.
[4] "AI and Cybersecurity: A New Era," Morgan Stanley, accessed August 2, 2024, https://www.morganstanley.com/articles/ai-cybersecurity-new-era.
[5] "Growing threats outpace cybersecurity workforce," Thomson Reuters, accessed August 2, 2024, https://legal.thomsonreuters.com/blog/growing-threats-outpace-cybersecurity-workforce/.
[6] "Academic Programs in Artificial Intelligence – February 2024," National Science Foundation – Directorate for STEM Education, accessed July 31, 2024, https://drive.google.com/file/d/10oDZcfpKRxKUxKQRhlxUJiW6wtvrW_kx/view.
[7] Victoria Feng, "More colleges are offering AI degrees – could they give job seekers an edge?," *NBC News*, July 29, 2024, https://www.nbcnews.com/tech/tech-news/ai-degree-major-college-university-schools-rcna163462.

Exhibit 1 lists the occupational demand, supply, typical entry-level education, and educational attainment for the occupations included in this report.

Exhibit 1: Labor Market Endorsement Summary

Occupation (SOC)	Demand (Annual Openings)	Supply (CC and Non-CC)	Entry-Level Hourly Earnings (25th Percentile)	Typical Entry-Level Education	Community College Educational Attainment
Computer Network Support Specialists (15-1231)	LA: 263	LA: 3,320	OC: $23.93	Associate degree	40%
	OC: 108	OC: 1,652			
	TTL: 372	*TTL: 4,972*			
Computer Network Architects (15-1241)	LA: 165	LA: 240	OC: $50.14	Bachelor's degree	37%
	OC: 76	OC: 85			
	TTL: 240	*TTL: 325*			
Network and Computer Systems Administrators (15-1244)	LA: 418	LA: 1,279	OC: $36.64	Bachelor's degree	39%
	OC: 173	OC: 482			
	TTL: 590	*TTL: 1,761*			
Total	**1,202**	**7,058**	**N/A**	**N/A**	**N/A**

Demand:

- The number of jobs related to these cybersecurity occupations is projected to increase 1% through 2028, equating to 1,202 annual job openings.
- Hourly entry-level wages for these cybersecurity occupations range from $23.93 to $50.14 in Orange County; 70% of annual job openings have entry-level wages above the Self-Sufficiency Standard living wage.
- There were 4,571 online job postings for these cybersecurity occupations over the past 12 months. The highest number of postings were for network engineers, systems administrators, and network administrators.
- The typical entry-level education for these cybersecurity occupations ranges from an associate degree to a bachelor's degree.
- Between 37% and 40% of workers in the field have completed some college or an associate degree as their highest level of educational attainment.

Supply:

- There was an average of 1,690 awards conferred by 28 community colleges in Los Angeles and Orange Counties from 2020 to 2023.
- Non-community college institutions conferred an average of 5,368 awards from 2019 to 2022.
- Orange County community college students that exited computer infrastructure and support programs in the 2020-21 academic year had a median annual wage of $52,028 ($25.01 per hour) after exiting the program and 63% attained the regional living wage.
- Throughout Orange County, 89% of computer infrastructure and support students that exited their program in 2019-20 reported that they are working in a job closely related to their field of study.

Demand

Occupational Projections:

Exhibit 2 shows the annual percent change in jobs for these cybersecurity occupations from 2018 through 2028. Though there was a 7% decline across all occupations in Los Angeles/Orange County from 2019 to 2020 due to the COVID-19 pandemic, employment in these cybersecurity occupations decreased 4% during the same period.

In the two years preceding the pandemic, employment for these occupations decreased in Orange County, with declines in 2018 and 2019. After a continued decrease in employment from 2020 and through 2023, employment for these three occupations in Orange County is projected to remain flat through 2028, experiencing a lower rate relative to all occupations in Los Angeles/Orange County.

Exhibit 2: Annual Percent Change in Jobs for Cybersecurity Occupations, 2018-2028

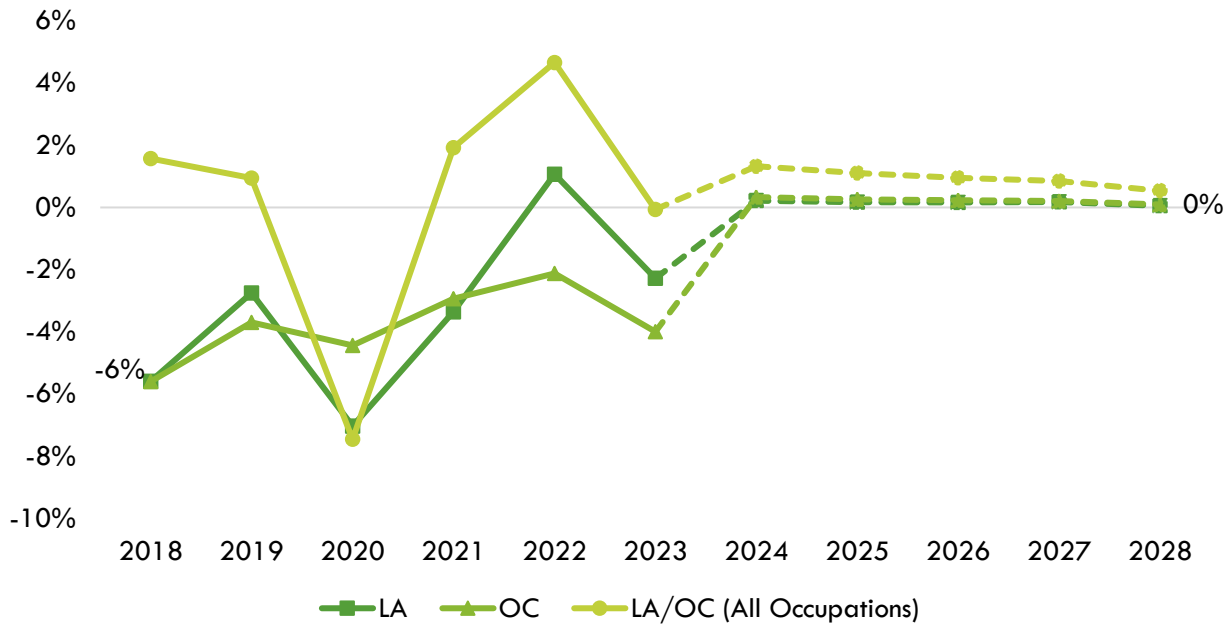


Exhibit 3 shows the five-year occupational demand projections for these cybersecurity occupations. In Los Angeles/Orange County, the number of jobs related to these occupations is projected to increase by 1% through 2028. There is projected to be 1,202 jobs available annually.

