

2024

# Post graduate dental career outcomes of students from Boston University's master's in Oral Health Sciences

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BOSTON UNIVERSITY

ARAM V. CHOBANIAN & EDWARD AVEDISIAN SCHOOL OF MEDICINE

Thesis

**POST GRADUATE DENTAL CAREER OUTCOMES OF STUDENTS FROM  
BOSTON UNIVERSITY'S MASTER'S IN ORAL HEALTH SCIENCES**

by

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B.S., Boston College, 2022

Submitted in partial fulfillment of the  
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2024



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BOSTON UNIVERSITY'S MASTER'S IN ORAL HEALTH SCIENCES**

**IROBOSA ENABULELE**

**ABSTRACT**

The Master's in Oral Health Sciences (OHS) program, part of Boston University's Graduate Medical Sciences in collaboration with Henry M. Goldman School of Dental Medicine, has aimed since its inception in 2005 to provide a pathway for students from underrepresented backgrounds to strengthen their academic qualifications for entry to dental school. This study evaluates the efficacy of the OHS Pathway program in supporting students in achieving their career aspirations while also contributing to the number of graduates from underrepresented backgrounds pursuing dental specialties. Data was sourced from deidentified OHS matriculation and graduation records and compared to published data obtained from the American Dental and the American Dental Education Associations. Student careers outcomes post-dental school were obtained from online platforms, including social media networks and LinkedIn.

The study evaluated data from 263 students enrolled in the OHS program between 2006 and 2018, capturing a range of demographics including race, ethnicity, gender, disadvantaged and first-generation status, along with OHS admission years and career status. Underrepresented minority (URM) status, including Black or African American, Hispanic or Latino, American Indian or

Alaska Native, and Native Hawaiian or Other Pacific Islander, were examined within the dataset. This comprehensive collection of demographic data aimed to shed light upon the career outcomes of former OHS students from historically underrepresented racial and ethnic backgrounds and compare the results with national statistics. This information has the potential to uncover trends, barriers, and opportunities faced by these groups in dentistry, offering insights into diversity and representation within the profession.

The results of this study demonstrate the success of the Oral Health Sciences Pathway Program in enhancing diversity in the dental profession. Graduates from the OHS master's program successfully pursue careers in both general practice (75.1% OHS; 92.2% URM-OHS) and specialization (24.9% OHS; 7.8% URM-OHS) in post-graduate programs. Interestingly, a smaller proportion of OHS URM graduates chose to specialize (7.86%) compared with national URM graduate trends (15.46%). Additional studies are needed to investigate potential factors resulting in this difference, as well as long-term career outcomes.

Overall, OHS stands as a model program, potentially setting a precedent for replication by other pre-professional schools. This study highlights the OHS program's significant success in providing a path for students, potentially overcoming previous academic challenges, to gain admission to dental school and develop a successful career in dentistry. This emphasizes the growing

importance of creating pathway programs akin to OHS to enhance diversity and inclusion within the dental profession.

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## LIST OF ABBREVIATIONS

ADA	American Dental Association
AEGD	Advanced Education in General Dentistry
BU	Boston University
DSOs	Dental service organizations
GPR	General Practice Residency
GSDM	Henry M. Goldman School of Dental Medicine
HUREs	Historically underrepresented races/ethnicities
MAMS	Masters in Medical Sciences
OHS	Oral Health Sciences
RWJF	Robert Wood Johnson Foundation
STEM	Science, technology, engineering and math
URM	Underrepresented minority

## INTRODUCTION

Dental school graduates typically find themselves entering a field with a strong demand for their expertise. Many opt for private practice, either by starting their own clinic or joining established dental offices, allowing them to serve their communities directly. Some graduates pursue specialization by undertaking additional education in areas such as orthodontics, periodontics, or endodontics, to hone their skills in niche areas of dental care. Others gravitate towards research, academia, or public health roles, contributing to advancements in dental science, education, or advocating for better oral health on a larger scale. Overall, dental school graduates have a range of avenues to explore, with opportunities for professional growth and impact in various facets of oral healthcare.

Minorities graduating from dental school often face unique challenges despite the overall positive outcomes of dental education (Poole et al., 2022). The representation of minorities within the dental profession remains relatively low compared to the general population. Factors such as financial barriers, limited access to mentorship opportunities, and systemic inequalities in education and healthcare contribute to this disparity (Poole et al., 2022). Additionally, cultural and societal factors might deter some minority students from pursuing dentistry as a career. This underrepresentation not only affects diversity within

the profession but also impacts access to dental care for minority communities, highlighting the importance of efforts to increase diversity in dental education and address these disparities through mentorship programs, scholarships, and initiatives that promote inclusivity within the field. Increasing the representation of minorities among dental school graduates is crucial for addressing oral healthcare disparities and ensuring equitable access to dental services for all communities (Poole et al., 2022).

In 2020, the dental workforce in the United States was composed of 70.2% White dentists, 18% Asian dentists, 5.9% Hispanic dentists, and 3.8% Black dentists. Comparatively, in 2005, White dentists made up 79.8%, Asians were 11.8%, Hispanics were 4.2%, and Black dentists accounted for 3.7%. Over time, the dental student body has become more diverse, with increasing numbers of Asian and Hispanic students. Presently, nearly a quarter of dental students are Asian, compared to their representation of 18% among dentists overall and 6% in the broader U.S. population (ADA, 2023). However, disparities persist in access to dental care and oral health status among the Black, Hispanic or Latino, and American Indian or Alaska Native populations. These groups remain underrepresented within the broader dental workforce, highlighting a gap between the demographic makeup of dental professionals and the diverse population they serve.

The representation of different ethnicities across various specialties within dental school can significantly influence outcomes post-graduation (Veal et al., 2004). Understanding the proportion of ethnicities in these specialties offers insights into the diversity of the dental workforce and the potential impact on patient care. For instance, if certain specialties have a higher representation of specific ethnic groups, it could lead to more culturally sensitive and tailored care for patients from those backgrounds. Additionally, having a diverse cohort of dentists across specialties may positively impact access to care in underserved communities, where patients often seek providers who understand their cultural context and language (Veal et al., 2004). Moreover, a diverse range of perspectives within specialties can foster innovation, problem-solving, and collaboration, potentially leading to improved approaches in dental care delivery. Ultimately, exploring the ethnic composition within dental specialties is pivotal in shaping the future landscape of dental practice and its broader impact on oral healthcare outcomes for diverse patient populations (Mertz et al., 2016).

Pipeline programs aimed at bolstering STEM (science, technology, engineering, and math) education and increasing minority representation strive to fortify the pathway for undergraduate students towards graduate schools. These initiatives are tailored to nurture talent and ignite interest in the sciences, fostering an inclusive environment for STEM undergraduates. By providing enriched educational experiences, these programs not only enhance retention

rates among STEM students but also significantly elevate the likelihood of their progression into graduate-level education (Smith et al., 2009). Their fundamental objective lies in cultivating a diverse pool of aspiring scholars, facilitating their academic success, and ultimately increasing the representation of underrepresented groups in advanced educational dental settings.

