The Underrepresentation of Black Females in Cybersecurity

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Introduction

Cybersecurity is the practice of protecting computer systems, networks, and data from unauthorized access, cyberattacks, and other digital threats. It involves a wide range of strategies and technologies aimed at safeguarding information and ensuring the confidentiality, integrity, and availability of digital assets. However, despite the critical importance of cybersecurity in today's increasingly digital world, one pressing issue is the severe underrepresentation of black females within the cybersecurity field. This underrepresentation hinders diversity in the industry and presents a significant challenge in addressing evolving and complex cybersecurity threats. Consequently, it is important to examine the factors contributing to the underrepresentation and propose solutions that can actively promote inclusivity in the cybersecurity field.

The Problem Statement

This paper focuses on the obstacles hindering the presence of Black females within the field of cybersecurity. The potential consequences of the absence of African American women in this field include reduced diversity, limited perspectives, and reinforced stereotypes. Addressing this issue requires further research to understand these barriers and discover practical solutions that can be implemented in real-world situations.

The Background of the Problem

Despite claims from technology and cybersecurity companies about promoting diversity, equity, and inclusion (DEI) in recent years, the cybersecurity field continues to be predominantly represented by white males. Recent data from the (ISC)[2] Cybersecurity Workforce Study reveals that just 24-25 percent of cybersecurity professionals are women; and of the percentage, only nine percent are black females (ISC[2], 2019). Women and individuals from diverse racial backgrounds are underrepresented in leadership roles within cybersecurity firms (Stewart & Sistla, 2021). Also,

according to Aspen Institute, both the government and the private sector express concerns about a shortage of cybersecurity talent, with numerous unfilled positions, blaming a perceived lack of qualified candidates (Stewart & Sistla, 2021). The big gap between what is said about promoting diversity and what is seen in the cybersecurity workforce shows the urgent need to take strong and effective steps to tackle the problems that block diversity and inclusion in the field.

Barriers Faced by Black Females

Socioeconomic factors

Socioeconomic factors play a significant role in the underrepresentation of Black females in cybersecurity. Lower-income communities often lack the resources to support Science, Technology, Engineering, and Mathematics (STEM) education and extracurricular activities necessary for skill development in cybersecurity. The economic disparities that exist, therefore, pose a significant barrier to entry for Black females interested in pursuing careers in this field. Gaining access to high-quality STEM education is a crucial foundation for individuals aspiring to enter careers like cybersecurity.

The absence of quality STEM education not only limits an individual's knowledge and skills but also has far-reaching consequences, particularly for underrepresented groups. When people lack exposure to rigorous STEM education, it can impede their pursuit of careers in STEM-related fields, including cybersecurity. This limited access is particularly concerning for Black females, who often experience both gender and racial underrepresentation. Research conducted by scholars emphasizes the pivotal role of quality STEM education in shaping one's career opportunities and provides insights into how the lack of quality STEM education creates difficulties for women of color (Ong et al., 2011). It reveals the obstacles they encounter in obtaining the necessary educational resources to succeed in these fields (Ong et al., 2011).

Discrepancies to access rigorous STEM education continue to contribute to the underrepresentation of Black females in cybersecurity, highlighting the requirement to tackle this problem by ensuring that everyone, regardless of their economic circumstances, has equal access to quality STEM education and skill development opportunities.

Moreover, extracurricular activities, which are essential for skill development, often demand financial means and accessibility. In many lower-income communities, these opportunities are in short supply, leaving aspiring Black females without the resources to develop the expertise and connections necessary for success in the field of cybersecurity. Additionally, economic disparities not only hinder access to educational resources but also impact the pursuit of higher education and training (Turner et al., 2008). As a result, these economic disparities create an ongoing cycle of inequality that stops minority groups from advancing in their education and careers.

Lack of access to education and resources

Access to quality education and resources is another contributing factor. Limited access to technology and high-speed internet can hinder the development of necessary digital skills, which can limit the pathway to cybersecurity careers for Black females and worsen the underrepresentation issue. In addition to this, the lack of computer science and cybersecurity courses in many U.S. schools contributes to the underrepresentation of Black females in cybersecurity. Only six percent of high school students have taken computer science and cybersecurity-related classes, with even fewer opportunities in elementary and middle schools. While there has been some progress, with the percentage of high schools offering computer science courses increasing from 35% in 2018 to 51% in 2021, disparities persist (Klein, 2021). It is hard to be interested in a field, such as cybersecurity, if an individual is not exposed to it earlier in their

life or if they do not have a role model in that particular field. Also, role models not only inspire but also show what is possible, boosting confidence. The absence of these factors can discourage Black females from considering cybersecurity as a career, so creating opportunities for early exposure and diverse role models is crucial for breaking down barriers and encouraging underrepresented groups to explore cybersecurity.