Exhibit 3: Occupational Demand in Los Angeles and Orange Counties[8]

Geography	2023 Jobs	2028 Jobs	2023-2028 Change	2023-2028 % Change	Annual Openings
Los Angeles	14,086	14,196	109	1%	845
Orange	5,897	5,965	67	1%	357
Total	**19,984**	**20,160**	**176**	**1%**	**1,202**

[8] Five-year change represents new job additions to the workforce. Annual openings include new jobs and replacement jobs that result from retirements and separations.

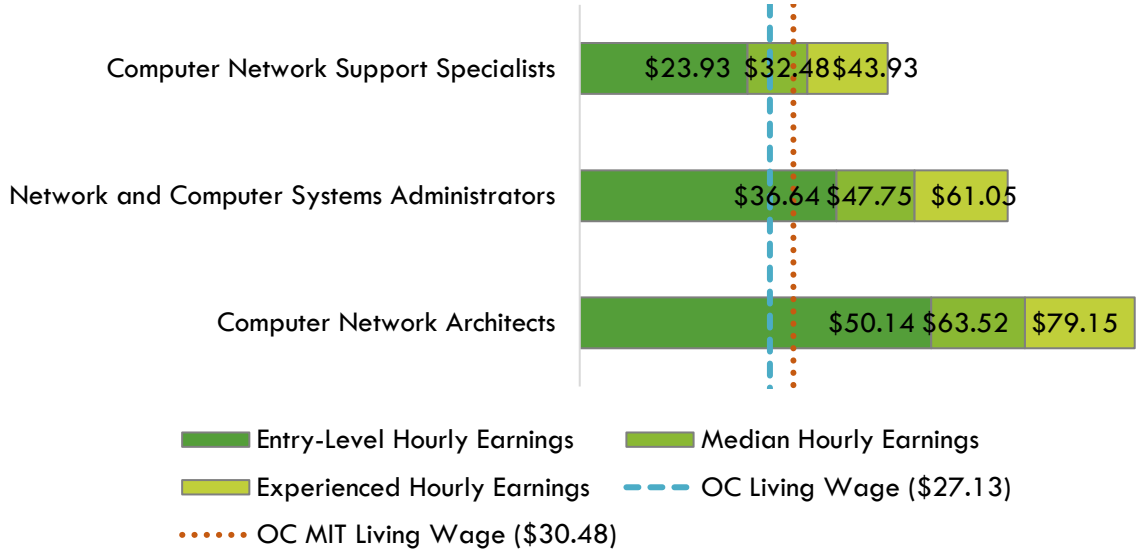
Wages:

The labor market endorsement in this report considers the entry-level hourly wages for these real estate occupations in Orange County as they relate to the county's living wage. Los Angeles County wages are included below to provide a complete analysis of the LA/OC region.

At the direction of the California Community College Chancellor's Office, the living wage endorsement criteria in this report uses the University of Washington's Center for Women's Welfare Self-Sufficiency Standard, which the COE refers to as a living wage, to determine Orange County's living wage of $27.13, last updated in March 2024. Additionally, data for the MIT Living Wage, updated on February 14, 2024, is provided as a reference. Currently, the MIT Living Wage in Orange County is $30.48. Both figures, which account for geographic-specific costs of necessities such as housing, food, health care, and transportation to assess the cost of living, are notated in the exhibits below.

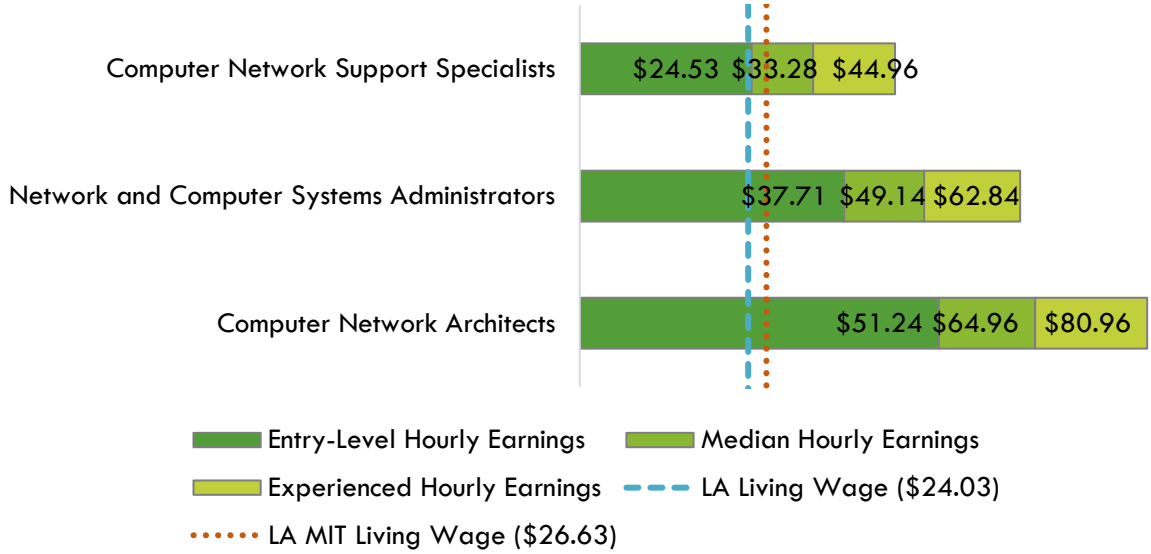
The majority (70%) of annual openings for these cybersecurity occupations have entry-level wages above the Self-Sufficiency Standard living wage for one adult ($27.13 in Orange County). Typical entry-level hourly wages range between $23.93 and $50.14. Orange County's average wages of $51.59 are significantly lower than the average statewide wage of $56.90 for these occupations. Exhibit 4 shows the wage range for each of these cybersecurity occupations in Orange County and how they compare to the regional living wage, sorted from lowest to highest entry-level wage.

Exhibit 4: Wages by Occupation in Orange County



All annual openings for these cybersecurity occupations have entry-level wages above the Self-Sufficiency Standard living wage for one adult ($24.03 in Los Angeles County). Typical entry-level hourly wages range between $24.53 and $51.24. Los Angeles County's average wages of 52.54 are significantly below the average statewide wage of $56.90 for these occupations. Exhibit 5 shows the wage range for each of these cybersecurity occupations in Los Angeles County and how they compare to the regional living wage, sorted from lowest to highest entry-level wage.

Exhibit 5: Wages by Occupation in Los Angeles County



Resilient Jobs and U.S. News & World Report Best Jobs:

Exhibit 6 shows if each occupation is considered an Orange County Great Recession-Resilient, COVID-19 Pandemic Recession-Resilient Job, or a 2024 U.S. News & World Report (USN&WR) Best Job. Only one occupation, *computer network architects*, met the criteria to be considered a COVID-19 Pandemic Recession-Resilient Job and a USN&WR Best Job. None of these three cybersecurity occupations are Great Recession-Resilient Jobs.