Established as a track within the well-known Masters in Medical Sciences (or MAMS) program at Boston University (BU) (MS in Medical Sciences, Boston University), the Oral Health Sciences (OHS) program was founded in 2005. Since then, over 400 students have successfully graduated from the OHS program (Davies et al., 2019). Additionally, over 90% of students who have completed the program have been accepted into dental schools in the United States (Abbas et al., 2014). These achievements have been notably recognized on a national level and as a result, the OHS program became a standalone master's degree in 2013 (Davies et al., 2019).

OHS was initially established as part of the national Pipeline, Profession, and Practice: Community-Based Dental Education initiative (Abbas et al., 2014). The main objective of this initiative was to enhance the academic preparedness of students from underrepresented minority groups along with students from disadvantaged backgrounds in the field of dentistry. With the goal of recruiting more students from disadvantaged backgrounds and underrepresented groups, the Henry M. Goldman School of Dental Medicine (GSDM) at Boston University

and the Chobanian & Avedisian School of Medicine at Boston University (then Boston University School of Medicine) joined together and introduced the Oral Health Sciences program in 2005 (Davies et al., 2019)

The program requires that students complete 32 credits across four semesters. Some students complete the program in one, one and half, or two years. This structure is appealing to students and allows them to choose a schedule that fits their timeline and career path. In addition to a flexible schedule, students take three DMD courses (Davies et al., 2019). Due to its competitive application pool and its advanced curriculum development and reputation, enrollment has increased from less than 10 when it began in 2005 to over 40 students now in 2023.

## LITERATURE REVIEW

### Dental School Graduates and Career Outcomes

After graduating from dental school, dental students embark on diverse and rewarding career paths. A common trajectory is entering clinical practice, where graduates can opt to work as general dentists, providing comprehensive oral care to a broad patient base. Many choose to establish their own private practice, establish their clinics or partner with existing practices. Joining group practices or dental service organizations (DSOs) is another avenue, offering collaborative environments and shared resources (Spears et al., 2013). For those with specialized interests, becoming a dental specialist, such as an orthodontist, oral surgeon, or periodontist allows for in-depth focus within a particular area of dentistry is another option. Choosing to enter an Advanced Dental Education Program is a significant investment of time as these residency programs are an additional 2-6 years (ADA, 2023). There is also an option of a one-year GPR (General Practice Residency) or AEGD (Advanced Education in General Dentistry) option (Spears et al., 2013). These programs allow students to gain one additional year of hands-on clinical experience under supervision (Mueldener et al., 2021) .

Beyond clinical practice, dental school graduates may also choose academic careers, joining dental school faculties as educators and researchers.

This path involves training future generations of dental professionals, contributing to dental research, and staying educated on advancements in the field.

Alternatively, some graduates explore opportunities in public health by working in government agencies or non-profit organizations. This avenue enables them to address community oral health needs, participate in public health initiatives, and advocate for policies promoting better oral health outcomes (Bethesda et al., 2021).

A subset of dental graduates may opt for careers in dental research, going into the scientific exploration of new treatments, technologies, and methodologies to advance the field. Others may find roles in the dental industry, contributing their expertise to product development, marketing, or sales for dental products and technologies. Additionally, some graduates choose the path of dental public policy, using their knowledge to shape healthcare policies, regulations, and advocacy efforts at local, national, or international levels (Bethesda et al., 2021).

In summary, the journey after dental school is a multifaceted exploration of professional opportunities. Whether in clinical practice, academia, public health, research, industry, or policy, dental school graduates play pivotal roles in advancing oral health and contributing to the well-being of individuals and communities (Bethesda et al., 2021).

## **Diversity in Dentistry**

Addressing diversity in the dental field is a multifaceted effort that involves initiatives at various levels, from dental education to professional practice. While progress has been made, there is ongoing work to further enhance diversity and inclusion in the dental profession.

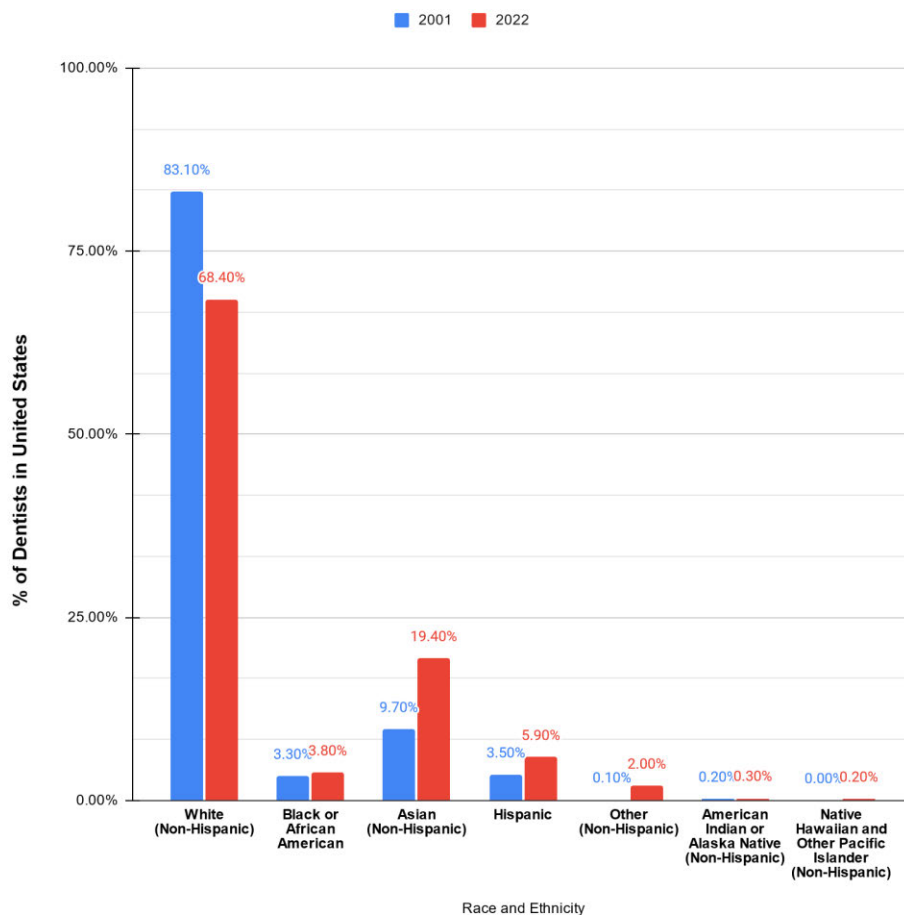
In the dental workforce, greater diversity has been shown to reduce oral health disparities and access barriers, increase patient satisfaction and health care quality, especially amongst minority populations (Salsberg et al., 2021). Lack of diversity and disproportionately inadequate delivery of dental care to minority populations in the dental workforce has been linked (Poole et al., 2022). Ethnic diversity in dentistry begins with access to dental education. Efforts are made to ensure that individuals from various ethnic backgrounds have equal opportunities to pursue education and training in dentistry. This involves addressing barriers that may disproportionately affect certain groups. Many dental schools and professional organizations have implemented initiatives to actively recruit individuals from underrepresented ethnic groups. Additionally, efforts are made to create a supportive environment that encourages the retention of diverse dental professionals throughout their careers, especially throughout training (Bethesda et al., 2021). In the dental workforce, diversity is crucial for addressing health disparities. Certain ethnic groups may face unique oral health challenges, and having a diverse group of dental professionals can

contribute to better understanding and addressing these disparities (Jackson et al., 2014).

