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Performance in credential enhancing masters program facilitates future success in the health professions

Abbas, Majed

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PERFORMANCE IN CREDENTIAL ENHANCING MASTERS PROGRAM
FACILITATES FUTURE SUCCESS IN THE HEALTH PROFESSIONS

by

MAJED MOHAMMAD ABBAS
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Approved by

First Reader

Theresa A. Davies, Ph.D.
Assistant Professor of Medical Sciences & Education
Director, M.S. in Oral Health Sciences Program

Second Reader

Kim McCall, Ph.D.
Professor of Biology
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PERFORMANCE IN CREDENTIAL ENHANCING MASTERS PROGRAM FACILITATES FUTURE SUCCESS IN THE HEALTH PROFESSIONS SCHOOLS

MAJED MOHAMMAD ABBAS

ABSTRACT

This paper examined the critical factors and potential predictors necessary for successful admission to dental school for students participating in the credential enhancing Oral Health Sciences (OHS) master’s program at Boston University. The academic parameters of OHS-DMD and traditional (four year) college graduate DMD students were compared to determine if OHS graduates performed at a comparable academic level in dental school as DMD students who entered dental school without completing a credential enhancing master’s program.

To accomplish this, we examined data from students who matriculated to the Oral Health Sciences program from 2006 to 2015 and collected demographic, undergraduate grade point average (GPA), dental admissions test (DAT) scores and Oral Health Sciences GPA from Admissions and Registrar records for our analyses. To compare dental school performance and success on national board exams we obtained data for both OHS-DMD and traditional DMD students who enter the Boston University Goldman School of Dental Medicine.

We performed unpaired T-tests to evaluate differences in undergraduate GPA, DAT and OHS GPA data for those OHS students matriculating to any dental school to
determine what criteria, if any, can be used to predict success. We found that two factors were significant in determining acceptance to dental school: the Oral Health Sciences GPA (3.501 ± 0.301 vs 2.914 ± 0.336, p <0.0001*) and DAT scores (18.380 ± 2.089 vs 17.231 ± 1.833, p = 0.0365*). Comparison of academic performance between DMD and OHS-DMD at BU dental school found that students perform equally as well in Year 1 but dropped lower in Year 2 when comparing GPA (3.40 ± 0.052 vs 3.290 ± 0.259*, p=0.043). Lastly, first attempt fail rates on national board examinations (8.3% + 4.78 vs 7.4% + 5.1, p=0.024) between traditional DMD and OHS-DMD students were reduced however retake pass rates were equivalent (p=0.120).

These studies demonstrate that both OHS-GPA and DAT scores are significant factors in successful admission to dental school for those who had been unable to gain acceptance without the credential enhancing master’s program. Additionally, students performing well in the Oral Health Sciences program matriculate to dental school and are nearly as successful academically and on board exams as traditional four-year students DMD. Lastly, in keeping with the original mission of the OHS program, we have been largely successful in allowing underachieving and/or underrepresented minority and socioeconomically disadvantaged students to gain acceptance dental school.
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</tbody>
</table>
LIST OF ABBREVIATIONS

AAMC .................................................. American Association of Medical Colleges
AADSAS .............................................. Associated American Dental Schools Application Service
ACA .............................................................. Affordable Care Act
ADA ............................................................. American Dental Association
ADEA .......................................................... American Dental Education Association
ANOVA ........................................................ Analysis of Variance
BU ....................................................................... Boston University
BUSM ................................................................... Boston University School of Medicine
CBDE .............................................................. Community-Based Dental Education
DAT ................................................................. Dental Admissions Test
EMSSP ............................................................ Early Medical School Selection Program
GSDM .............................................................. Goldman School of Dental Medicine
GPA ........................................................................ grade point average
MAMS ............................................................. Masters of Arts in Medical Sciences
MCAT ............................................................... Medical College Admission Test
NBDE ............................................................... National Board Dental Exam
OHS ..................................................................... Oral Health Sciences
OHS-GPA ........................................................ Oral Health Sciences grade point average
RWJF ............................................................... Robert Wood Johnson Foundation
SED ..................................................................... Socioeconomically disadvantaged
SMDEP ........................................... Summer Medical and Dental Education Program
SMEP ................................................................................... Summer Medical Education Program
SMP ........................................................................................ Special Masters Programs
UGPA .................................................................................. Undergraduate grade point average
URM ..................................................................................... Underrepresented minority students
INTRODUCTION

Academic enrichment programs have become increasing prevalent over the years. These programs take many forms, from simply a set of summer courses for enrichment (Gravely et al., 2004; Johnson et al., 2013) to formal post baccalaureate certificates (Giordani et al., 2001; Reeves et al., 2008) and finally to more advanced programs resulting in a master’s degree (Franzblau et al., 2013, Thomson et al., 2010). However, what all these programs have in common is providing students an opportunity to enhance their academic credentials with rigorous coursework while gaining study and test taking skills before entering a health professions school. They have offered significant benefits in allowing students to gain experience in their chosen profession, enhance their science foundation, and improve scientific literacy while encouraging students outside of the sciences to enter the health professions (Alexander and Mitchell, 2010; Gravely et al., 2004).