Exhibit 6: Resilient Jobs and USN&WR Best Jobs Designations

Occupation	Great Recession-Resilient Job	COVID-19 Pandemic Recession-Resilient Job	2024 USN&WR Best Job
Computer Network Support Specialists	☐	☐	☐
Computer Network Architects	☐	☑	☑
Network and Computer Systems Administrators	☐	☐	☐

Job Postings:

Important Online Job Postings Data Note: *Online job postings data is sourced from Lightcast, a labor market analytics firm that scrapes, collects, and organizes data from online job boards such as LinkedIn, Indeed, Glassdoor, Monster, GovernmentJobs.com, and thousands more. Lightcast uses natural language processing (NLP) to determine the related company, industry, occupation, and other information for each job posting. However, NLP has limitations that include understanding contextual words of phrases; determining differences in words that can be used as nouns, verbs, and/or adjectives; and misspellings or grammatical errors.*[9] *For these reasons, job postings could be assigned to the wrong employer, industry, or occupation within Lightcast's database.*

[9] K. R. Chowdhary, Fundamentals of Artificial Intelligence (Basingstoke: Springer Nature, 2020), https://link.springer.com/book/10.1007/978-81-322-3972-7.

Additionally, there are several limitations when analyzing job postings. A single job posting may not represent a single job opening, as employers may be creating a pool of candidates for future openings or hiring for multiple positions with a single posting. Additionally, not all jobs are posted online, and jobs may be filled through other methods such as internal promotion, word-of-mouth advertising, physical job boards, or a variety of other channels.

There were 4,571 online job postings related to these cybersecurity occupations listed in the past 12 months. Exhibit 7 shows the number of job postings by occupation. The majority of job postings were for *computer network architects* (55%), followed by *network and computer systems administrators* (41%).

Exhibit 7: Number of Job Postings by Occupation (n=4,571)

Occupation	Job Postings	Percentage of Job Postings
Computer Network Architects	2,531	55%
Network and Computer Systems Administrators	1,865	41%
Computer Network Support Specialists	175	4%
Total Postings	**4,571**	**100%**

The top employers in the region, by number of job postings, are shown in Exhibit 8.

Exhibit 8: Top Employers by Number of Job Postings (n=4,571)

Employer	Job Postings	Percentage of Job Postings
Northrop Grumman	133	3%
Raytheon Technologies	105	2%
Robert Half	84	2%
Allegis Group	76	2%
Insight Global	74	2%
Randstad	59	1%
TEKsystems	59	1%
The Judge Group	58	1%
University of California	58	1%
Boeing	47	1%

The top specialized, soft, and computer skills listed by those most frequently mentioned in job postings (denoted in parentheses) are shown in Exhibit 9.

Exhibit 9: Top Skills by Number of Job Postings (n=4,571)

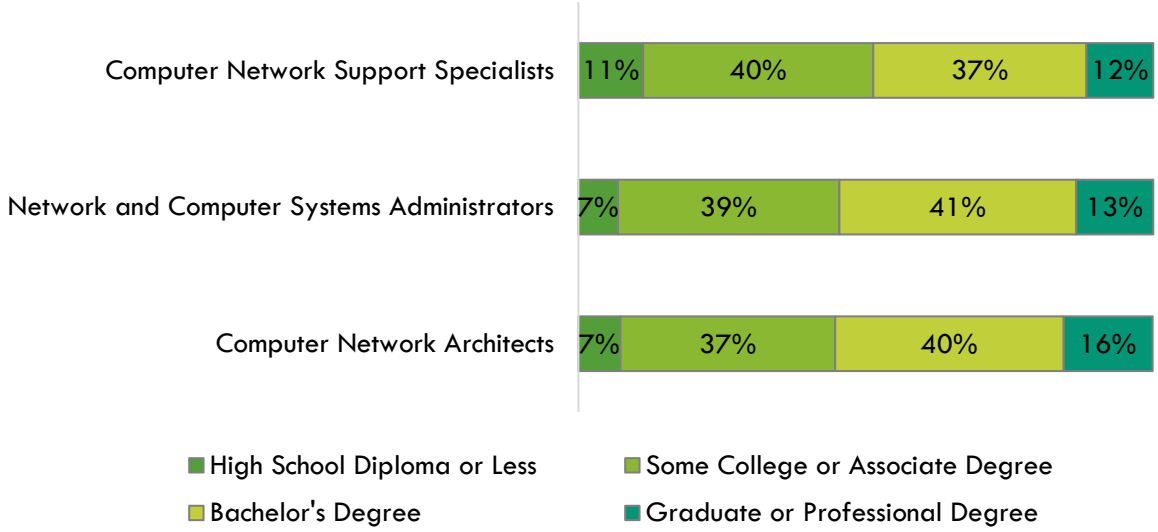
Top Specialized Skills	Top Soft Skills	Top Computer Skills
Computer Science (1,162)	Troubleshooting (Problem Solving) (2,087)	Firewall (1,075)
Network Routing (1,123)	Communication (1,796)	Linux (906)
Firewall (1,075)	Management (1,467)	Operating Systems (868)
Network Switches (973)	Operations (1,243)	Python (Programming Language) (664)
Network Engineering (972)	Problem Solving (1,122)	Microsoft Azure (636)
Automation (938)	Planning (752)	Active Directory (633)

Top Specialized Skills	Top Soft Skills	Top Computer Skills
Linux (906)	Information Technology (751)	Amazon Web Services (527)
Operating Systems (868)	Customer Service (628)	Border Gateway Protocol (523)
Wide Area Networks (687)	Leadership (589)	Dynamic Host Configuration Protocol (DHCP) (484)
Local Area Networks (672)	Detail Oriented (455)	Windows Servers (432)

Educational Attainment:

The Bureau of Labor Statistics (BLS) lists an associate degree as the typical entry-level education for *computer network support specialists* and a bachelor's degree for *network and computer systems administrators* and *computer network architects*. However, the national-level educational attainment data indicates between 37% and 40% of workers in the field have completed some college or an associate degree as their highest level of education. Exhibit 10 shows the educational attainment for each occupation, sorted by highest community college educational attainment to lowest.

Exhibit 10: National-level Educational Attainment for Occupations



Of the 60% of the cumulative job postings for these cybersecurity occupations that listed a minimum education requirement in Los Angeles/Orange County, 79% (2,144) requested a bachelor's degree and 20% (537) requested a high school diploma or an associate degree.

Educational Supply

Community College Supply:

Exhibit 11 shows the three-year average number of awards conferred by community colleges in the related TOP code:

- Information Technology, General (0701.00)
- Computer Information Systems (0702.00)
- Computer Software Development (0707.00)
- Computer Programming (0707.10)
- Computer Systems Analysis (0707.30)
- Computer Infrastructure and Support (0708.00)
- Computer Networking (0708.10)
- Computer Support (0708.20)
- World Wide Web Administration (0709.00)

The colleges with the most completions in the region are Long Beach, Orange Coast, and Mt. San Antonio. Over the past 12 months, there were six other related program recommendation requests from regional community colleges.