Diversity within the healthcare profession is not only crucial for recruitment but also plays a vital role in mitigating discrimination and fostering retention in the field (Braidwood et al., 2022). While information about the dentist workforce is accessible through various channels, comprehensive demographic data remains incomplete. Notably, the absence of basic diversity demographic details for specialty subgroups, as overlooked by respective specialty organizations, underscores both a lack of awareness within organizations representing dental specialists and a devaluation of diversity and inclusion by professional leadership. To address this, it is imperative for specialty organizations to take the lead in collecting this information, bringing attention to the issue. The initial step involves prioritizing data collection across all dental specialty organizations, followed by concerted efforts to enhance diversity. This includes establishing associations that not only mentor underrepresented minority (URM) dental students but also create purposeful pathways into specialized fields (Poole et al., 2022).

According to the American Dental Association (ADA), in 2001, 83% of the dental workforce were White. On the other hand, 3.3% were Black or African American, 9.7% were Asian, and 3.5% were Hispanic. This leaves 0.3% which

make up non-Hispanic, American Indian or Alaska Native and Native Hawaiian (Figure 1) (ADA, 2023). In 2022, White dentists make up 68.4% of the dental workforce while 19.8% are Asian, 3.8% are Black or African American dentists, and 5.9% are Hispanic Only 2.5% makeup non-Hispanic, American Indian or Alaska Native and Native Hawaiian dentists. Over 20 years, URM populations nationally have increased by 14.6%. Compared to 2001, URM representation among dentists in the workforce has increased but White dentists still make up a majority of dentists. Among URM dentists, Asians are overrepresented relative to Black or African Americans and Hispanics (Figure 1) (ADA, Dentist Demographics Dashboard, 2023). Thus, significant disparities still exist.



**Figure 1. Demographical Data of the Dental Workforce from 2001-2022**

Demographical data of the dental workforce from the years 2001-2022. The x-axis represents the different racial and ethnic groups. The y-axis represents the percentage of dentists in the United States. Note: National data are from the American Dental Association (ADA), Dentist Demographics Dashboard, (2023).

## **History of Dental Pipeline Programs**

The history of dental pipeline programs traces back to the latter half of the 20th century, responding to concerns about the lack of diversity in the dental profession and disparities in oral health care. Early initiatives, supported by organizations like the Robert Wood Johnson Foundation, sought to increase the representation of underrepresented minority groups in dental schools (Pechura et al., 2001). Over time, these programs evolved to include community-based approaches, mentorship components, and expanded interventions at various educational levels. Focused on addressing workforce shortages and enhancing access to dental education, pipeline programs formed partnerships with dental schools, professional organizations, and communities (Ballweg et al., 2011). Research has been conducted to assess program effectiveness, highlighting their role in diversifying the dental workforce. Continuously adapting to new challenges, these programs remain vital in fostering diversity, supporting aspiring dental professionals, and creating pathways for underrepresented individuals to contribute to the dental profession (Pechura et al., 2001).

Dental schools have recognized the need for URM's as disparities continue to exist in the profession. In 2000, the U.S Department of Health and Human Services issued *Oral Health in America: A Report of the Surgeon General*. This report acknowledged the progress made in the profession regarding common oral diseases. On the other hand, the report found profound

oral health disparities within the U.S. Population. Minorities and the medically disabled have the least access and poorest oral health (Satcher et al., 2017)

To aid URM's in the medical profession, the Robert Wood Johnson Foundation (RWJF) funded scholarships for minority and low-income dental and medical students from 1972 to 1977 (Pechura et al., 2001). This was funded through the Medical Student Aid Program and Dental Aid Program. The Medical Student Aid Program provided the RWJF with \$10 million and the Dental Aid Program provided \$4.1 million. Keeping underserved areas in mind, these programs provided financial support for students who would be likely to work in those areas. Many times, school debt prevented students from working in those areas, so having that fund helped to mitigate the financial issue.

To address the need for a more diverse oral health workforce, pipeline programs began to rise in 2000. The Robert Wood Johnson Foundation (RWJF) has a history of being concerned with disparities in access to health care for minority groups. They decided to launch a pipeline program. This program, called The Pipeline, Profession, and Practice: Community-Based Dental Education program was founded to help combat the low numbers of URM's in the field. (Abbas et al., 2014). From 2002 to 2007, 13 primarily White dental schools participated in the program. URM enrollment increased significantly in the first year compared to schools that did not participate in the program. Participating

schools were allowed to use Dental Pipeline funds to create new recruiting and retention initiatives.

From 2000-2010, there was an increase in the number of summer enrichment programs and post-baccalaureate programs to develop the interest of URM college students in dentistry (Wides et al., 2013). These programs used the same Dental Pipeline Program, this in turn increased the competitiveness of URM's as applicants to dental school. On the other hand, post-baccalaureate programs increased the number of URM applicants who enrolled in dental school.

### **Pipeline Programs and Diversity**

Pipeline programs have been used to improve diversity or recruitment for a specific program, profession, or area of study. As stated, in the health professions, racial and ethnic minorities have been underrepresented for years. In order to reduce health disparities, increase diversity, and address education opportunity gaps, education pipeline programs play a vital role (Smith et al. 2009). These programs may include mentorship programs, educational resources, and hands-on experiences to encourage interest in the field early in pre-college and college years as well as post-bac, masters and summer program following college (Gravely et al., 2004). Research demonstrates that racial and minority health providers are more likely to serve underrepresented minority

patients (Smith et al., 2009). Improved patient satisfaction, better practitioner and patient communication are all connected to diversity among healthcare providers.

One of the primary goals of dental pipeline programs is to enhance diversity within the dental profession. By actively recruiting and supporting individuals from underrepresented racial, ethnic, and socioeconomic backgrounds, these programs contribute to a more representative and inclusive dental workforce. Also, they aim to address oral health disparities by promoting access to oral healthcare in underserved communities. By training and encouraging individuals from these communities to pursue careers in dentistry, pipeline programs help build a healthcare workforce that is more culturally competent and better positioned to serve diverse patient populations (Greenway et al., 2017). Based on ADA data, there is a lack of URM representation in the dental field. These programs contribute to addressing potential shortages in the dental workforce. By identifying and nurturing talented individuals interested in dentistry, these programs help ensure a sustainable supply of qualified dental professionals, particularly in regions facing shortages or in underserved communities (Greenway et al., 2017).

In addition, some programs offer early exposure to the field of dentistry for students at various educational levels, from high school through undergraduate studies. This exposure helps individuals make informed decisions about pursuing a dental career and provides insight into the educational and professional

pathways involved (Abbas et al., 2014). Dental education can be financially and academically challenging. Pipeline programs often provide support, resources, and mentorship to individuals who may face barriers to entering and completing dental school. This support helps improve access to dental education for a broader range of aspiring professionals.