Predental and premedical enrichment programs have helped increase the diversity of entering classes as a result of programs such as the National Pipeline Profession, and Practice: Community-Based Dental Education (CBDE) program (Formicola et al., 2010; Alexander and Mitchell, 2010; Brunson et al, 2010). Programs such as this are geared toward underrepresented minority (URM) or socioeconomically (SED) disadvantaged students traditionally underrepresented in the health professions. Even though the number of Black, Hispanic and Native American / Alaskan/Pacific Islander applicants has increased as a result of such programs overall nationally, the trend is still poor and
novel approaches are necessary (Formicola et al., 2010). The CBDE approach has also shown positive trends with more students tending to work with underserved and diverse populations upon graduation (Rohra et al., 2014).

Predental enrichment programs are related in style to premedical enrichment programs as both share the same common outcome, matriculation to health professions school. In some special masters programs or SMPs, students attend the same classes as medical students and further enhance their credentials for applying to medical school (AAMC, n.d.). Franzblau et al. (2013) notes how undergraduate academic performance hinders many prospective medical school applicants from successfully gaining admission to medical school. Also noted, these types of programs have also been very successful in preparing students for future medical careers. In a study evaluating the premedical credential enhancing master’s program (MAMS, or Masters of Arts in Medical Sciences) at Boston University School of Medicine, the post-bachelor master’s program has been extremely successful with more than 2500 graduates to date and an acceptance rate to medical school of 70 percent. Additionally, students from the MAMS/MD dual degree program performed well in medical school and secured high quality residency positions (Andriole and Jeffe, 2011; Franzblau et al., 2013). Another interesting aspect of these premedical enrichment programs is the fact that the students seeking admission to credential enhancing master’s program tend to be more diverse demographically and are more likely to broaden their practice area post-graduation to underserved and marginalized populations (Rohra et al., 2014).
Following the initial success of the Pipeline, Profession, and Practice: Community-Based Dental Education program (Formicola et al., 2010), the Henry M. Goldman School of Dental Medicine (GSDM) at Boston University created the OHS (Oral Health Sciences) post-baccalaureate program as a way for predental students to enhance their credentials for entrance into dental school. It was created in 2005 as the dental correlate to the successful MAMS program (Alhumaid, 2011; Franzblau et al., 2013). Besides enhancing academic credentials, the program also assists students in gaining exceptional critical thinking skills while completing a thesis or capstone. Since its inception, it has graduated 150 students with the majority of graduates gaining acceptance into a United States dental school (Davies et al., 2015). The data from these preliminary results have been expanded here in this thesis.

The goal of this thesis is to demonstrate the overall success and effectiveness of the Boston University’s M.S. in Oral Health Sciences program during its first ten years. Using data compiled from the OHS classes matriculating from 2005 to 2015, we will examine whether DAT scores, undergraduate GPA (UGPA) and OHS GPA are predictors of successful dental school acceptance, as well as of academic performance and future NBDE examination pass rates while at BU GSDM. We hope to provide supportive evidence that students who enter the OHS program are equally prepared and successful in dental school relative to students who enter dental school directly from their undergraduate institutions without post-baccalaureate training.
BACKGROUND

Diversity in the Health Professions

Building diversity in health professionals was one of the key reasons for starting many dental and medical school enrichment programs with a goal to better prepare underrepresented minority (URMs) and socioeconomically disadvantaged (SED) students who could practice in their own communities upon graduation. Generally programs began as summer programs and offered additional academic preparation and support. These programs helped to assist with issues that these students may have faced such as lesser quality education, a lack of role models, a deficiency of academic preparation and difficulties transitioning to new settings (Alexander and Mitchell, 2010).

The continued expansion of these programs has become necessary due to the severe lack of URMs in the dental profession. While thirty percent of minorities in the United States are African American, Hispanic and American Indian/Alaskan/Pacific Islander, these minorities make up just 6% of the practicing dentists. The American Dental Education Association (ADEA) has been working to try to remedy this disparity but still, the fact remains that only 13% of first year dental students are URMs (Table 1)(Lacy et.al. 2011).
Table 1: Dental School Minority Status Demographics 2000 - 2009

First-year dental student enrollment in U.S. dental schools, broken down by underrepresented minority status between the years 2000–09. Data represented by number and percentage of total students. Table taken from Lacy et al., 2011.

