

Cybersecurity Employment Outcomes of Two-Year College Alumni

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2024 CAE in Cybersecurity Symposium





572,392

U.S. Cybersecurity Job Openings
- CyberSeek -

\$6.9 trillion

Global Cost of Cyberattacks in 2021
- FBI -

3,432,476

Global Cybersecurity Workforce Gap
- (ISC)2 -



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Overview



Background & Approach



Findings

analysis & results



Discussion

implications & contributions

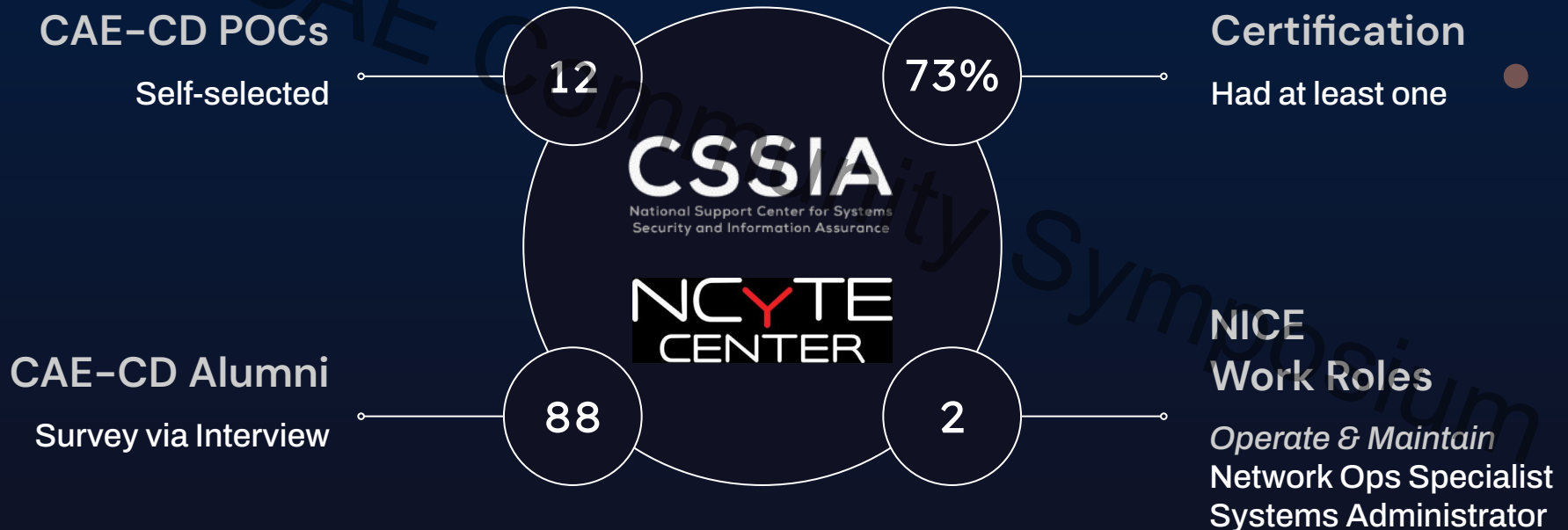
Background & Approach

Prior research & nested sampling

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Workforce Study: Community College Cybersecurity Alumni

Where Are They Now?



Survey Method



CAE-CD Points
of Contact

Quantitative Survey

CAE-CD
Alumni

Quantitative +
Qualitative Survey

Compare

Perceived
Work Roles &
Outcomes

Interpret

Looking for themes &
patterns in preparatory
resources

Cross-Sectional Sequential Mixed Methods Design

Data Analysis

Work Roles

Comparison
POC & Alumni



Preparation

Alumni rating &
resources indicated

Demographics

Alumni & U.S.