Exhibit 11: Regional Community College Awards (Certificates and Degrees), 2020-2023

TOP Code	Program	College	2020-2021 Awards	2021-2022 Awards	2022-2023 Awards	3-Year Award Average
0701.00	Information Technology, General	East LA	4	30	18	17
		Glendale	3	17	16	12
		LA Harbor	1	2	0	1
		LA Mission	1	4	3	3
		LA Southwest	2	12	1	5
		Long Beach	106	88	73	89
		Mt San Antonio	49	23	12	28
		Santa Monica	1	0	0	0
		West LA	0	6	4	3
		LA Subtotal	**167**	**182**	**127**	**159**
		Santa Ana	3	9	25	12
		OC Subtotal	**3**	**9**	**25**	**12**
Supply Subtotal/Average			**170**	**191**	**152**	**171**
0702.00	Computer Information Systems	Citrus	4	6	2	4
		Compton	0	12	4	5
		East LA	23	11	23	19
		El Camino	11	28	19	19
		Glendale	6	8	11	8
		LA City	4	3	4	4
		LA Harbor	0	1	2	1
		LA Mission	1	1	0	1
		LA Southwest	0	21	20	14

TOP Code	Program	College	2020-2021 Awards	2021-2022 Awards	2022-2023 Awards	3-Year Award Average
		LA Trade	15	17	35	22
		Long Beach	3	0	6	3
		Mt San Antonio	6	68	41	38
		Rio Hondo	6	15	14	12
		Santa Monica	0	0	2	1
		West LA	9	14	8	10
		LA Subtotal	**88**	**205**	**191**	**161**
		Coastline	0	2	7	3
		Fullerton	31	49	48	43
		Irvine	0	0	1	0
		Orange Coast	0	1	0	0
		Saddleback	1	0	1	1
		Santa Ana	16	18	8	14
		Santiago Canyon	1	1	5	2
		OC Subtotal	**49**	**71**	**70**	**69**
		Supply Subtotal/Average	**137**	**276**	**261**	**225**
0707.00	Computer Software Development	LA City	0	1	0	0
		LA Harbor	0	2	2	1
		LA Mission	0	2	0	1
		LA Pierce	4	7	7	6
		Santa Monica	1	1	2	1
		West LA	0	6	1	2
		LA Subtotal	**5**	**19**	**12**	**12**
		Golden West	6	4	1	4
		Orange Coast	2	0	0	1
		Saddleback	10	15	16	14
		OC Subtotal	**18**	**19**	**17**	**18**
		Supply Subtotal/Average	**23**	**38**	**29**	**30**
0707.10	Computer Programming	Cerritos	3	7	2	4
		Citrus	3	9	7	6
		East LA	1	0	1	1
		LA City	8	10	19	12
		LA Harbor	2	4	6	4
		LA Mission	7	7	6	7
		LA Pierce	5	5	7	6
		LA Southwest	2	2	3	2
		LA Valley	13	8	15	12

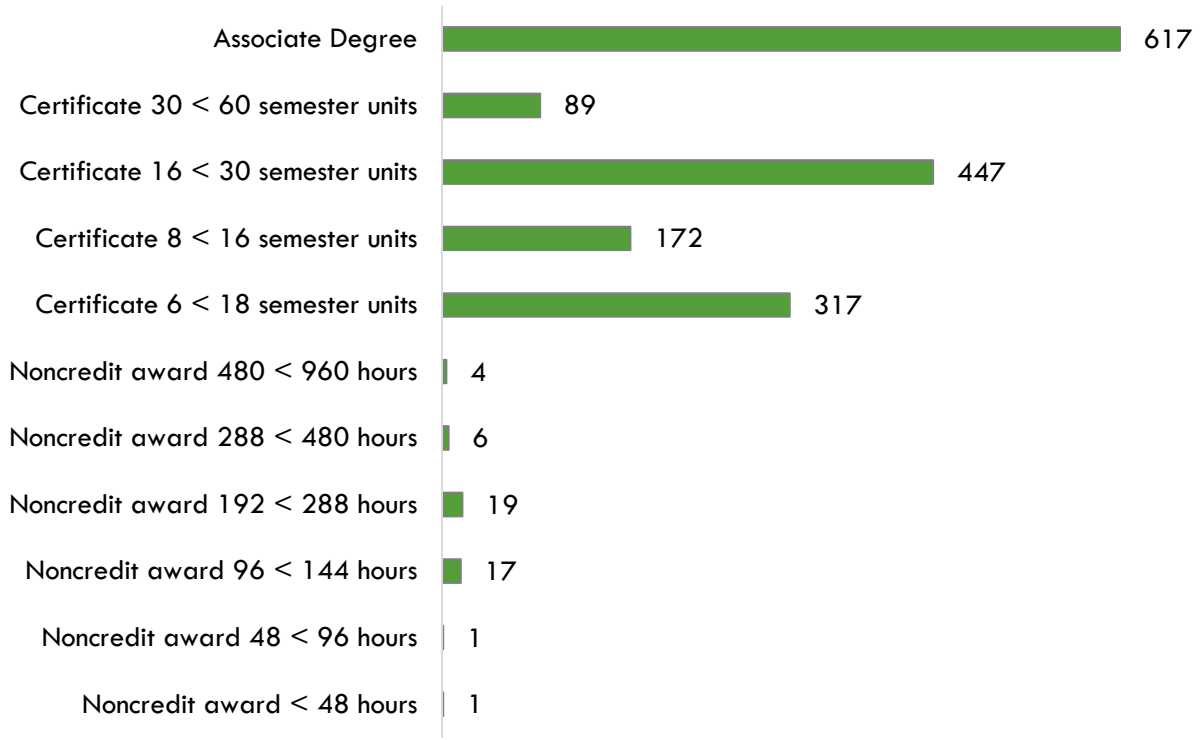
TOP Code	Program	College	2020-2021 Awards	2021-2022 Awards	2022-2023 Awards	3-Year Award Average
		Long Beach	3	7	4	5
		Mt San Antonio	83	125	65	91
		Pasadena	23	23	37	28
		Santa Monica	65	71	55	64
		LA Subtotal	**218**	**278**	**227**	**241**
		Coastline	0	1	2	1
		Cypress	6	5	5	5
		Fullerton	24	28	32	28
		Orange Coast	206	160	250	205
		Santiago Canyon	2	2	3	2
		OC Subtotal	**238**	**196**	**292**	**242**
Supply Subtotal/Average			**456**	**474**	**519**	**483**
0707.30	Computer Systems Analysis	Cerritos	0	5	2	2
		East LA	0	0	4	1
		LA City	1	6	5	4
		LA Harbor	1	1	0	1
		LA Mission	1	1	2	1
		LA Pierce	6	5	6	6
		LA Trade	0	0	2	1
		Mt San Antonio	0	9	6	5
		Rio Hondo	0	3	2	2
		LA Subtotal	**9**	**30**	**29**	**23**
		-	-	-	-	-
		OC Subtotal	**-**	**-**	**-**	**-**
Supply Subtotal/Average			**9**	**30**	**29**	**23**
0708.00	Computer Infrastructure and Support	Cerritos	4	9	14	9
		East LA	0	3	11	5
		El Camino	0	5	8	4
		Glendale	4	11	3	6
		LA City	5	12	19	12
		LA Harbor	1	2	1	1
		LA Mission	17	32	20	23
		LA Valley	4	3	2	3
		Long Beach	8	2	24	11
		Mt San Antonio	24	36	17	26
		Pasadena	24	8	17	16
		Rio Hondo	11	19	30	20