### **Residencies and Advanced Education Programs**

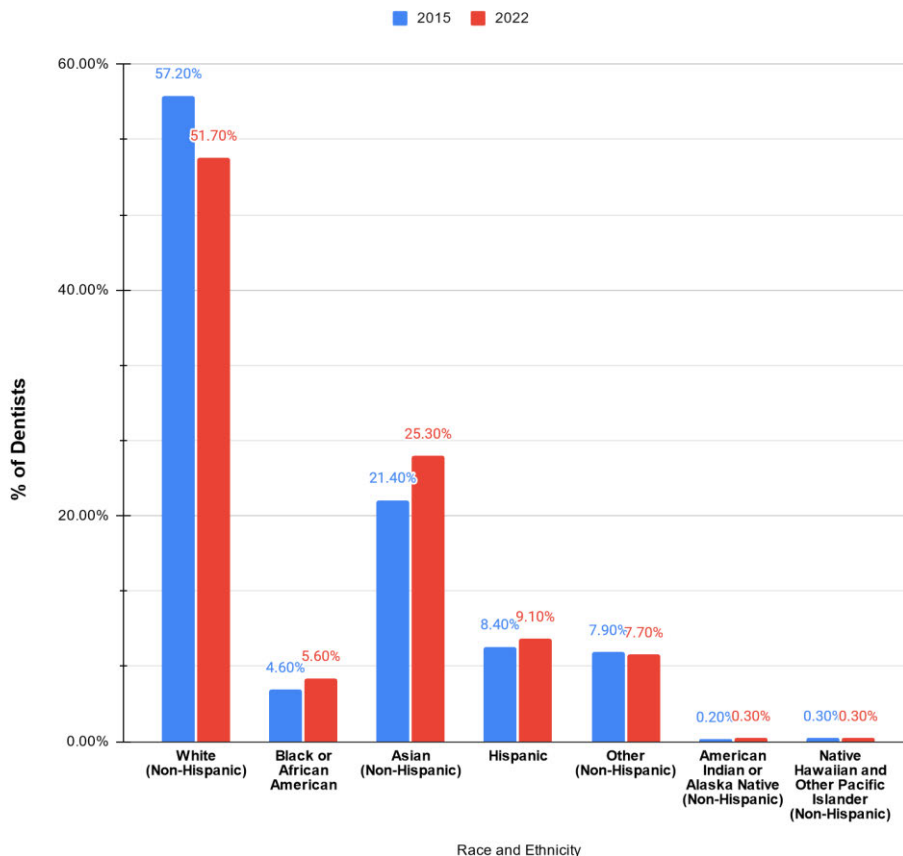
Dental residencies are essential components of post-graduate dental education (ADA, 2023). They provide advanced training and specialization beyond basic dental school curriculum. Ranging from one to six years, these programs offer specializations such as oral surgery, orthodontics, periodontics, and more (Figure 3). Rooted in intensive clinical experiences, residencies blend didactic education, research opportunities, and interdisciplinary collaboration. Residents work under mentorship, gaining hands-on experience in complex cases and contributing to scholarly activities (Glowacki et al., 2022). Completion often leads to board certification and opens diverse career paths, including private practice, academia, research, and leadership roles. Dental residencies not only deepen clinical expertise but also address broader public health goals through community engagement (Glowacki et al., 2022).

Dental residencies hold significant importance in the professional development of dentists. Through intensive clinical experiences, residents gain expertise in treating complex cases, enhancing clinical skills, and fostering confident decision-making. Mentorship from experienced faculty guide residents, offering insights into the nuances of dental practice. The emphasis on interdisciplinary collaboration ensures a holistic approach to patient care, contributing to comprehensive healthcare practices. Engaging in community-oriented practices addresses public health goals, reducing oral health disparities. Moreover, dental residencies enhance dentists' marketability, opening diverse career paths and ensuring their adaptability to evolving dental practices and technologies. To summarize, dental residencies are pivotal in producing well-rounded, skilled professionals, advancing oral healthcare, and meeting the diverse needs of patients (Hau et al., 2017).

Studies have been conducted that show URM dentists do not enroll in specialty programs at the same rate as non-URM groups. Instead, many of them chose primary care due to loan repayment / debt relief options instead of specializing (Poole et al., 2022). Among URM dental specialists, pediatric dentistry stands out as the most prevalent field, constituting nearly a quarter of these specialists. In contrast, specialties like public health and prosthodontics collectively represent a smaller proportion, accounting for about a tenth of the URM specialist group (Poole et al., 2022).

Factors influencing the initial career plans differ between generalists and specialists. Family considerations are a primary factor for both, but specialists are notably impacted by educational debt compared to generalists. URM generalists often have distinct backgrounds, being more likely to be the first in their family to graduate college, originate from rural areas, and attend public dental schools (Poole et al., 2022). This information sheds light on the diverse pathways and influences affecting choices and demographics within various branches of dentistry, particularly among underrepresented minority groups.

Between 2015 and 2022, enrollment in advanced dental education programs among URMs has seen an increase (Figure 2) (ADA, CODA Advanced Dental Education Series, 2023). In 2015, 57.2% of enrolled students were White, while 4.6% were Black or African American, 8.4% Hispanic, and 21.4% Asian. Additionally, 8.4% comprised American Indian or Alaska Native, Native Hawaiian, other Pacific Islander, or individuals of two or more races.

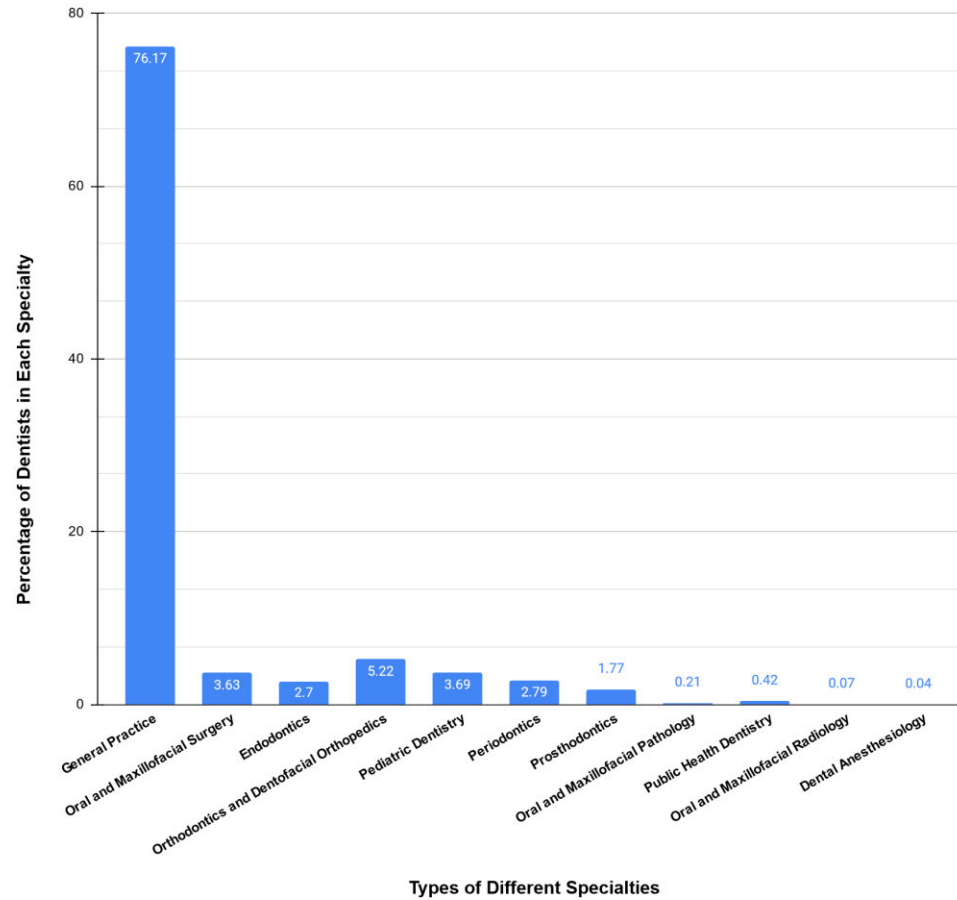


**Figure 2: Enrollment in Advanced Dental Education Programs by Race/Ethnicity from 2015 and 2022**

Enrollment of students in advanced dental education programs after graduation. Data was organized based on race and ethnicity. The y-axis represents the percentage of dentists in the United States. The x-axis represents the different racial and ethnic groups. Note: National data are from the American Dental Association (ADA), CODA Advanced Dental Education Series, (2023).