Stereotypes and biases

Stereotypes and biases are common in the technology and cybersecurity industries, which especially impact Black females. These biases not only impede their entry into the field but also make advancement within it challenging. Gender bias remains a pervasive issue in these industries, with the perception that certain roles are traditionally meant for men. This bias can be seen in various forms, including the underrepresentation of women in leadership positions and a general lack of diversity. For Black females, this gender bias often intersects with racial bias, worsening the challenges they face. They may confront the assumption that they do not fit the traditional idea of a technology or cybersecurity professional, which can lead to exclusion and limited opportunities. Racial bias intensifies these challenges further, as Black females encounter stereotypes and biases related to both their gender and race. They may confront preconceived notions that they are less qualified or less capable than their peers, despite their skills and qualifications. This can lead to implicit or explicit discrimination and a lack of access to mentorship and career advancement opportunities. As a result, Black females often find the workplace less than welcoming, impacting their ability to succeed. Recognizing and addressing these biases is crucial for promoting diversity and equality in these industries, fostering inclusive and supportive work environments.

Workplace culture and inclusivity

The workplace culture and inclusivity, or the lack thereof, within the cybersecurity industry represents another significant factor contributing to the underrepresentation of Black females in the cybersecurity field. The absence of inclusive workplace practices has a direct impact on the underrepresentation issue, as it fails to create an environment where Black females can enter the field to thrive, advance, and reach their full potential. For instance, David A. Harrison and Katherine J. Klein's research, as presented in "What's the difference? Diversity constructs as separation, variety, or disparity in organizations," provides valuable insights into the detailed aspects of diversity within organizations (Harrison & Klein, 2007). Their work highlights that the presence of individuals from underrepresented groups, such as Black females, is not enough to address underrepresentation (Harrison & Klein, 2007). Rather, a more significant transformation involving inclusion and equity is required (Harrison & Klein, 2007). To add on to this, the study also underscores the importance of fostering workplace environments that move beyond token representation and actively encourage diversity and inclusion (Harrison & Klein, 2007). Inclusivity is not a one-time effort restricted to recruitment but an ongoing process that is instrumental in sustaining long-term changes within organizations. Creating an inclusive culture is essential for retaining diverse talent, fostering innovation, and enabling employees to bring their whole selves to work.

Impact of underrepresentation on the cybersecurity industry

The underrepresentation of Black females in the cybersecurity industry has profound implications for the field. Research by the National Initiative for Cybersecurity Education (NICE) reveals in its report "The Cybersecurity Workforce: Ensuring Our National Security" that diversity within the workforce fosters a wider range of perspectives, leading to more creative problem-

solving and innovation (Bate & Weingarten, 2019). The lack of Black females in cybersecurity limits the industry's ability to harness these benefits. Moreover, underrepresentation can also bias decision-making when a workforce lacks diversity, potentially maintaining inequalities, so addressing the underrepresentation issue is not only a matter of social justice but also a necessity for ensuring the industry's long-term growth, security, and success.

Solutions

Education programs and outreach efforts

Education programs and outreach efforts play a noteworthy role in addressing the underrepresentation issue of Black females in cybersecurity. By providing access to quality education and targeted outreach, these initiatives can help bridge the gap between underrepresented groups and the opportunities within the field. These programs offer tailored learning programs, scholarships, and resources that can empower Black female students to pursue careers in cybersecurity. They also organize workshops, seminars, and mentorship sessions, facilitating a supportive environment where participants can engage with role models and industry professionals. The Cybersecurity Workforce Study conducted by the Center for Cyber Safety and Education in 2019 underscores the importance of educational initiatives in building a more diverse cybersecurity workforce (ISC², 2019). This research highlights the need for promoting cybersecurity education at an early age to attract underrepresented groups. Furthermore, reports like the 2020 (ISC)² Cybersecurity Workforce Study emphasize the growing demand for cybersecurity professionals and the importance of diversity in addressing the industry's skills gap (ISC², 2020). Education programs and outreach efforts, when designed and executed effectively, can help Black females overcome barriers and gain access to the education, mentorship, and networking opportunities essential for success in the cybersecurity field.

Mentorship and sponsorship programs

Mentorship and sponsorship programs have the potential to effectively address the underrepresentation issue of Black females in cybersecurity. These programs offer critical support, guidance, and opportunities for individuals who often face unique challenges and biases in the field. Mentors can provide valuable insights, helping mentees navigate the complexities of the cybersecurity industry, from technical skills development to career advancement strategies. Moreover, sponsors, who actively advocate for and promote their proteges, can open doors to networking, job opportunities, and leadership roles that might otherwise remain out of reach for marginalized groups. By actively promoting and facilitating mentorship and sponsorship opportunities, the cybersecurity industry can foster a more inclusive and equitable environment for Black female professionals, ultimately benefitting the entire field.