TOP Code	Program	College	2020-2021 Awards	2021-2022 Awards	2022-2023 Awards	3-Year Award Average
		West LA	16	7	4	9
		LA Subtotal	**118**	**149**	**170**	**146**
		Coastline	73	91	81	82
		Cypress	1	1	0	1
		Orange Coast	5	7	2	5
		Saddleback	3	13	14	10
		Santa Ana	27	14	20	20
		Santiago Canyon	0	0	1	0
		OC Subtotal	**109**	**126**	**118**	**118**
		Supply Subtotal/Average	**227**	**275**	**288**	**263**
0708.10	Computer Networking	Cerritos	8	6	10	8
		Glendale	0	2	2	1
		LA City	4	8	6	6
		LA Pierce	12	19	14	15
		Long Beach	48	52	70	57
		Mt San Antonio	4	25	13	14
		Rio Hondo	2	5	7	5
		Santa Monica	0	0	1	0
		West LA	58	24	24	35
		LA Subtotal	**136**	**141**	**147**	**141**
		Coastline	92	49	17	53
		Cypress	61	71	116	83
		Fullerton	1	0	0	0
		Irvine	10	18	27	18
		Saddleback	19	15	17	17
		Santa Ana	23	45	47	38
		OC Subtotal	**206**	**198**	**224**	**209**
		Supply Subtotal/Average	**342**	**339**	**371**	**351**
0708.20	Computer Support	Citrus	1	4	0	2
		El Camino	0	0	1	0
		Glendale	2	7	7	5
		LA Pierce	6	6	4	5
		LA Valley	1	0	5	2
		Long Beach	40	33	22	32
		Pasadena	34	12	19	22
		LA Subtotal	**84**	**62**	**58**	**68**
		Cypress	3	13	15	10

TOP Code	Program	College	2020-2021 Awards	2021-2022 Awards	2022-2023 Awards	3-Year Award Average
		OC Subtotal	**3**	**13**	**15**	**10**
		Supply Subtotal/Average	**87**	**75**	**73**	**78**
0709.00	World Wide Web Administration	Cerritos	0	3	3	2
		Glendale	10	7	2	6
		LA Pierce	2	0	2	1
		Long Beach	34	44	39	39
		Mt San Antonio	0	0	4	1
		Santa Monica	16	0	3	6
		West LA	6	7	8	7
		LA Subtotal	**68**	**61**	**61**	**63**
		Fullerton	1	0	0	0
		Saddleback	2	3	3	3
		OC Subtotal	**3**	**3**	**3**	**3**
		Supply Subtotal/Average	**71**	**64**	**64**	**66**
		Supply Total/Average	**1,522**	**1,762**	**1,786**	**1,690**

Exhibit 12 shows the annual average community college awards by type from 2020-21 to 2022-23. The plurality of the awards are for associate degrees, followed by certificates between 16 and less than 30 semester units and certificates between 6 and less than 18 semester units.

Exhibit 12: Annual Average Community College Awards by Type, 2020-2023



Community College Student Outcomes:

Exhibit 13 shows the Strong Workforce Program (SWP) metrics for computer infrastructure and support programs in Coast Community College District (CCCD), the Orange County Region, and California. Of the 617 Orange County computer infrastructure and support students in the 2020-21 academic year, 75% (463) attended a CCCD college.

Additionally, CCCD students that exited computer infrastructure and support programs in the 2021-22 academic year had higher median annual earnings ($56,078 or $26.96 per hour) compared to all computer infrastructure and support students in Orange County ($52,028 or $25.01 per hour). A higher percentage of CCCD computer infrastructure and support students attained the living wage (69%) when compared to all computer infrastructure and support students in Orange County (63%).

Exhibit 13: Computer Infrastructure and Support (0708.00) Strong Workforce Program Metrics, 2021-22[10]

SWP Metric	CCCD	OC Region	California
SWP Students	463	617	6,600
SWP Students Who Earned 9 or More Career Education Units in the District in a Single Year	24%	28%	38%
SWP Students Who Completed a Noncredit CTE or Workforce Preparation Course	Insufficient Data	Insufficient Data	84%

[10] All SWP metrics are for 2021-22 unless otherwise noted.

SWP Metric	CCCD	OC Region	California
SWP Students Who Earned a Degree or Certificate or Attained Apprenticeship Journey Status	52	68	528
SWP Students Who Transferred to a Four-Year Postsecondary Institution (2019-20)	51	51	383
SWP Students with a Job Closely Related to Their Field of Study (2019-20)	93%	89%	71%
Median Annual Earnings for SWP Exiting Students (2020-21)	$56,078 ($26.96)	$52,028 ($25.01)	$53,844 ($25.89)
Median Change in Earnings for SWP Exiting Students (2020-21)	9%	17%	17%
SWP Exiting Students Who Attained the Living Wage (2020-21)	69%	63%	68%

Non-Community College Supply:

To comprehensively analyze the regional supply, it is crucial to include data from other institutions offering cybersecurity training programs. Exhibit 14 displays the annual and three-year average awards granted by these institutions under the related Classification of Instructional Programs (CIP) codes:

- Computer and Information Sciences, General (11.0101)
- Information Technology (11.0103)
- Computer Programming/Programmer, General (11.0201)
- Computer Science (11.0701)
- Computer Systems Networking and Telecommunications (11.0901)
- Network and System Administration/Administrator (11.1001)
- Computer and Information Systems Security/Auditing/Information Assurance (11.1003)
- Computer Support Specialist (11.1006)

No awards were conferred under the followed related CIP codes:

- Computer Systems Analysis/Analyst (11.0501)
- Cloud Computing (11.0902)

The available data covers 2019 to 2022. During this period, non-community college institutions in the region conferred an average of 5,368 awards annually in related programs.