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Black</th>
<th>Hispanic</th>
<th>American Indian</th>
<th>URM Total</th>
<th>Total Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000–01</td>
<td>223 (5.2%)</td>
<td>237 (5.5%)</td>
<td>30 (0.7%)</td>
<td>490 (11.3%)</td>
<td>4,327</td>
</tr>
<tr>
<td>2001–02</td>
<td>264 (6.2%)</td>
<td>260 (5.9%)</td>
<td>16 (0.4%)</td>
<td>540 (12.3%)</td>
<td>4,407</td>
</tr>
<tr>
<td>2002–03</td>
<td>256 (5.8%)</td>
<td>246 (5.5%)</td>
<td>23 (0.5%)</td>
<td>525 (11.8%)</td>
<td>4,448</td>
</tr>
<tr>
<td>2003–04</td>
<td>278 (6.0%)</td>
<td>236 (5.1%)</td>
<td>22 (0.5%)</td>
<td>536 (11.6%)</td>
<td>4,618</td>
</tr>
<tr>
<td>2004–05</td>
<td>267 (5.8%)</td>
<td>273 (5.9%)</td>
<td>27 (0.6%)</td>
<td>567 (12.3%)</td>
<td>4,612</td>
</tr>
<tr>
<td>2005–06</td>
<td>310 (6.6%)</td>
<td>282 (6.0%)</td>
<td>30 (0.6%)</td>
<td>622 (13.3%)</td>
<td>4,688</td>
</tr>
<tr>
<td>2006–07</td>
<td>291 (6.1%)</td>
<td>295 (6.2%)</td>
<td>31 (0.7%)</td>
<td>617 (13.0%)</td>
<td>4,733</td>
</tr>
<tr>
<td>2007–08</td>
<td>279 (5.8%)</td>
<td>323 (6.8%)</td>
<td>30 (0.6%)</td>
<td>632 (13.2%)</td>
<td>4,770</td>
</tr>
<tr>
<td>2008–09</td>
<td>274 (5.6%)</td>
<td>283 (5.8%)</td>
<td>42 (0.9%)</td>
<td>599 (12.2%)</td>
<td>4,918</td>
</tr>
<tr>
<td>2009–10</td>
<td>300 (5.9%)</td>
<td>324 (6.4%)</td>
<td>23 (0.5%)</td>
<td>647 (12.7%)</td>
<td>5,089</td>
</tr>
<tr>
<td>U.S. population, 2010</td>
<td>12.9%</td>
<td>15.8%</td>
<td>1.0%‡</td>
<td>29.7%</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 illustrates the need to diversify the dental student population. Increased diversity is known to enhance the learning experiences for dental students and diversify the profession leading to a broader base of clinicians caring for patient from URM or SED groups. It has been shown that the dental care need is not met for many racial and ethnic groups and previous research in the medical professions supports this as African American and Hispanic populations were more likely to face a shortage of physicians. Additionally, African American and Hispanic doctors were more likely to treat African
American and Hispanic patients as well (Anderson, 2007; Lacy et.al. 2012a, 2012b; Price and Grant-Mills, 2010).

Because of the increased access to healthcare for many underserved populations due to the Affordable Care Act (ACA), it is important that the increasingly diverse patient pool has a diverse caregiver pool, but at this point the caregiver pool is still lacking in diversity (Nivet, 2010). Dental school enrichment programs were started specifically to help address this need years before the ACA and they provide future URM applicants an opportunity to gain science and academic enrichment while obtaining clinical care exposure in their desired field (i.e. medicine or dentistry). In turn, these programs have attracted many students who were never previously science or pre-dental majors while allowing them to become better prepared as dental school applicants (Nivet, 2010). This is illustrated by the continuously increasing enrollment of URMs students in dental school (Table 1).

As of 2003, 43 of the 60 U.S. dental schools had implemented some sort of summer enrichment program, while 16 of them had created a post baccalaureate program (Alhumaid, 2003, Smith et al., 2009a, 2009b). As stated previously, the goal of these programs was initially to increase the diversity of applicants to health professions schools (i.e. dental school). More recently however, they have transitioned and include strengthening of academic aptitude, professionalism skills and scientific competence and overall applicant competitiveness (Alexander and Mitchell, 2010).
Boston University School of Medicine and Goldman School of Dental Medicine

Boston University School of Medicine (BUSM) was one of the early leaders in this undertaking, starting one of the earliest enrichment programs in 1983 called the Early Medical School Selection Program (EMSSP) as a way to increase URM representation in BUSM and other medical schools across the country (Edelin and Ugbolue, 2001). This program was six weeks long and students enrolled during their junior and senior years. Students would take courses in medical terminology and introduction to biochemistry, they would increase scientific literacy by reading published literature, develop time management skills, and participate in Medical College Admission Test (MCAT) preparation. Afterwards, students would spend their senior year at BUSM taking medical school-level courses in biochemistry, psychiatry, and histology. Students who maintained a 3.0 GPA would then be admitted to BUSM. Between 1983 and 2000, 60% of the students who enrolled in the EMSSP program eventually entered BUSM as medical students.