Resources

Coding for similarities &
frequency

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Findings

Analysis and results

Population



Employment Rates

88%

Overall

Employed

70%

Tech Roles

Self-Reported

70%

AAS degrees

Associate of
Applied Science

82%

AS degrees

Associate of Science

55%

Certificates

Computer Networking
& Cybersecurity

NICE Work Roles

| WORK ROLE PREP | POC ($n_{1B}=17$) | CURRENT WORK ROLE | ALUMNI ($n_2=90$) |
|-------------------------------|---------------------|---------------------------|---------------------|
| System Administration | 15 | Technical Support | 30 |
| Network Management | 10 | System Administration | 22 |
| Technical Support | 9 | Network Management | 11 |
| Vulnerability Analysis | 9 | Systems Management | 10 |
| Incident Response | 5 | Incident Response | 10 |

Further Education & Program Importance

41%

Continued education

1 AAS, 3 bachelor's,
1 masters

7%

Plan to in the future

48

Important
or Very Important

7

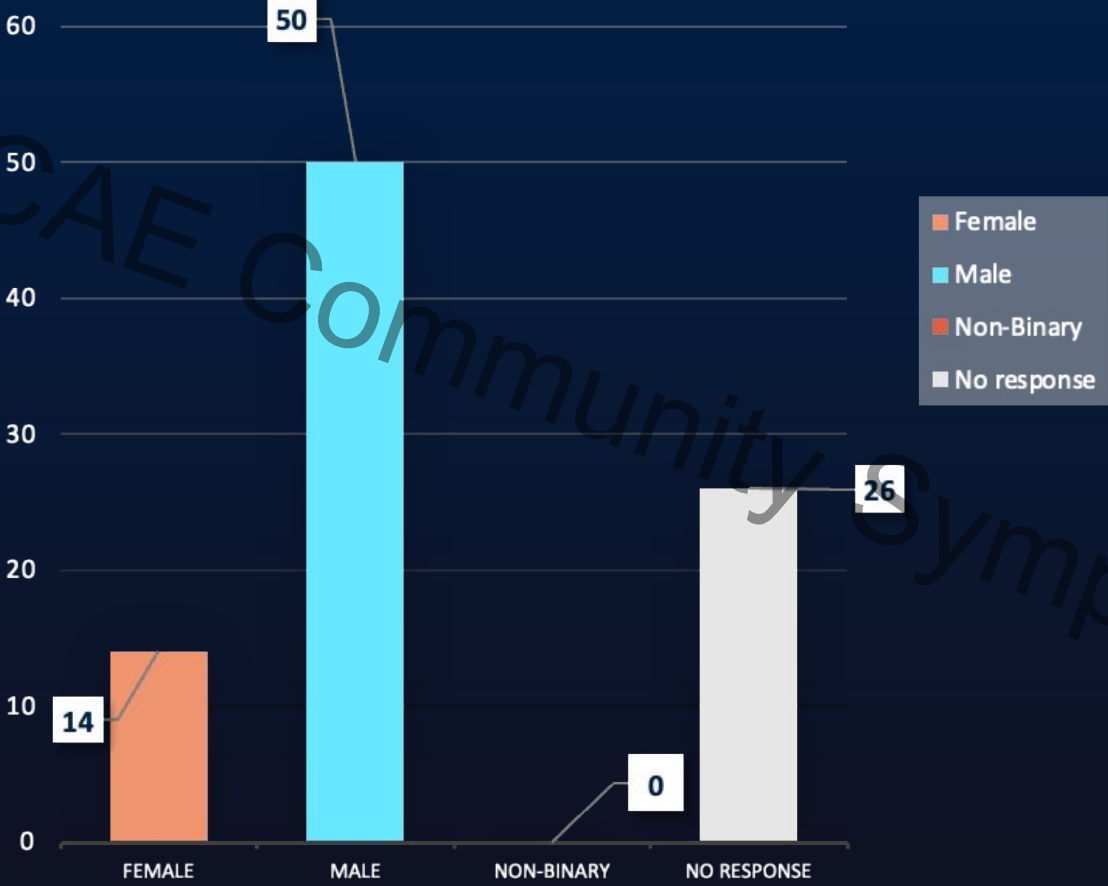
Neutral

8

Unimportant
or Very Unimportant

Alumni Gender Identities

(n₂=90)