Exhibit 14: Regional Non-Community College Awards, 2019-2022

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
11.0101	Computer and Information Sciences, General	Azusa Pacific University	21	25	5	17
		Chapman University	16	20	25	20
		Los Angeles Pacific College	6	2	2	3
		Loyola Marymount University	27	46	60	44
		Mount Saint Mary's University	0	0	0	0

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		Pacific States University	2	2	4	3
		Pitzer College	0	1	0	0
		The Master's University and Seminary	9	5	3	6
		University of California-Irvine	4	1	0	2
		University of La Verne	23	36	20	26
		University of Massachusetts Global	30	36	37	34
		University of the People	203	292	478	324
		Vanguard University of Southern California	0	0	0	0
		Westcliff University	0	4	22	9
		Supply Subtotal/Average	**341**	**470**	**656**	**489**
11.0103	Information Technology	Bethesda University	0	0	0	0
		Brand College	13	17	18	16
		California Intercontinental University	2	0	0	1
		California State Polytechnic University-Pomona	0	16	21	12
		California State University-Dominguez Hills	4	10	17	10
		California State University-Fullerton	58	62	19	46
		California State University-Los Angeles	180	141	118	146
		California State University-Northridge	29	51	45	42
		Platt College-Anaheim	15	17	12	15
		Platt College-Los Angeles	12	6	3	7
		University of La Verne	2	3	15	7
		University of Massachusetts Global	0	0	1	0
		Westcliff University	0	3	65	23
		Supply Subtotal/Average	**315**	**326**	**334**	**325**
11.0201	Computer Programming / Programmer, General	ABCO Technology	46	34	14	31
		Platt College-Anaheim	4	0	0	1

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		Supply Subtotal/Average	**50**	**34**	**14**	**33**
11.0701	Computer Science	Azusa Pacific University	0	0	9	3
		Biola University	18	18	15	17
		California Institute of Technology	73	84	78	78
		California State Polytechnic University-Pomona	266	297	229	264
		California State University-Dominguez Hills	77	90	96	88
		California State University-Fullerton	360	396	400	385
		California State University-Long Beach	316	304	312	311
		California State University-Los Angeles	177	182	172	177
		California State University-Northridge	172	228	274	225
		Chapman University	30	45	50	42
		Claremont McKenna College	25	17	13	18
		Concordia University-Irvine	0	0	3	1
		Harvey Mudd College	47	48	48	48
		Occidental College	14	14	31	20
		Pitzer College	9	5	10	8
		Pomona College	34	33	49	39
		Scripps College	11	4	6	7
		Southern California Institute of Technology	10	7	5	7
		The Master's University and Seminary	0	0	0	0
		University of California-Irvine	886	990	869	915
		University of California-Los Angeles	437	507	507	484
		University of Southern California	1,273	1,386	1,015	1,225
		Supply Subtotal/Average	**4,235**	**4,655**	**4,191**	**4,360**
11.0901		Brand College	2	0	2	1
		PCI College	0	0	0	0

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
	Computer Systems Networking and Telecommunications	University of California-Irvine	26	20	9	18
		University of Southern California	1	3	1	2
		Supply Subtotal/Average	**29**	**23**	**12**	**21**
11.1001	Network and System Administration / Administrator	ABCO Technology	25	40	104	56
		Brand College	9	16	9	11
		California Intercontinental University	1	1	1	1
		Supply Subtotal/Average	**35**	**57**	**114**	**69**
11.1003	Computer and Information Systems Security / Auditing / Information Assurance	ABCO Technology	0	0	0	0
		Azusa Pacific University	0	0	0	0
		California State University-Dominguez Hills	19	8	39	22
		InterCoast Colleges-West Covina	0	0	2	1
		Learnet Academy Inc	5	4	3	4
		Loyola Marymount University	0	0	0	0
		University of La Verne	0	0	0	0
		University of Southern California	25	29	13	22
		Westcliff University	0	0	0	0
		Supply Subtotal/Average	**49**	**41**	**57**	**49**
11.1006	Computer Support Specialist	Southern California Institute of Technology	26	17	24	22
		Supply Subtotal/Average	**26**	**17**	**24**	**22**
		Supply Total/Average	**5,080**	**5,623**	**5,402**	**5,368**

Regional Demographics

This section examines demographic data for Orange County community college students in computer infrastructure and support programs compared to the OC population, along with occupational data, to identify potential diversity and equity issues addressable by community college programs.

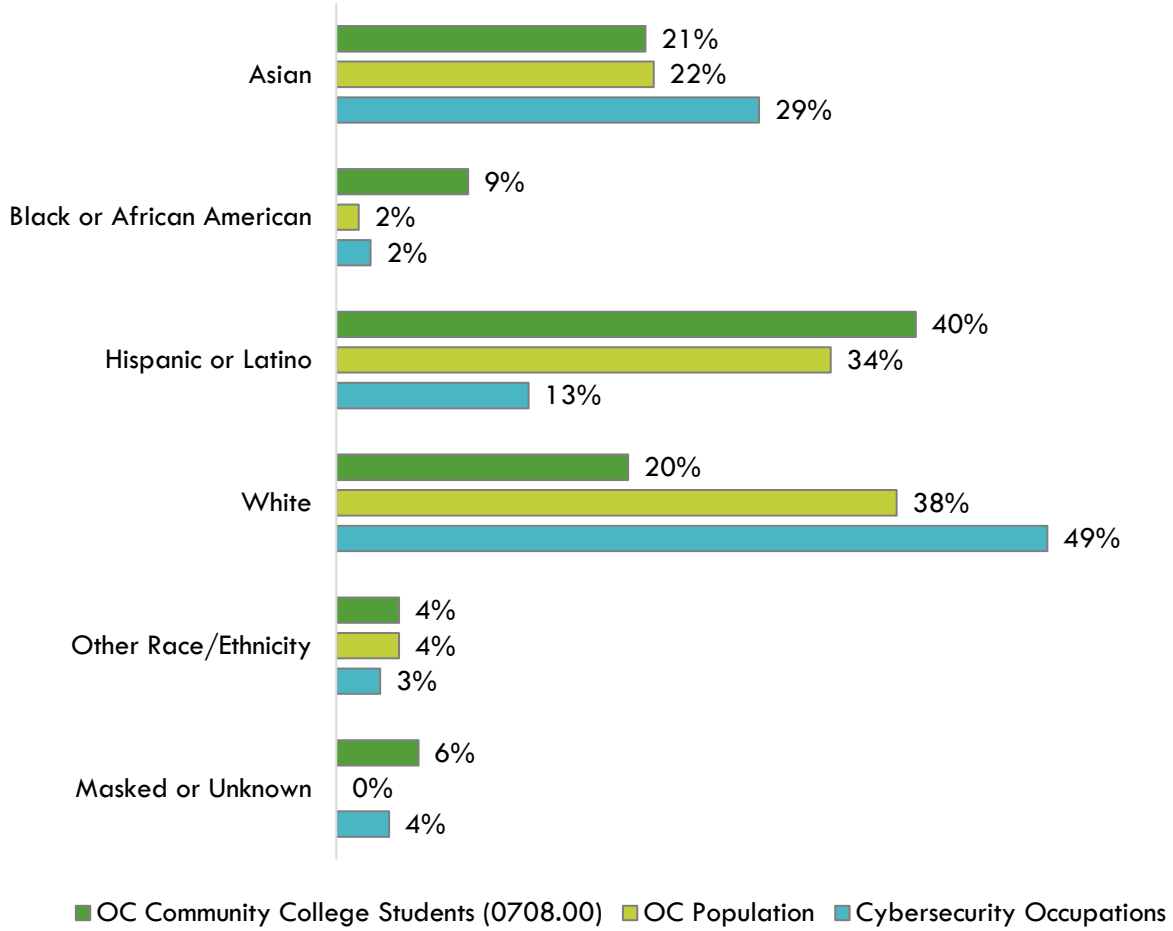
Ethnicity:

Exhibit 15 compares the ethnicity of Orange County community college students enrolled in computer infrastructure and support programs, the overall Orange County population, and occupation-specific data for the three cybersecurity occupations included in this report.

Notably, 49% of workers employed in these cybersecurity occupations are white, which is much higher than the population (38%) and community college computer infrastructure and support students (20%). Conversely, 40% of community college computer infrastructure and support students are Hispanic or Latino, which is higher than the population (34%) and workers in the field (13%).

Examining disaggregated data for each occupation (not shown), white individuals account for the plurality or majority of workers in each of the three occupations: *computer network architects* (58%), *network and computer systems administrators* (54%), and *computer network support specialists* (46%). The occupation with the highest percentage of Hispanic or Latino workers is *network and computer systems administrators* (15%), which has the second highest entry-level wages of the three cybersecurity occupations.

Exhibit 15: Program and County Demographics by Ethnicity



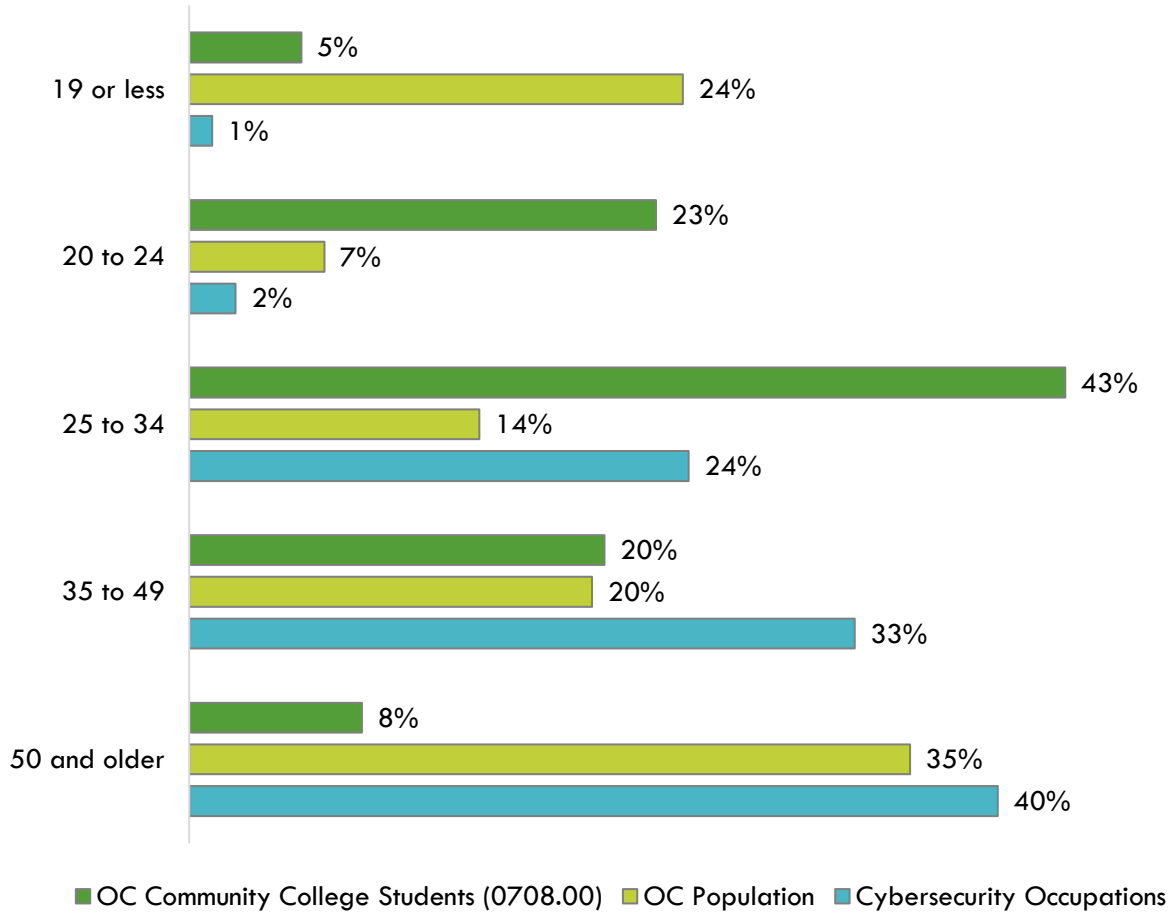
Age:

Exhibit 16 compares the age of Orange County community college students enrolled in computer infrastructure and support programs, the overall Orange County population, and occupation-specific data for the three cybersecurity occupations included in this report.

Nearly 73% of workers in these cybersecurity occupations are 35 and older, which is higher than the population (55%) and significantly higher than community college computer infrastructure and support students (29%). Conversely, 71% of community college computer infrastructure and support students are 34 or less, which is higher than the population (45%) and significantly higher than workers in these occupations (28%).

Examining disaggregated data for each occupation (not shown), the occupation with the highest percentage of workers 34 or younger is *computer network support specialists* (33%), which has the lowest entry-level wages of all three cybersecurity occupations. Conversely, the occupation with the highest percentage of workers 35 and older is *computer network architects* (94%). This occupation also has the highest entry-level wages of the three occupations.