In 1992, the Bureau of Health Professions awarded the Boston University Goldman School of Dental Medicine (BU GSDM) a one-year grant for Excellence in Minority Education to recognize the school’s commitment to increasing URM enrollment (Sinkford et al., 2005). Following in the footsteps of BUSM, the GSDM created the EXCEL (Experiential Center for Excellence in Learning) Program in 1993 as a means to provide academic enrichment to students entering BU’s GSDM one month before their DMD matriculation (Friedman, 2001). The program proved very successful with 96% of students surveyed from 1996 to 2006 stating they felt the program strengthened their
desire to pursue dentistry and 97% recommended all students matriculating to BUGSDM participate in the EXCEL program (Friedman, 2001; Alhumaid, 2003).

**The National Pipeline**

Other dental schools also recognized the low number of students from URMs enrolled in the U.S. leading to the initiation in 2000 of a program called the Pipeline, Profession, and Practice: Community-Based Dental Education program (Crall et al., 2009, Mascarenhas et al., 2009 suppl.). The program was designed to both increase URM enrollment and also address the lack of access to dental care for minorities. Phase 1 of this program ran from 2002 until 2007 and was undertaken by 13 primarily white dental schools, in conjunction with the Robert Wood Johnson Foundation (RWJF) and the California Endowment. In an attempt to recruit and enroll URM students, encouraging results were found initially as first-year URM enrollment increased by 54.4% in the first year of the program compared to just 16% increase in schools that were not participating in the program (the 16% was skewed due to one school having a large increase, removing that value revealed overall enrollment was actually 3%)(Formicola et.al. 2009; Andersen et.al. 2009b). Further evidence from the American Dental Education (ADA) association shows the African-American, Native American / Pacific Islander and Hispanic/Latino applicants and enrollees increased from 1990-2009, with applicants especially being markedly higher during Phase 1 of the Pipeline Program (Figure 1; Table 2) (Formicola et.al. 2010).
Figure 1: First time enrollees of U.S. Dental Schools from 1990-2009

A: Hispanic/Latino first time, first year, enrollees, B: African American or Black first time, first year enrollees. C: Native American/Native Alaskan first time, first year enrollees. Figure taken from Formicola et.al. 2010.
Table 2: 2000-2014 Dental School Applicant Demographic Information

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<tr>
<td>Black or African American</td>
<td>391</td>
<td>428</td>
<td>425</td>
<td>495</td>
<td>551</td>
<td>666</td>
<td>743</td>
<td>807</td>
<td>717</td>
<td>718</td>
<td>694</td>
<td>622</td>
<td>684</td>
<td>635</td>
<td>581</td>
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<tr>
<td>Hispanic or Latino</td>
<td>506</td>
<td>466</td>
<td>488</td>
<td>452</td>
<td>554</td>
<td>629</td>
<td>715</td>
<td>838</td>
<td>627</td>
<td>743</td>
<td>859</td>
<td>880</td>
<td>926</td>
<td>946</td>
<td>965</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>45</td>
<td>38</td>
<td>49</td>
<td>56</td>
<td>68</td>
<td>76</td>
<td>92</td>
<td>79</td>
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<td>38</td>
<td>39</td>
<td>24</td>
<td>36</td>
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<tr>
<td>Native Hawaiian or Pacific Islander</td>
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<td>NA</td>
<td>NA</td>
<td>NA</td>
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<td>NA</td>
<td>12</td>
<td>14</td>
<td>8</td>
<td>7</td>
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<tr>
<td>All URM Subtotal</td>
<td>942</td>
<td>932</td>
<td>962</td>
<td>1,003</td>
<td>1,173</td>
<td>1,371</td>
<td>1,650</td>
<td>1,724</td>
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<td>1,626</td>
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<td>Asian</td>
<td>1,821</td>
<td>1,609</td>
<td>1,555</td>
<td>1,693</td>
<td>1,892</td>
<td>2,377</td>
<td>2,831</td>
<td>3,187</td>
<td>2,929</td>
<td>3,060</td>
<td>3,234</td>
<td>2,918</td>
<td>2,961</td>
<td>2,916</td>
<td>2,891</td>
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<tr>
<td>White</td>
<td>4,700</td>
<td>4,164</td>
<td>4,256</td>
<td>4,335</td>
<td>4,683</td>
<td>6,111</td>
<td>7,062</td>
<td>7,664</td>
<td>6,569</td>
<td>6,384</td>
<td>6,447</td>
<td>6,143</td>
<td>6,050</td>
<td>6,022</td>
<td>5,910</td>
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<td>Non-URM Subtotal</td>
<td>6,521</td>
<td>5,763</td>
<td>5,811</td>
<td>6,028</td>
<td>6,575</td>
<td>8,488</td>
<td>9,893</td>
<td>10,851</td>
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<td>NA</td>
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<td>317</td>
<td>350</td>
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<td>764</td>
<td>1,145</td>
<td>1,685</td>
<td>872</td>
<td>1,029</td>
<td>1,167</td>
<td>1,260</td>
<td>1,239</td>
<td>394</td>
<td>340</td>
<td>378</td>
<td>544</td>
<td>370</td>
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<td>Nonresident Alien</td>
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<td>NA</td>
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</tr>
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<td>Total Applicants</td>
<td>7,770</td>
<td>7,412</td>
<td>7,537</td>
<td>8,176</td>
<td>9,433</td>
<td>10,731</td>
<td>12,463</td>
<td>13,742</td>
<td>12,178</td>
<td>12,210</td>
<td>12,001</td>
<td>12,039</td>
<td>12,077</td>
<td>12,162</td>
<td>11,745</td>
</tr>
</tbody>
</table>