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Discussion

Implications and contributions

Comparison to Previous Studies

2019 Study

Operate & Maintain

Network Ops Specialist
System Administrator

2022 JAMK Study

Operate & Maintain

Cyber Defense Analyst
Network Ops Specialist

2023 Study

Implementation & Operation

Technical Support
System Administration

Employed in Field of Study

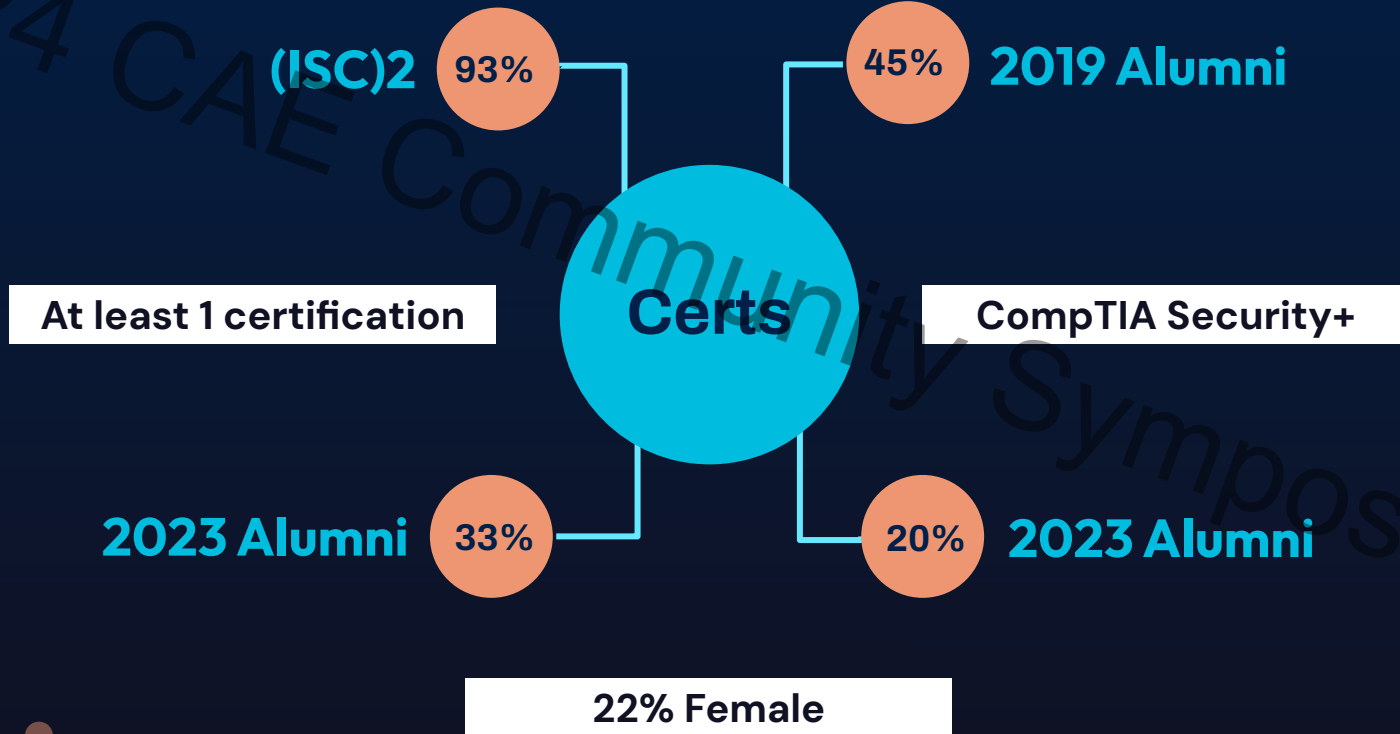
Next Gen
Financial

43%

70%

2023 Alumni

Comparison to Previous Studies



Recommendations



NSA & Agencies

For evaluating work roles, pathway initiatives, and employment offerings for two-year college alumni



NICE

To better inform the list of work roles that two-year college alumni are engaged with in the workplace

Recommendations

Faculty

Many opportunities exist to:

- Evaluate academic programs
- Recognize the need for additional student engagement with program resources
- Increase opportunities for industry-certification prep & access to exam vouchers
- Examine programs for gaps and validate existing practices
- Recognize the need for and value of continued alumni contact



Employers

Better understand the work roles that CAE-CD two-year colleges most often prepare students for and the types of industry certifications the alumni may have achieved



Students

Better understand the prominent work roles that two-year colleges most often prepare students for



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SAFE Community

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Questions

Thank You

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Gratitude

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Background

Terms and introduction

Research Questions

Which cybersecurity work roles of the National Initiative for Cybersecurity Education (NICE) Framework are alumni of Centers of Academic Excellence in Cyber Defense (CAE-CD) two-year colleges employed in as compared to the work roles identified by their college?