Exhibit 16: Program and County Demographics by Age

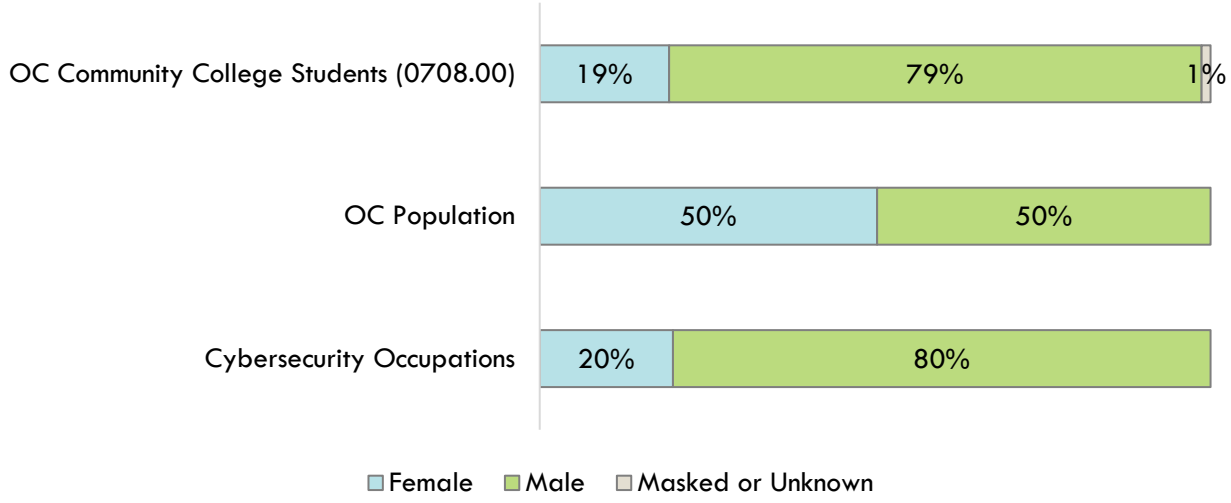


Sex:

Exhibit 17 compares the sex of Orange County community college students enrolled in computer infrastructure and support programs, the overall Orange County population, and occupation-specific data for these cybersecurity occupations.

Though the population is split evenly between women and men, only 20% of workers in the field and 19% of community college computer infrastructure and support students are women. Examining disaggregated data for each occupation (not shown), men account for the majority of workers in each of these occupations: *computer network support specialists* (80%), *computer network architects* (88%), and *network and computer systems administrators* (76%). the occupation with the largest percentage of women is *network and computer systems administrators* (24%), which offers the second highest entry-level wages of the three cybersecurity occupations.

Exhibit 17: Program and County Demographics by Sex



Appendix A: Methodology

The OC COE prepared this report by analyzing data from occupations and education programs. Occupational data is derived from Lightcast, a labor market analytics firm that consolidates data from the California Employment Development Department (EDD), U.S. Bureau of Labor Statistics (BLS) and other government agencies. Program supply data is drawn from two systems: Taxonomy of Programs (TOP) and Classification of Instructional Programs (CIP).

Using a TOP-SOC crosswalk, the OC COE identified middle-skill jobs for which programs within these TOP codes train. Middle-skill jobs include:

- All occupations that require an educational requirement of some college, associate degree or apprenticeship;
- All occupations that require a bachelor's degree, but also have more than one-third of their existing labor force with an educational attainment of some college or associate degree; or
- All occupations that require a high school diploma or equivalent or no formal education, but also require short- to long-term on-the-job training where multiple community colleges have existing programs.

The OC COE determined labor market supply for an occupation or SOC code by analyzing the number of program completers or awards in a related TOP or CIP code. The COE developed a "supply table" with this information, which is the source of the program supply data for this report. TOP code data comes from the California Community Colleges Chancellor's Office MIS Data Mart (datamart.cccco.edu) and CIP code data comes from the Integrated Postsecondary Education Data System (nces.ed.gov/ipeds/use-the-data), also known as IPEDS. TOP is a system of numerical codes used at the state level to collect and report information on California community college programs and courses throughout the state that have similar outcomes. CIP codes are a taxonomy of academic disciplines at institutions of higher education in the United States and Canada. Institutions outside of the California Community College system do not use TOP codes in their reporting systems.

Data included in this analysis represent the labor market demand for relevant positions most closely related to the proposed program as expressed by the requesting college in consultation with the OC COE. Traditional labor market information was used to show current and projected employment based on data trends, as well as annual average awards granted by regional community colleges. Real-time labor market information captures job post advertisements for occupations relevant to the field of study which can signal demand and show what employers are looking for in potential employees but is not a perfect measure of the quantity of open positions.

All representations have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. The most recent data available at the time of the analysis was examined; however, data sets are updated regularly and may not be consistent with previous reports. Efforts have been made to qualify and validate the accuracy of the data and findings; however, neither the Centers of Excellence for Labor Market Research (COE), COE host district, nor California Community Colleges Chancellor's Office are responsible for the applications or decisions made by individuals and/or organizations based on this study or its recommendations.

Appendix B: Data Sources

Data Type	Source
Occupational Projections, Wages, and Job Postings	Traditional labor market information data is sourced from Lightcast, a labor market analytics firm. Lightcast occupational employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics and the American Community Survey. For more information, see https://lightcast.io/
Living Wage	"Living Wage" measures the income necessary for an individual or family to afford basic expenses by assessing the costs such as housing, food, child care, health care, transportation, and taxes. Per the CCCCCO's this report's endorsement criteria uses the University of Washington's Center for Women's Welfare Self-Sufficiency Standard last updated in March 2024, which is $27.13 per hour ($56,451 annually) in Orange County. For more information, see: http://www.selfsufficiencystandard.org/California The MIT Living Wage, updated on February 14, 2024, is a nationally recognized living wage metric and is provided for reference. The current MIT Living Wage in Orange County is $30.48. For more information, see: https://livingwage.mit.edu/counties/06059
Typical Education and Training Requirements, and Educational Attainment	The Bureau of Labor Statistics (BLS) provides information about education and training requirements for hundreds of occupations. BLS uses a system to assign categories for entry-level education, work experience in a related occupation, and typical on-the-job training to each occupation for which BLS publishes projections data. For more information, see https://www.bls.gov/emp/documentation/education/tech.htm
Emerging Occupation Descriptions, Additional Education Requirements, and Employer Preferences	The O*NET database includes information on skills, abilities, knowledges, work activities, and interests associated with occupations. For more information, see https://www.onetonline.org/help/online/
Educational Supply	The CCCCO Data Mart provides information about students, courses, student services, outcomes and faculty and staff. For more information, see: https://datamart.cccco.edu The National Center for Education Statistics (NCES) Integrated Postsecondary Integrated Data System (IPEDS) collects data on the number of postsecondary awards earned (completions). For more information, see https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions
Student Metrics and Demographics	LaunchBoard, a statewide data system supported by the California Community Colleges Chancellor's Office and hosted by Cal-PASS Plus, provides data on progress, success, employment, and earnings outcomes for California community college students. For more information, see: https://www.calpassplus.org/LaunchBoard/Home.aspx

Data Type	Source
Population and Occupation Demographics	The Census Bureau's American Community Survey (ACS) is the premier source for detailed population and housing information. For more information, see: https://www.census.gov/programs-surveys/acs Data is sourced from IPUMS USA, a database providing access to ACS and other Census Bureau data products. For more information, see: https://usa.ipums.org/usa/about.shtml

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