1 Asian includes Native Hawaiian and Pacific Islander for years 2000 to 2009.
NA: Not Available
Note: All URM includes Black or African American, Hispanic or Latino, American Indian or Alaska Native, and Native Hawaiian or Pacific Islander Source: American Dental Education Association, U.S. Dental School Applicants and Enrollees, 2014 Entering Class-2016 American Dental Education Association.
The Pipeline Program conducted student focus groups made up of a subset of the 13 schools involved in the Pipeline study to evaluate the key factors inhibiting URM students from entering dentistry (Veal et al., 2004; Thind et al., 2008), to lay the groundwork for future work improving outreach and support. One of the key findings of the Veal study was that many students had inadequate predental advising while undergraduates and they did not have early or frequent exposure to dentistry in order to choose it as a profession. The students also felt there was a lack of diversity on dental school faculties and that recruitment programs were very basic; they were however, happy with the success of summer enrichment programs. The Thind et al. study (2008) suggested that the schools were doing a strong job recruiting and enrolling URM students but they worried that funding would not be sustained limiting efforts being made. They also added that there were other barriers to completion of their dental school applications including long-term debt, absence of social/familial/mentor support and a lack of promotion of dentistry as a profession at undergraduate institutions (Thind et al., 2008).

The diversity problem in dental schools was still prevalent even after the Phase 1 (2002-2007) study. This put the onus on schools that did not participate in the initial Pipeline initiative to make changes: they needed to develop a strategy to replicate and enhance the successes that had been observed in these preliminary reports. Other schools noted that the programs which successfully recruited more URM students had focused their efforts on adding to the dental applicant pool, which meant increasing the number of minority health science majors who applied to dental school which was the driving factor. To that end, schools focused efforts on four key areas (Formicola, et.al. 2009):
1. Determining factors in effective outreach and recruitment

2. Admission guidelines to increase student diversity

3. How the school environment aids in achieving diversity

4. How enrichment programs can help strengthen the academic pipeline.

These successful strategies later paved the way for changes to the dental school accreditation process where a renewed emphasis was placed on making sure schools continued to pave the way for URM students and faculty of all backgrounds to enroll and subsequently become part of schools (Brunson et al., 2008; Thind et al., 2008; Formicola et al., 2009; 2010).

**Summer Enrichment Programs**

Meharry offered the Biomedical Sciences Program to address the lack of diversity. Their eight week enrichment program was very successful and merged with other programs and now is part of the Health Careers Opportunity Pre-Baccalaureate Program (Wilson and Murphy, 1999). The RWJF had previously helped pioneer summer enrichment programs for medical schools where students gained more experience and exposure before matriculation. Beginning in 1988, the SMEP (Summer Medical Education Program), provided a 6-week course to students and 63% of the students who enrolled were accepted into medical school (Pethura, 2001; Robert Wood Johnson Foundation, n.d.). This led to the expansion of the program in 2003 to include predental college students and an assessment conducted in 2005 showed that 83% of those enrolled
were accepted into dental schools. The program became known as the Summer Medical and Dental Education Program (SMDEP) and the AAMC (American Association of Medical Colleges) and ADEA funded 12 additional schools to continue the program (Cantor et al., 1998; Bergeisen and Cantor, 2000). By combining medical and dental programs into one, this program has proven to be a successful method to increase URM enrollment in both health professional schools. URM applications increased by 77% while enrollment increased by 54.4% compared to just 16% for the non-pipeline programs, as discussed previously (RWJF, The Front Line of Medicine; Soto-Green et al., 1999).