What proportion of the cybersecurity program alumni are not employed in any cybersecurity work roles?



What proportion of the alumni pursued another degree within three years of graduation from a CAE-CD two-year college?



How do the alumni gender and ethnicity demographics align with the gender and ethnicity demographics of the cybersecurity workforce of the United States?

Current Situation

Purpose

Examine cybersecurity
program alumni
employment outcomes

Cybercrime

Adversaries are
increasingly sophisticated



Initiatives

Government + academia +
industry projects



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CAE

Centers of Academic Excellence

NSA/DHS Designation
Rigorous Requirements
Education Focus
Build Cyber Workforce



Two-Year Colleges

i.e., Community College

Associate Degrees
Certificates
Career Pathways
High School - University
1000+ Colleges in U.S.

Underrepresented
Populations

NICE Framework

50 Work Roles

NIST/NICE
Taxonomy/Lexicon
Living Document
Government + Industry +
Academia + Public

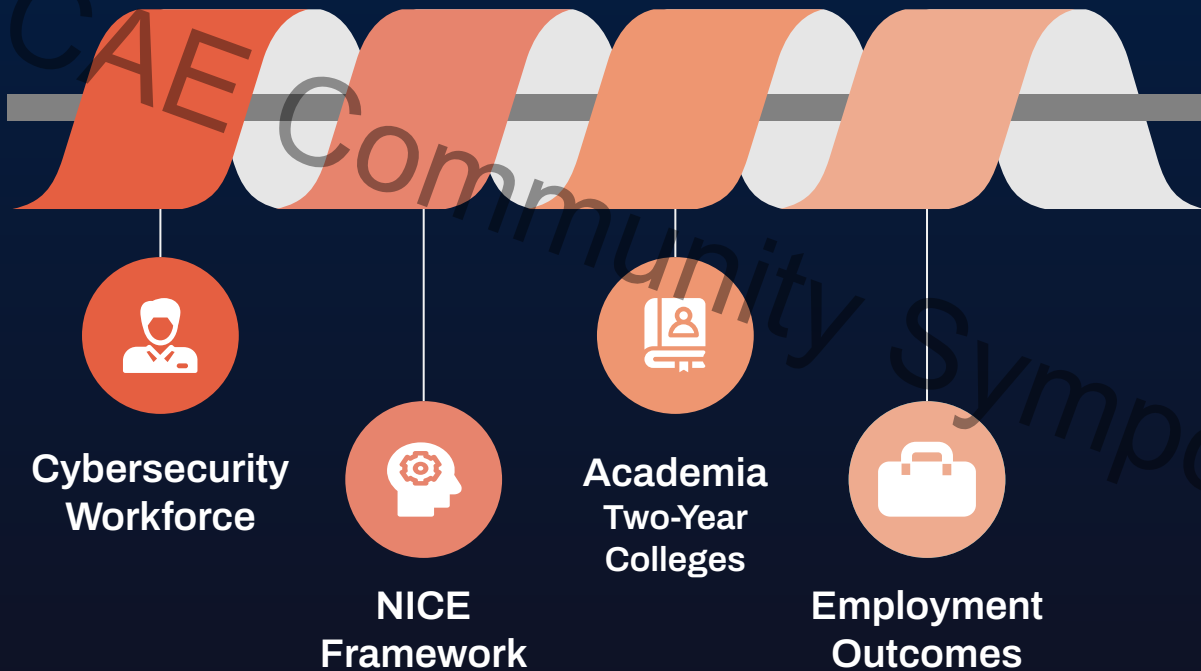


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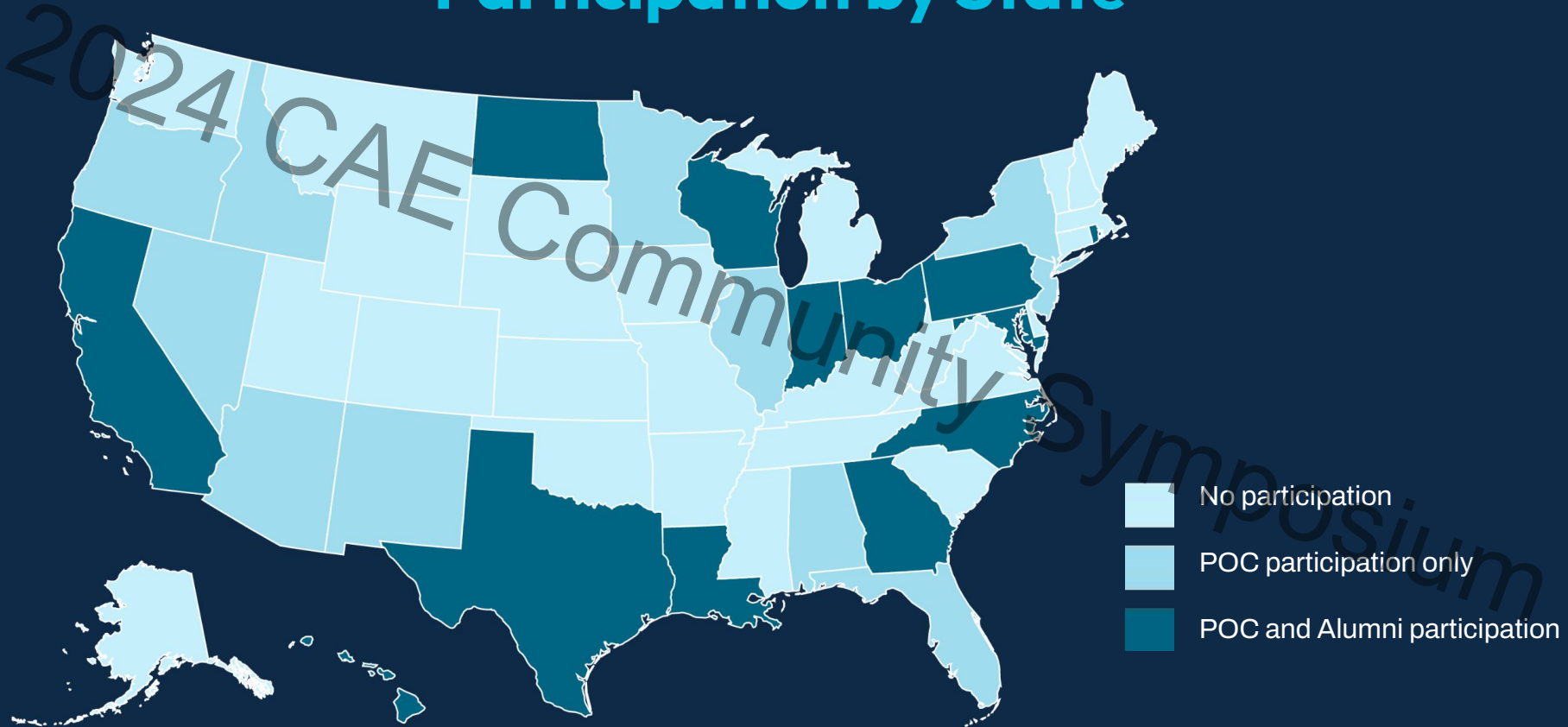
Literature