Creating inclusive workplace environments

Creating an inclusive workplace environment holds the potential to substantially mitigate the underrepresentation of Black females in the cybersecurity field. When organizations actively foster diversity and equity, they provide opportunities for individuals from underrepresented groups, like Black females, to thrive and excel in the industry. Inclusive environments ensure that Black female professionals are welcomed, valued, and supported, thus reducing feelings of isolation and the impact of unconscious biases. These environments also encourage mentorship, networking, and professional development, which are essential for career advancement as stated above. The cybersecurity industry can benefit from these practices to create a more diverse and representative workforce. Inclusive workplaces help break down the barriers that have historically excluded Black females and, in turn, contribute to a more balanced and innovative cybersecurity industry.

Advocacy and awareness campaigns

Advocacy and awareness campaigns are essential in addressing the underrepresentation of Black females in cybersecurity. These campaigns raise awareness about the disparities in the field and advocate for the active inclusion and advancement of Black females. By leveraging various platforms, including social media and partnerships, these initiatives highlight the achievements of Black females in cybersecurity and spotlight the need for equal representation. They foster conversations, inspire action, and prompt organizations to implement policies and practices that promote inclusivity. Advocacy and awareness campaigns contribute significantly to dismantling biases, promoting access, and ensuring a more balanced and equitable representation of Black females in the cybersecurity workforce.

Success Stories and Role Models

The inclusion of insights gathered from interviews with three accomplished women in the cybersecurity field provides valuable perspectives on their journeys and experiences. These interviews shed light on the challenges these accomplished women have overcome, the milestones they have achieved, and the impact they have made within the industry. Their stories serve as inspiring examples for aspiring Black females looking to pursue careers in cybersecurity. Through these interviews, the experiences and wisdom of these women offer guidance and motivation, illustrating that success in the cybersecurity field is attainable and paving the way for future generations of underrepresented individuals to find their own paths to success.

Ms. Renata C. Spinks is a trailblazer and an inspirational figure in cybersecurity, particularly as a black female breaking barriers in a field marked by underrepresentation. With a distinguished career, including being the Chief Executive Officer of a technology start-up named CyberSec International, serving as Assistant Director/Deputy Chief Information Officer at the

Information, Command, Control, Communications, and Computers Department within the Senior Executive Service of the Headquarters Marine Corps, and making history as the nation's first Cyber Technology Officer within the Marine Corps at Marine Forces Cyberspace Command, Ms. Spinks offers a compelling success story. Her motivation stemmed from a military deployment experience where the critical need for cybersecurity practices became apparent. She emphasizes the importance of staying in the field to pave the way for others who look like her.

However, her journey has not been without challenges. Ms. Spinks has encountered managers who were dismissive and degrading, highlighting the need for a more inclusive and supportive industry culture. Despite these challenges, Ms. Spinks found inspiration in General Officers within the Marine Corps and Brigadier General Select Orientation Course (BGSOC) class of 2018. She also sheds light on other potential problems faced by black females in cybersecurity, such as the mental challenge of preparing to be the only black female in the room and dealing with the absence of a clear roadmap in the field. One important quote from Ms. Spinks underscores the impact of the lack of representation: "…if there is not a lot of us [black females] in the room, we have no one to gravitate to and we don't feel comfortable" (Crosby & Spinks, 2023).

The underrepresentation of black females in cybersecurity has broader implications for the industry, affecting both the quantity and quality of personnel. Ms. Spinks stresses the importance of addressing this issue to ensure a diverse and inclusive workforce, especially in emerging technologies like machine learning algorithms. To overcome these challenges, Ms. Spinks advocates for staying informed, asking questions, seeking mentorship, and diversifying one's skill set. Her advice, "those who matter will try to elevate you, those who don't will try to keep you down," resonates as valuable guidance for future black females navigating the cybersecurity field

(Crosby & Spinks, 2023). Additionally, she underscores the significance of being oneself and persevering in the face of adversity.

Addressing the underrepresentation issue requires proactive measures, including introducing coding and cybersecurity curriculum in elementary and middle schools. Ms. Spinks proposes targeting 5th-6th graders, acknowledging their early exposure to social media and financial responsibilities. By fostering early interest and education in these areas, the industry can begin to break down barriers and promote greater diversity and inclusion.

Colonel Lynne Hamilton-Jones, USAF is an accomplished individual with a commendable 25-year career in the U.S. Air Force followed by a successful trajectory in the corporate sector. Her military service showcased her expertise as an engineer, project manager, and director on pivotal communication systems and aircraft development projects, including the Joint Strike Fighter, C-17, and Defense Travel System. Notably, she currently serves as the Senior Program Manager at the Department of Transportation, overseeing all of her company's contracts providing crucial cybersecurity support, emphasizing her commitment to national security.