By 2022, the landscape had shifted slightly: 51.7% of enrolled students were White, 5.6% were Black or African American, 9.1% were Hispanic, and 25.3% were Asian. The remaining 8.3% were a mix of American Indian or Alaska Native, Native Hawaiian, other Pacific Islander, or individuals of two or more races.

Over the seven-year period, there was an overall increase of 5.5% in URM enrollment within advanced dental education programs. This shift indicates a gradual but notable rise in the representation of underrepresented minorities within these specialized dental programs (Figure 3) (ADA, CODA Advanced Dental Education Series, 2023).



**Figure 3: National Dental Specialties Average from 2010-2022**

Enrollment of students in advanced dental education programs after graduation was assessed. Data was organized based on the type of specialty. The y-axis represents the percentage of dentists in each specialty in the United States. The x-axis represents the different types of specialties. Note: National data are from the American Dental Association (ADA), CODA Advanced Dental Education Series, (2023).

### **Boston University's Oral Health Sciences Program**

Boston University's OHS program has consistently had a focus on providing underrepresented minority applicants with the opportunity to improve their academic credentials for dental school admission. The program began as a track within the MA in Medical Sciences Program due to its small size and very focused mission. Over the past 20 years, as the program has grown in size and reputation, and funding as dwindled, it has expanded its class to include students from all backgrounds with a goal to increase the number of dentists both underrepresented in dentistry but also those truly passionate about serving others including those from underserved backgrounds such as the homeless and marginalized. This in turn will hopefully lead to more dentists serving in underserved areas as oral health disparities in communities become more prevalent (Davies et al., 2019, 2020).

The OHS program has created a challenging 32-credit biomedical sciences curriculum. Students can complete the program in one, one and a half, or two years (Figure 2) (Davies et al., 2019). The first semester includes two dental school classes (Biochemistry and Physiology) and one class from the graduate school (Evidence-Based Dentistry). The second semester includes an additional dental school class (Microbiology and Immunology or Pathology) and the option to take additional electives such as Infectious Diseases, Introduction to Biomedical Information, Prevention and Oral Health Promotion in Dentistry,

Fundamentals in Head and Neck Anatomy, Applied Histology, Biostatistics, etc. These courses provide students with extensive background in biomedical sciences and prepares them for the rigorous curriculum in dental school (Table 1).

Fall 1	Spring 1
*OH 751 Biochemistry ( 6cr)	*OH 731 Physiology ( 2cr)
*OH 730 Physiology ( 6cr)	MS 640 Biomedical Information (2cr)
Electives (2-4 cr)	OH 750 Oral Health Promotion in Dentistry (3cr)
	Electives (8-10 cr)
Electives	
OH 770 Evidence Based Dentistry (2 cr)	OH 771 Head and Neck Anatomy (3 cr)
OH 735 Applied Physiology (2cr)	MS 700 Biostatistics ( 2cr)
MA 640 Cultural Formation of a Clinician (3cr)	**OH 740 Microbiology & Immunology ( 4cr)
MS 701 Clinical Skills (2cr)	**OH 700 Pathology (4cr)
CI 670 Biostatistics (4cr)	OH 685 Infectious Diseases
MS 600 Introduction to Leadership (2cr)	OH 710 Applied Histology (2cr)
Summer I	Summer II
MS 971 (Capstone) (2cr)	MS 986 Continuing Student
OR	
Fall 2	Spring 2
MS 971 (Thesis)(2cr)	MS 972 (Thesis)(2cr)

**Table 1. Sample Oral Health Science Curriculum.** Shown is the standard curriculum for students in the MS in Oral Health Sciences Program. Students take the required courses indicated and then choose additional electives. The courses indicated with the Asterix (\*) are DMD courses. The curriculum can be completed in one or two calendar years by completing semesters 3 and 4 either in Summer I and II or Fall and Spring 2. Table from Boston University Oral Health Sciences Curriculum, n.d. (<https://www.bumc.bu.edu/gms/ohs/curriculum/>)

## OBJECTIVES

The MS in Oral Health Sciences program has maintained records of their student outcomes including matriculation to dental school. To date, over 400 graduates, greater than 90%, have matriculated to US dental schools. The overall goal of this thesis is to investigate former OHS student career outcomes post-graduation from dental school and evaluate the potential success of OHS as a Pathway program to enhance representation from historically under-represented or disadvantaged groups in field of dentistry.

Specifically, this study will:

- Identify career outcomes of OHS graduates enrolled in the program between 2006-2019 (dental school graduates 2010-2023)
- Evaluate and compare the career outcomes of former OHS students with known race and ethnicities as established from student application records
- Compare career outcomes and diversity of OHS graduates with national American Dental Association data of national dental school graduates to determine the success of the OHS program in enhancing career outcomes and representation from historically under-represented or disadvantaged groups in field of dentistry.

## METHODS

This study, sanctioned by the IRB board at Boston University Medical Campus, received an EXEMPT status (H-33295). To safeguard confidentiality, strict data collection procedures were upheld. These included utilizing a secure database for information storage and immediate de-identification of data upon export.

The evaluation focused on students enrolled in the OHS program between 2006 and 2018 (and in some cases to 2020 as indicated). Data was obtained through admission records upon matriculation to OHS. Dental school matriculation records were tracked upon graduation from OHS. Comparisons were made using data from the ADA to compare OHS graduate career outcomes (ADEA. U.S. Dental School Applicants (n.d.) ADA. CODA Survey of Dental Education Series (n.d.) ADEA. Percent of National Graduates Entering a Specialty (n.d.); ADA. CODA Survey of Advanced Dental Education Series (n.d.) and URM statistics with national post-dental school population records (ADA). Dentist Demographics Dashboard. (n.d.).

To evaluate the career paths of former OHS students after graduating dental school, a comprehensive screening approach was used through multiple platforms such as social media networks and LinkedIn. This screening process

aimed to gather information regarding the post-dental school placements of these students, correlating an understanding with their career paths.

Upon completion of the screening phase, a de-identification process was implemented. This critical step was undertaken to ensure the anonymity and confidentiality of the gathered information, ensuring the privacy of the individuals involved.