**Traditional Post-Baccalaureate Programs**

Post-baccalaureate programs initially began with a familiar mission: to increase the number of minority students enrolled. They were started in order to increase medical school applications and enrollment specifically for URM or disadvantaged students who otherwise would be unable to attend medical school due to lack of competitive credentials. The first program was created at Wayne State University in Michigan and the program was very successful as 90% of those who attended the program matriculated to medical school. This success, along with a national decrease in applications in 1988, prompted the U.S. Public Health Service to implement post-baccalaureate programs at other universities and colleges. Successful programs were started at Michigan State, University of California (Zamora and Bau, 2009) and University of North Texas (Gravely et al., 2004; Reeves et al., 2008; Whitten, 1999). However, there have been few studies to fully determine the success of these programs, though studies that have been done have
reported positively on URM student enrollment, retention and graduation (Betancourt, 2002).

Post-baccalaureate programs for dental school did not begin until the 1990s but unlike those for medical school, they were open for anyone to apply and attend them. These programs typically offered exposure to upper level science courses and significant DAT preparation. As stated previously, 43 of the 60 U.S. dental schools have some sort of summer enrichment program, with 16 of them having post-baccalaureate programs. As with the medical school programs, there is a lack of studies proving the efficacy of these programs and the long-term results (Wides et al., 2013).

**Special Master’s Programs**

Special master’s programs are similar to post-baccalaureate programs in providing academic enrichment and further exposure to upper level science curriculum with the major difference being that students who take part in these programs receive a master’s degree. One of the more well-known and oldest programs is the Boston University School of Medicine Program, MAMS, which was started in 1985 and has thus far helped over 2000 students gain acceptance into medical school through a rigorous 32-credit program (Franzblau et al., 2013). The program also offers the opportunity to become involved in academic, clinical or laboratory research in order to complete a required thesis (BU Master’s in Medical Sciences program, n.d.).

As part of the MAMS program, an Oral Health Sciences (OHS) track was established in 2005 for students pursuing a career in dentistry. The main objectives of the program are shown in Table 3.
Table 3: Objectives of the Oral Health Sciences Program.
(Amended from BU Oral Health Sciences Program - Objectives, n.d.).

1. Develop intellectual skills necessary for success in a rigorous dental school curriculum.

2. Improve students’ overall academic credentials (through coursework, research and extracurricular experiences) to become a competitive dental school applicant and gain admission to a U.S. dental school.

3. Demonstrate research and critical thinking skills through completing a novel Capstone or Thesis

A sample of the curriculum completed by the students is listed below (Table 4), and as is apparent, multiple upper level science courses, including classes specific to dentistry, are integral to the OHS structure. Students can complete the program in 1 or 2 academic years and complete a thesis or capstone, gaining more exposure to the dental field. The flexibility of a 1 versus 2 year path allows the program to meet the specific needs of each enrolled student.

The Program provides extensive advising support including study skill and test taking support, DAT preparation, tutoring, additional review sessions, AADSAS application assistance including personal statement advice and mock interview preparation. This advising support is key to the overall success of the Program and has proved invaluable in terms of student success and improved confidence. Most importantly, students gain invaluable experience to a rigorous dental school-like program that can be extremely beneficial to their future (BU Oral Health Sciences Program, n.d.).
Table 4: OHS Sample Curriculum
(Taken from BU Oral Health Sciences - Curriculum (n.d.))