Academic and industry

Traditional Approach



Participation by State



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Findings

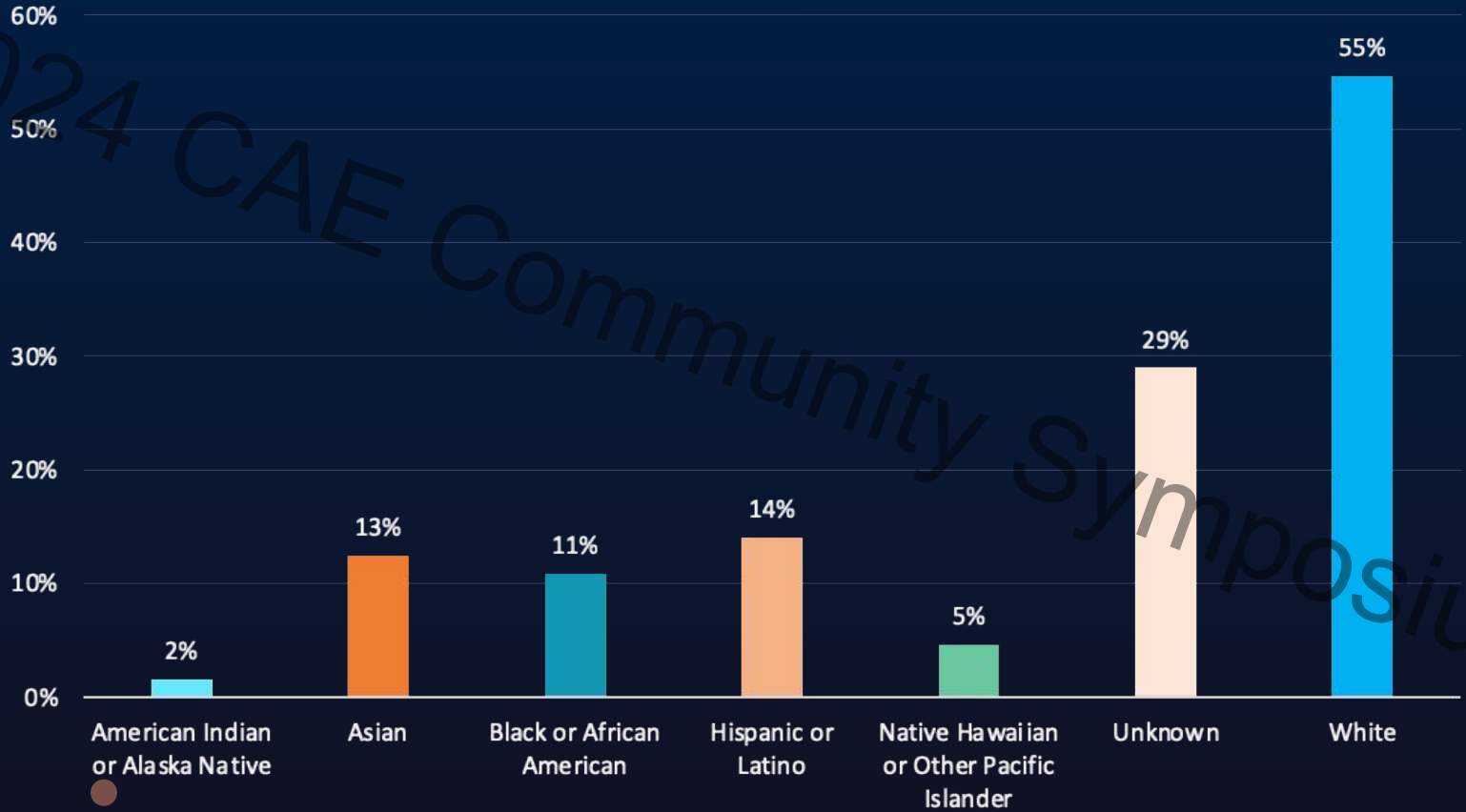
Analysis and results

Co/Extra-Curricular Resources

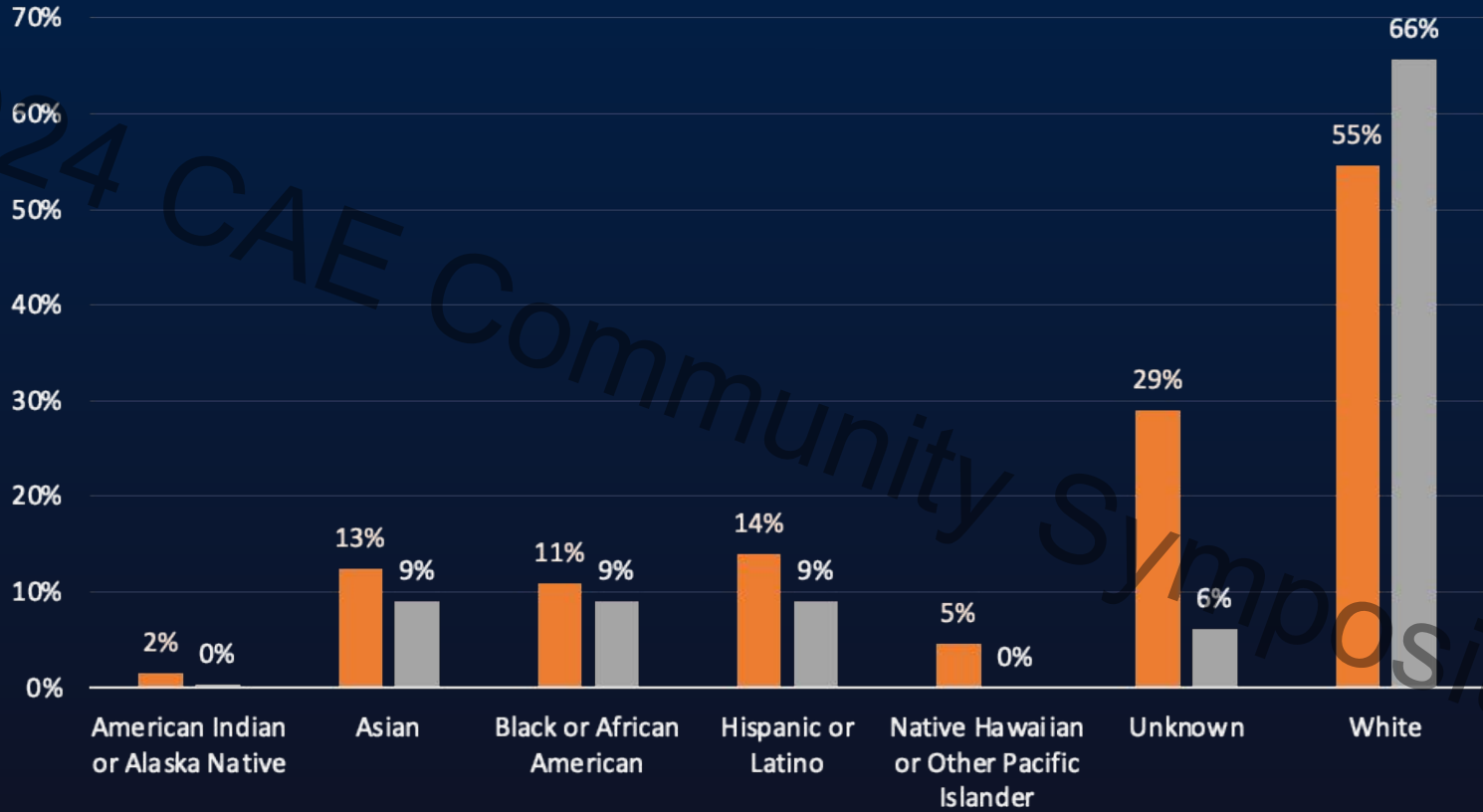
| ACTIVITY | POC (n _{1B} =17) | ALUMNI (n ₂ =90) |
|-------------------------------------|---------------------------|-----------------------------|
| Apprenticeship | 4 (24%) | 5 (6%) |
| Capture-the-Flag (CTF) | 9 (53%) | 23 (26%) |
| Cybersecurity Competitions | 14 (82%) | 18 (20%) |
| Hands-on Labs | 16 (94%) | 36 (40%) |
| Industry Certification Exam Voucher | 8 (40%) | 19 (21%) |
| Industry Speakers | 17 (100%) | 10 (11%) |
| Internship | 4 (24%) | 24 (27%) |
| Student Club | 14 (82%) | 11 (12%) |
| Summer Camp | 4 (24%) | 1 (1%) |
| Other | 5 (29%) | 3 (3%) |
| No Activities | 0 (0%) | 39 (43%) |

Alumni Race & Ethnic Identities

(n₂=90)



Comparison to U.S. Cybersecurity Workforce



2023 Study Zippia

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Conclusion

Future research and remarks

Limitations



Participation

Gaps in participation due to POCs lack of relationships with alumni



Point-in-time

Data is limited by the cross-sectional approach



Privacy Restrictions

Some POCs said they no longer had access to email or contact info due to regulations



Foundational Guide

Although limited, this study can be used as a guide for future studies

Future Research



Longitudinal

Follow career patterns and further education impacts on work roles



Co/Extra-Curricular

Correlate program resources to impact on work roles; emphasis on competitions



Contributing Factors

Ask alumni to rank contributing factors that led to their work roles



Two- & Four-Year

Compare and contrast college and university employment outcomes

Concluding Remarks



Workforce Landscape

Two-year college programs should continue to raise awareness to influence non-traditional & historically underrepresented populations to pursue cybersecurity education & careers.



Alumni in Tech Roles

Relationships with POCs can be a key to establishing additional industry partnerships for the college and returning to encourage other students in their cybersecurity studies



Maintain Relationships

Relationships with alumni appear to be underutilized as a program resource

References

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