The study population consisted of students in the OHS program from the year 2006-2018 comprising a total of 263 students. The data consisted of: year admitted into OHS, gender, disadvantaged status, first generation status, race, ethnicity, and career outcomes to date. URM students were categorized as historically underrepresented races/ethnicities, or HUREs, if they self-identified as one or more of the following: American Indian or Alaska Native, Black or African American, Hispanic or Latino, and Native Hawaiian or other Pacific Islander.

Career outcome data for 14 OHS graduates were excluded due to lack or unclear information, and one student was excluded as they were no longer practicing dentistry. Microsoft Excel and Google Sheets were used to organize and analyze all data. Statistics to determine significance were completed using paired samples T-test.

## RESULTS

The OHS program has been increasing its enrollment since 2005 due to its growing success and recognition nationally. Table 2 shows the number of matriculating students from 2006-2018. In 2006, OHS began with 11 graduates and in 2018, OHS increased enrollment and resulted in a graduating class of 31.

### Demographics

The demographics of OHS students are shown in Tables 2 and 3. OHS enrollment data broken down by gender shows that from 2006 to 2018, 129 males and 134 females completed the program. Out of 263 students, 49% were males and 51% females, 15.6 % were disadvantaged (financially, medically or grew up in a rural underserved area) and 10.6% were first generation (i.e., first in their family to attend college) (Table 2). Table 3 shows the racial and ethnic demographic data of students in OHS from 2006 to 2018. Out of 263 students, 110 (42%) were White, 23 (8.7%) were Black or African American, 47 (17.8%) were Hispanic, 72 (27.4%) were Asian, 2 (0.76%) were either American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, and 9 (3.4%) were two or more races. A total of 83 of the 263 enrolled students were minorities (Table 2).

**Table 2. Graduate Students Enrolled in the Oral Health Sciences Program 2006-2018.** Data represents the total number of OHS students enrolled between 2006 and 2018 including gender, socioeconomic status (disadvantaged financially, medically or grew up in a rural underserved area) and whether they were first generation, i.e. first in their family to attend college. (n=263).

Academic Year	Number of Students	Male	Female	Dis-advantaged	First Generation
2005-06	6	4	2	1	1
2006-07	9	2	7	0	1
2007-08	8	4	4	1	0
2008-09	21	10	11	4	0
2009-10	11	7	4	2	1
2010-11	7	4	3	0	0
2011-12	9	6	3	1	2
2012-13	19	9	10	4	2
2013-14	20	9	11	3	3
2014-15	22	9	13	4	6
2015-16	24	9	15	2	3
2016-17	39	20	19	5	4
2017-18	37	15	22	5	4
2018-19	31	21	16	9	1
Total	263	129 (49%)	134 (51%)	41 (15.6%)	28 (10.6%)

**Table 3. Race and Ethnicity of Graduates from the Oral Health Sciences Program Enrolled from 2006-2018.** Shown are the number of students that identified as different racial/ethnic categories and total URM students enrolled in OHS. Other represents students that identified with two or more races/ethnicities (n=263). Abbreviations: Indian, Native Alaskan/Hawaiian or other Pacific Islander (NA/HI & PI)

Academic Year	Number of Graduates	White	Black	Hispanic	Asian	(NA/HI & PI)	Other	URM Total
2005-06	6	4	0	1	1	0	0	1
2006-07	9	4	1	3	1	0	0	4
2007-08	8	3	3	1	1	0	0	4
2008-09	21	11	0	1	6	1	3	5
2009-10	11	3	1	3	3	0	1	5
2010-11	7	2	0	3	2	0	0	3
2011-12	9	3	0	2	3	0	1	3
2012-13	19	9	2	1	7	0	0	3
2013-14	20	8	0	1	8	0	3	4
2014-15	22	10	3	6	3	0	0	9
2015-16	24	11	2	8	3	0	0	10
2016-17	39	15	2	9	13	0	0	11
2017-18	37	14	7	2	12	0	2	11
2018-19	31	13	2	6	9	1	1	9
Total	263	110 (42%)	23 (8.7%)	47 (17.8%)	72 (27.4%)	2 (0.76%)	9 (3.4%)	83 (31.5%)

### **General Dentistry Practice**

As shown in Table 4 and Figure 3, the primary career path for OHS graduates was general dentistry, accounting for 75.10% of graduate outcomes. Nationally, according to ADA reports, 76.17% of graduates pursued general dentistry, revealing an insignificant difference between OHS students and traditional students nationally. Among OHS students pursuing general dentistry, 24.8% were URM. Nationally, only 3.8% of those entering general dentistry come from URM backgrounds (ADA, CODA Advanced Dental Education Series, n.d.). This marks a substantial positive difference of 21.0% indicating more dentists enter general dentistry from URM groups when completing the Pathway program when comparing OHS program data with national ADA statistics (Table 4).

Table 4 and Figure 3 show the percentage of URM OHS graduates and their overall career paths. Among URM OHS graduates, general dentistry was the predominant career path at 92.2%, followed by specialization in pediatrics at 5.4%. Table 5 shows the percentage of Black or African American and Hispanic OHS graduates in General Dentistry compared with national data from the ADA. Overall, 7.2% of OHS graduates in general dentistry were Black or African American, and 14.9% were Hispanic. Nationally, Black or African American enrollment in General Dentistry was 5.8% lower than that of OHS students, while Hispanics enrolled 13.2% less than their OHS counterparts (Table 5). Hence, a

higher proportion of URM OHS students opt for general dentistry compared to the national average.

### **Residency Programs**

While many OHS graduates enter clinical practice immediately after dental school, some enter 1-year AEGD programs or specialty training programs. Between 2006 and 2019, 26.2% of students from OHS have gone on to specialty programs with 7.8% of those being from underrepresented groups. A total of 12.45% entered residency programs to specialize in pediatrics. Nationally, only 3.69% of dental school graduates pursue specialization in pediatrics (ADA, CODA, Advanced Dental Education Series, n.d.). This represents a positive difference of 8.76% among former students in the OHS program entering pediatrics (Table 4 and Figure 3).

The national URM enrollment rate of dentists specializing in pediatrics is 2.9% (ADA, CODA, Advanced Dental Education Series, n.d.) , signifying a positive difference of 1.5% in comparison to the OHS average (Table 5 and Figure 3). In the OHS program, 0.8% of students enrolled into pediatrics were Black or African American, and 2.7% were Hispanic. Nationally, 1.3% of students in pediatrics are Black or African American, and 1.3% are Hispanic (Table 5). Following pediatrics, orthodontics emerged as the second most sought-after

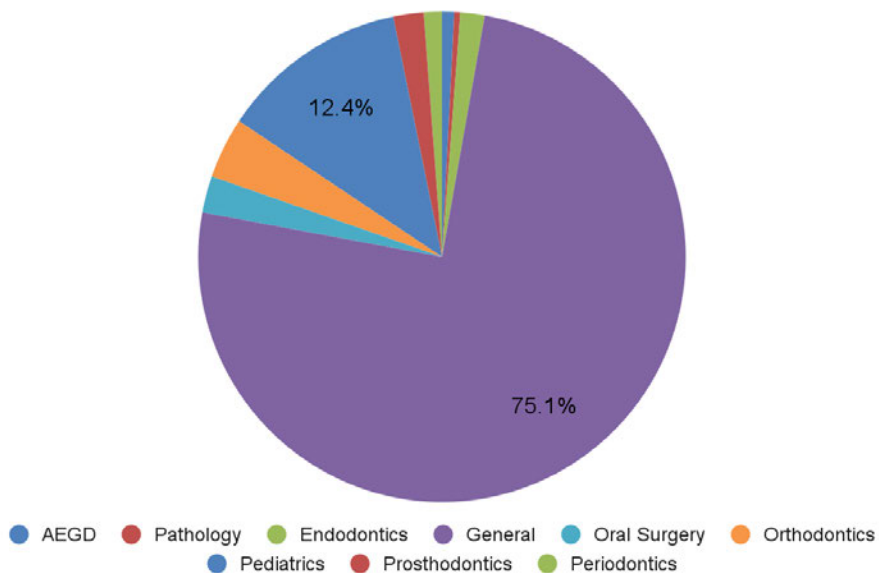
specialty program among OHS students, resulting in 4.82% enrolling, 1.2% of which are URM (Table 5 and Figure 3).