<table>
<thead>
<tr>
<th>Fall 1</th>
<th>Spring 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>*OH 751 Biochemistry (6cr)</td>
<td>*OH 731 Physiology (2cr)</td>
</tr>
<tr>
<td>*OH 730 Physiology (6cr)</td>
<td>MS 640 Biomedical Information (2cr)</td>
</tr>
<tr>
<td>Electives (2-4 cr)</td>
<td>OH 750 Oral Health Promotion in Dentistry (3cr)</td>
</tr>
<tr>
<td></td>
<td>Electives (8-10 cr)</td>
</tr>
<tr>
<td><strong>Electives</strong></td>
<td></td>
</tr>
<tr>
<td>OH 770 Evidence Based Dentistry (2 cr)</td>
<td>OH 771 Head and Neck Anatomy (3 cr)</td>
</tr>
<tr>
<td>MS 600 Ethical Issues of Bioscience (3 cr)</td>
<td>MS 700 Biostatistics (2 cr)</td>
</tr>
<tr>
<td>MA 640 Cultural Formation of a Clinician (3 cr)</td>
<td>*OH 740 Microbiology (4 cr)</td>
</tr>
<tr>
<td>MS 793 Fundamentals of Biotechnology (2 cr)</td>
<td>PM 730 Medical Pharmacology (4 cr)</td>
</tr>
<tr>
<td>CI 670 Biostatistics with Computer (4 cr)</td>
<td>PA 600 Pathology (4 cr)</td>
</tr>
<tr>
<td></td>
<td>MS 585 Infectious Diseases: Agents, Epidemiology, and Clinical Manifestations</td>
</tr>
<tr>
<td><strong>Summer I</strong></td>
<td><strong>Summer II</strong></td>
</tr>
<tr>
<td>MS 971 (Capstone) (2 cr)</td>
<td>MS 986 Continuing Student</td>
</tr>
<tr>
<td>OR</td>
<td></td>
</tr>
<tr>
<td><strong>Fall 2</strong></td>
<td><strong>Spring 2</strong></td>
</tr>
<tr>
<td>MS 971 (Thesis) (2 cr)</td>
<td>MS 972 (Thesis) (2 cr)</td>
</tr>
</tbody>
</table>

* DMD I courses

The OHS program is just one of multiple successful programs of this model. Two other programs, one at Barry University (n.d.) and another at Rutgers University (n.d.) also offer master’s degrees and allow students to take dental classes and have proven successful in getting their students accepted into dental school.
Overall, there are many different options for students from economically, socially, and academically disadvantaged backgrounds as well as minority status (race / ethnicity) to enhance their credentials for dental school admission. Additionally, programs like OHS assists students from ALL walks of life a second chance to improve their chances for dental school matriculation. Though the statistical results for many programs have not been compiled or are inconclusive, current trends have shown how effective these credential-enhancing programs have been in allowing URM and otherwise disadvantaged students a chance to improve their standings for acceptance to dental school.
SPECIFIC AIMS

Due to the evidence supporting the need for, and the positive impact of, training a more diverse group of health professionals to align better with the needs of an ever changing, diverse, country, the Oral Health Sciences program at BU was developed. The goal of this thesis is to assess the first 10 years of the program.

Specifically we will:

1. Determine the overall success of OHS students measured by matriculation to dental school
2. Determine what characteristics, if any, are significant predictors of dental school acceptance for OHS graduates
3. Compare the success of OHS students who matriculate to BU dental school versus though who enter directly from undergraduate institutions with respect to DMD-GPA and first and second time pass rates on the National Dental Board Exams (NDBE).

We hope to demonstrate that the OHS master’s program is an excellent avenue for improving the credentials of predental students who wish to gain acceptance to dental school. We also will determine if any academic parameter(s) (UGPA, OHS-GPA, DAT scores) can be utilized as significant predictors of successful acceptance to dental school. Finally, we aim to show that OHS students who matriculate to dental schools perform comparably to those traditional students who enter dental school directly without completion of a credential enhancing master’s program.
METHODS

This study was determined to be EXEMPT by the IRB board of Boston University Medical Campus, Protocol # H-33295. Confidentiality was maintained by strict data collecting procedures including a secure database for ongoing use and de-identification of data immediately after export such that the master key will be kept in a separate secure location only known by key personnel and the Primary Investigator.

Students enrolled in the OHS program between the years 2006 and 2015 were evaluated and their academic credentials collected from admissions records (BU-OHS and BU-GSDM) and BU’s Office of Institutional Research. Data obtained included main undergraduate institution attended, undergraduate grade point average (UGPA), gender, Dental Admissions Test (DAT) scores (best academic average score) and gender (male / female). OHS student GPA (OHS-GPA) and data indicating matriculation to dental school was obtained through the faculty and advisor link or from the Registrar. Also, demographic data, including race, ethnicity and socioeconomic status was obtained from those same sources.

Success in the program for all enrolled students was assessed by two primary means: (1) GPA in the program (OHS-GPA) and (2) successful matriculation to dental school. Mean values of enrolled students’ OHS-GPA, UGPA and DAT scores relative to their success in being offered dental school admission was compared via unpaired T-tests with a 95% confidence interval. Additionally the number of students matriculating to GSDM and to other dental schools nationally after completing OHS is reported. The
overall goal of OHS program is to evaluate which admissions criteria (if any) correlate with academic success in the MS in Oral Health Sciences (OHS) program and subsequent matriculation to dental school. Also included for comparison is URM data but it is not directly tested.