Col. Hamilton-Jones transitioned into the cybersecurity field after retiring from the Air Force, inspired by the growing importance of cybersecurity and her pride in serving her country. She also devoted several years of service to her alma mater, Virginia Tech. As the first African American to serve as Chairperson of the Electrical and Computer Engineering (ECE) Department Industrial Advisory Board and be inducted into the Virginia Tech ECE Academy of Distinguished Alumni, she stands as a pioneer and role model. Despite her accomplishments, Col. Hamilton-Jones acknowledges the existence of bias in the industry, where people sometimes see color first. Her advice to overcome this barrier is to excel in one's work so that others remember the achievements rather than focusing on color.

The industry impact of underrepresentation is underscored by Col. Hamilton-Jones, who notes the missing variety in perspectives that black females bring to the table. Strategies and initiatives recommended by Col. Hamilton-Jones include finding and maintaining communication with mentors and seeking advice from those who have achieved success. She encourages pushing boundaries and networking through company connections to establish meaningful relationships.

Col. Hamilton-Jones finds inspiration in those who have supported her journey, such as Walter Jones, a retired Black brigadier general of the Air Force who went on to become the Founder of his own cybersecurity firm. He was the first person to hire Col. Hamilton-Jones after her military service and served as a valuable mentor to her during her transition to the commercial world. She recommends that future Black females in the cybersecurity field closely examine and pursue job opportunities that continually challenge one's capabilities, while also planning career paths that consider personal and family goals (Crosby & Hamilton-Jones, 2023).

To address the underrepresentation issue, Col. Hamilton-Jones advocates for outreach programs for youth to increase exposure and emphasizes the importance of talking more about the achievements of people of color in the cybersecurity field. This proactive approach aims to inspire and attract a more diverse talent pool, fostering an inclusive and representative industry.

Dr. Aurelia Williams stands as a dedicated leader with a profound commitment to advancing higher education. Dr. Williams' journey in higher education began with inspiration from a previous employer after graduating from Norfolk State University (NSU). She embarked on a career at the National Security Agency located at Fort Meade, MD before returning to her alma mater as the Senior Vice Provost for Academic and Faculty Affairs and Founding Executive Director of NSU's Cybersecurity Complex, bringing her skills to new research initiatives. However, her path was not without barriers; faced with peers questioning her competence, she

consistently felt the need to prove herself. Despite these challenges, she persevered, becoming a trailblazer. An important quote from Dr. Williams captures what it is like being a black female in the cybersecurity field and a perspective from her experience: "The challenge of being the only one [black female] at the table, means you bear the weight of speaking for everyone" (Crosby & Williams, 2023).

Her role models, who broke glass ceilings in different STEM fields, inspired Dr. Williams to provide similar opportunities for students. The advice she received and now imparts to future black females focusing on the lifelong learning nature of the field. According to Dr. Williams, "… you don't necessarily master the craft, you master your ability to learn" (Crosby & Williams, 2023). She advocates for creating networks, emphasizing that support can come from anyone regardless of their race, ethnicity, or gender. This is important to note since Dr. Williams puts signficant importance on how underrepresentation can impact the cybersecurity industry; it can lead to a lack of diversity in thought and limit the consideration of perspectives from certain groups of people.

To address the underrepresentation issue, Dr. Williams encourages early consideration of the field, making outreach programs available to showcase the fun and rewarding aspects of pursuing a career in cybersecurity. Through her inspiring journey, impactful initiatives, and invaluable advice, Dr. Aurelia Williams continues to shape the landscape of higher education and champion diversity and inclusion in the cybersecurity field.

Conclusion

In summary, the underrepresentation of Black females in the cybersecurity field presents a complex challenge rooted in various systemic obstacles. These hurdles, stemming from socioeconomic disparities, limited educational access, workplace biases, and a scarcity of role

models, pose significant barriers for Black females pursuing careers in this vital industry. Nonetheless, the experiences and insights of accomplished professionals provide not only inspiration but also a roadmap for addressing this issue. Achieving a more inclusive and equitable cybersecurity sector demands collaboration among industry, educational institutions, and policymakers. By dismantling barriers associated with the underrepresentation of Black females in cybersecurity and fostering a supportive environment, society can ensure that Black females enjoy equal access to this critical field. Inclusivity will enrich the industry with diverse perspectives, talent, and innovation. Through collective efforts, mentorship, and dedicated initiatives, progress can be made towards achieving a cybersecurity field that genuinely reflects the diversity of our society.

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