Oral surgery was the next specialty with 2.41% (1.2% URM) of OHS students opting to specialize while prosthodontics with 2.01% (0% URM) entering the field (Table 4). Endodontics attracted 2.7% (0.4% URM) of OHS students. Moving to the less frequently chosen programs, periodontics had 1.2% (0.4% URM) of OHS students enrolled and oral and maxillofacial pathology had one student enroll from OHS (Table 4 and Figure 3). There was not enough enrollment to compare these values to national trends.

Conversely, public health dentistry, oral and maxillofacial radiology, and dental anesthesiology had no OHS students enroll over the years. The national averages for these programs are 0.42% for public health dentistry, 0.07% for oral and maxillofacial radiology, and 0.04% for dental anesthesiology (Table 4 and Figure 3) (ADA, CODA, Advanced Dental Education Series, n.d.).

**Table 4: List of Specialty Choices of Oral Health Sciences Graduates.** Shown are the career paths of former OHS students following graduation from dental school, including the percent of underrepresented minority (URM) students from OHS choosing different specialties versus general dentistry.

<b>Career Path</b>	<b>Number of OHS graduates</b>	<b>Percentage of OHS graduates</b>	<b>Percent of URM OHS graduates</b>
General Dentistry	187	75.10%	92.2%
Endodontics	4	1.61%	0.4%
Oral Surgery	6	2.41%	0.4%
Orthodontics	10	4.82%	1.2%
Pediatrics	31	12.45%	5.4%
Prosthodontics	5	2.01%	0%
Periodontics	3	1.20%	0.4%
Oral and Maxillofacial Pathology	1	0.40%	0%
Public Health Dentistry	0	0%	0%
Oral and Maxillofacial Radiology	0	0%	0%
Dental Anesthesiology	0	0%	0%
Total	249	100%	100%



**Figure 4: Percentage of OHS graduates that went through or are currently in a dental residency program in the United States.**

Table 5 shows the percentage of Black or African American and Hispanic OHS graduates practicing general dentistry. Within the URM OHS graduates, 7.2% were Black or African American. In contrast, only 1.4% of students enrolling in General Dentistry nationally identify as Black or African American. This reveals a positive difference of 5.8% among former OHS students compared to the national averages in this field (Table 5).

OHS students from Hispanic backgrounds make up 14.9% of URM enrollment in General Dentistry, while there is 1.7% representation of Hispanic students in general dentistry nationally. This highlights a positive difference of 13.2% between OHS and the national average regarding Hispanic representation in this field (Table 5) (ADA, CODA, Advanced Dental Education Series, n.d.; ADEA, National Graduates Entering a Specialty, n.d.).

**Table 5: Specialties and Ethnicity**  
 Percentage of Black or African American and Hispanic OHS graduates practicing General Dentistry and Pediatrics compared to national data from dental school graduates. Note: National data are from the American Dental Association, CODA, Advanced Dental Education Series (n.d.), ADEA, National Graduates Entering a Specialty (n.d.).

<b>Career Path</b>	<b>Black/ African American OHS Graduates in Specialty Program</b>	<b>Black/ African American Dental School Graduates (national)</b>	<b>Difference (%)</b>	<b>Hispanic OHS Graduates in Specialty Program</b>	<b>Hispanic Dental School Graduates (national)</b>	<b>Difference (%)</b>
<b>General Dentistry</b>	7.2%	1.4%	+5.8%	14.9%	1.7%	+13.2%
<b>Pediatrics</b>	0.8%	1.3%	-0.5%	2.8%	1.3%	+1.5%

### **Specialty Choice**

Comparing graduates from the OHS program to graduates from the national cohort between 2010 and 2022 indicated that there was a significantly larger proportion of URM students graduating from OHS than nationally (33.29% compared to 15.22%)( $p < 0.001$ )(Table 6) (ADA, CODA, Advanced Dental Education Series, n.d.; ADEA, U.S. Dental School Applicants, n.d.; ADEA, National Graduates Entering a Specialty, n.d.).

Within the national graduate pool, approximately 27.40% pursued specialty programs, excluding GPR and AEGD, with 15.22% of those specializing coming from URM backgrounds. In contrast, OHS had a comparable number of graduates (26.29%) enrolled in specialty programs, among whom 7.86% were URM (Table 6). These results were significantly different ( $p < 0.001$ ).

**Table 6: Specialty Choice in Oral Health Sciences Graduates Versus Traditional Dental Graduates.**

Average percentage of URM students in OHS and in the traditional national cohort who chose to specialize. The results do not include those who opted to complete a GPR or AEGD; the traditional specializations are only included here. Data presented as mean +/- standard deviation.

Abbreviations: URM: underrepresented minority, GPR: General Practice Residency, AEGD: Advanced Education in General Dentistry.

\*Data amended from American Dental Education Association (n.d.) and American Dental Association, CODA Survey of Advanced Dental Education Series, (n.d.); ADEA, U.S. Dental School Applicants, n.d.

# indicates statistical significance using paired samples t-test, < 0.05 significant

<b>Cohort</b>	<b>Mean +/- standard deviation</b>	
Percent URM in National Graduating Classes (2010-2022) (*ADEA)	15.22+/- 2.04#	t(12) = -5.38, p < 0.001
Percent URM in OHS	33.29 +/- 11.76	
<hr/>		
Percent National Grads Entering a Specialty (excluding GPR and AEGD) (2016-2022) (*ADA)	27.42 +/- 0.39	t(6) = 5.675, p < 0.001
Of those who Specialize, % that are URM	15.46 +/- 5.42#	
<hr/>		
Percent OHS Graduates Entering a Specialty (2010-2022)	26.29 +/-14.87	t(12) = 5.584, p < 0.001
Percent OHS URM Graduates Entering a Specialty	7.86 +/- 9.96#	

## **DISCUSSION**

The goal of this thesis was to evaluate student career outcomes post-graduation from dental school and assess the MS in Oral Health Sciences as a Pathway program for students from historically under-represented groups as well as disadvantaged and first-generation students into the dental profession. By evaluating the career placement of former OHS student's post-graduation and comparing these results to traditional dental school graduates nationally, we demonstrate the success of the OHS master's program in enhancing diversity of the dental profession. The results also demonstrate that the OHS program consistently channels a considerable number of URM graduates into dental programs annually, where these individuals successfully graduate and pursue either general practice (75.1% OHS; 92.2% URM-OHS) or specialization (24.9% OHS; 7.8% URM-OHS) in post-graduate programs.

### **OHS as a Pipeline Program**

The long-standing mission of pipeline or pathway programs, OHS included, is to improve diversity and recruitment to specific programs, professions, or areas of study (Hewlett et al., 2022). The main goal is to reduce health disparities, increase diversity, and address education opportunity gaps across not just health fields but science and engineering fields as well. Based on

results presented here, it is clear that Boston University Graduate Medical Sciences, in collaboration with Henry M. Goldman School of Dental Medicine, have succeeded in their goal of providing a strong and successful pipeline program. Many students went on to matriculate to a variety of dental schools across the country (Davies et al., 2019). In 2018, URM representation among enrolled OHS students reached 31.5%. According to the ADA, URM dentists represent only 10.2% of the total dental workforce (Figure 1)(ADA, Dentist Demographics Dashboard, 2023). Even though it is an increase from 2001, there is still a need for programs such as the MS in Oral Health Sciences as it is well below the national population percentage of minorities of 30.8% (Hewlett et al., 2022). It is evident through the findings here that OHS has a commendable track record in cultivating diversity within the dental profession by consistently channeling a higher number of minority students into the field. The program stands out for its ability to attract and support URM individuals – academically and through professional enrichment – creating pathways for them to pursue careers in dentistry (Davies & Bowley, 2023).

### **General Practice**

General dentistry was the most popular career outcome among OHS students at 75.1% (Table 4). According to the ADA, the national average of dentists that go into a general practice is 76.17 percent (Figure 3)(ADA, Dentist

Demographics Dashboard, 2023). In terms of post-graduate outcomes, 24.8% of URM OHS graduates became general practice dentists. These findings highlight the significance of pipeline programs for URMs aspiring to enter general dentistry.

### **Residency Programs**

Following dental school, graduates may choose to enter into a residency program to further their education in Advanced Education in General Dentistry (AEGD) or one of 12 ADA recognized specialties that include Dental Pathology, Endodontics, Oral Surgery, Orthodontics, Pediatrics, Prosthodontics, and Periodontics, etc. After analyzing the post-graduate specialty data, OHS graduates cast a wide net in terms of specialty choices. The second most popular choice after general practice among OHS graduates was pediatric dentistry at 12.4 percent (Table 4) (Figure 3). This percentage is well above the national average of graduates choosing pediatrics (3.69%) (ADA, CODA, Advanced Dental Education Series (n.d.); ADEA, National Graduates Entering a Specialty (n.d.)). This data is significant in showing that OHS and URM representation in specialty programs are increasing and adding to the field, further reducing the disparity in profession (Table 5). Enrollment in advanced dental education programs or residencies for URM's is on the rise. From 2015-2022, URM's in residency programs have increased by 5.5% (Figure 2).

These findings highlight the diverse array of specialties OHS graduates select after completing dental school. The prevalence of pediatric dentistry as a preferred specialty among OHS graduates, surpassing the national average, indicates a particular attraction towards this field within the OHS community. Moreover, the increasing representation of OHS graduates, especially URMs, in specialty programs indicates a positive trend in reducing disparities within the dental profession.

### **URM Representation in Dentistry**

OHS focuses on guiding students through their dental education journey, ensuring they successfully complete the program and develop the necessary skills. Between 2010 and 2022, a similar number of students nationally (27.7%) and from OHS (26.28%) pursued specialty programs. This data depicts indicates that OHS students are on par academically with the national graduating cohort.

Among those who specialized, 15.46% of national graduates were from URM backgrounds, while only 7.86% of URMs at OHS pursued specialties. This suggests that more OHS graduates choose to enter general practice. This may reflect a disparity in confidence regarding entering specialty fields or be related to financial debt burden, family responsibilities or lack of interest among possibilities.

These findings carry significance in understanding the pivotal role that OHS plays in contributing to diversity within the field of dentistry. However, OHS just does not prepare students academically for dental school as it is well known that retention takes more than just academic preparation. It is well-documented, that success in dental school, requires more than academics for students from underrepresented groups to thrive (Nguyen, 2022). Similar to other programs with strong mentoring (OHS have robust near-peer mentoring program) (Davies et al., 2019), the program also provides professional development opportunities in addition to the academic support we provide, including social components to further prepare students for success (Davies & Bowley, 2023).

### **Oral Health Sciences Enrichment Program**

Over the past several years OHS has developed a multi-dimensional enrichment program to help OHS students be more well-rounded and successful. By building their academic skills and confidence through the rigorous coursework students are prepared academically. OHS also promotes their development through building personal and professional skills by providing more exposure to dentistry, and growing relational skills by fostering networking with faculty and dentists. The multi-dimensional enrichment program helps to lay a foundation that promotes success in dental school, especially for those students from

underrepresented and disadvantaged groups who need extra support and are seeking a sense of community (Davies & Bowley, 2023).

## **Conclusion**

This study sheds light on the career paths of individuals from historically underrepresented racial and ethnic backgrounds within the field of dentistry. This information holds the potential to unveil patterns, challenges, and opportunities to support students from these groups that can promote their success as they enter their years of dental training and ultimately the profession, offering a new perspective on diversity and representation within the field.

The central finding of this study highlights the success of the OHS program in offering a pathway for students, potentially those who faced academic challenges earlier, to secure admission to dental school through credential enhancement and academic enrichment by a supportive Pathway program. OHS stands as a model Pathway program that would be an ideal model to be replicated by other graduate and pre-professional schools in collaboration with dental schools. Notably, students from the OHS program show significant underrepresented minority (URM) representation within general dentistry and specific specialty programs, such as pediatrics, compared to the national average. This highlights the growing necessity for additional pipeline programs akin to OHS.

Moving forward, continued tracking of current and future students are needed to gain additional data and evaluate other specialty programs. Exploring the trajectories of OHS students beyond their academic journey within the program and dental school presents a promising avenue for further research. An in-depth study could go into the post-graduation pathways of these students, specifically tracking their destinations in terms of long-term endpoints. For example, in depth studies could determine if OHS students more inclined to practice in private offices or academic affiliated institutions. If students are strongly mentored, are they more likely to become mentors? If so, does this process help promote diversity and mentorship moving forward? This is a concept that has been proposed in terms of clinical practice but not in terms of education (Mertz et al., 2017). It is also important to investigate the percentage of OHS graduates from disadvantaged backgrounds and underrepresented groups that go on to practice in underserved areas. Lastly, evaluating students that enter the military, pursue loan forgiveness programs, or participate in public service programs like the National Health Service Corps, might lend insight into the financial burden that many OHS and traditional dental students face, including URM students in particular, and the effect on career choices and outcomes (Davidson et al., 2011; Holaday et al., 2023).

Moreover, additional studies could provide insight into the preferences, choices, and factors influencing OHS graduates when selecting specific

programs or institutions for advanced studies. Examining whether certain schools or programs attract a higher number of OHS alumni might uncover underlying drivers such as specialization offerings, or geographic preferences among these graduates.

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