Academic performance of OHS-DMD and DMD students were compared. The DMD GPA for both cohorts was compared in year 1 and year 2 at BU’s GSDM. Additionally pass / fail rates on the NBDE for OHS-DMD students compared to DMD students are compared using a paired by T-test. Further analysis was done with an ANOVA comparison due to the large discrepancy in size of the two sample groups.
RESULTS

The Oral Health Sciences program has been growing since its initiation in 2005. Table 5 shows the number of complete applications submitted to the program between matriculation years 2006 through 2015.

Table 5: Number of Complete OHS Applications Submitted to the Division of Graduate Medical Sciences as Boston University for Years 2006-2015

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Applications</td>
<td>41</td>
<td>54</td>
<td>66</td>
<td>118</td>
<td>132</td>
<td>137</td>
<td>160</td>
<td>130</td>
<td>148</td>
<td>154</td>
</tr>
</tbody>
</table>

Demographics

The demographics of the enrolled OHS students are shown in Tables 6 & 7. The class is equally divided between genders (Table 7). Since the original mission of program was to bring more qualified dental applicants from minorities traditionally under-represented in dentistry, ethnicities are also noted initially broken down by year (Table 7) and summarized totals (Table 8). Approximately 14% of the enrollees were financially disadvantaged and 9% were students who were the first in their family to attend college. A total of 39 of the 159 enrolled students self-identified as minorities, which shows that the BU OHS program continues to further the original mission of the predental enrichment program initiative.
Table 6: OHS Enrollee Ethnicities from 2006-2015

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>All OHS 2006-15 N=159</th>
<th>DMD 06 N=6</th>
<th>DMD 07 N=13</th>
<th>DMD 08 N=9</th>
<th>DMD 09 N=23</th>
<th>DMD 10 N=15</th>
<th>DMD 11 N=7</th>
<th>DMD 12 N=9</th>
<th>DMD 13 N=19</th>
<th>DMD 14 N=20</th>
<th>DMD 15 N=19</th>
<th>DMD 16 N=3</th>
<th>No admission N=16</th>
</tr>
</thead>
<tbody>
<tr>
<td>White-non Hispanic Hispanic</td>
<td>58</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>11</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Asian</td>
<td>22</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>African American Other/unknown/undeclared Asian Pacific Islander American Indian</td>
<td>47</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>10</td>
<td>3</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 7: Summary of OHS Enrollee Ethnicities, Gender and Disadvantaged Status from 2006-2015

<table>
<thead>
<tr>
<th>Minority</th>
<th>Total number (n=159)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>80</td>
<td>50.3</td>
</tr>
<tr>
<td>Female</td>
<td>79</td>
<td>50.0</td>
</tr>
<tr>
<td>Socioeconomically disadvantaged</td>
<td>22</td>
<td>13.8</td>
</tr>
<tr>
<td>1st generation to college</td>
<td>15</td>
<td>9.4</td>
</tr>
<tr>
<td>Native American, Alaskan / Pacific Islander</td>
<td>3</td>
<td>1.9</td>
</tr>
<tr>
<td>African American</td>
<td>15</td>
<td>8.9</td>
</tr>
<tr>
<td>Asian</td>
<td>39</td>
<td>24.5</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>22</td>
<td>13.8</td>
</tr>
<tr>
<td>Mixed race</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>White</td>
<td>64</td>
<td>40.2</td>
</tr>
<tr>
<td>Decline to declare</td>
<td>14</td>
<td>8.9</td>
</tr>
<tr>
<td><strong>Total URM</strong></td>
<td><strong>42</strong></td>
<td><strong>26.4</strong></td>
</tr>
</tbody>
</table>

Program Completion

Program completion rates were evaluated. Only 4 students of 159 withdrew from the OHS program without completion. A total of 143 (of 159) completed the program for an 89.9% completion rate. Of those that completed the OHS Program a total of 12 were not successful in gaining acceptance to any dental school (Table 9)
Table 8: Oral Health Science Program Completion Rates for Enrollees from 2006-2015.

<table>
<thead>
<tr>
<th>Status</th>
<th>Total number (n=159)</th>
<th>Percent (n=159)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withdraw</td>
<td>4</td>
<td>2.1</td>
</tr>
<tr>
<td>Complete Masters /Matriculation to dental school</td>
<td>143</td>
<td>89.9</td>
</tr>
<tr>
<td>Complete Masters /No matriculation to dental school</td>
<td>12 (4 URM)</td>
<td>7.5 (2.5 URM)</td>
</tr>
</tbody>
</table>

Applications to Dental School

The results of OHS student data from 2006-2015 revealed several interesting points highlighting the overall success of the program. As can be seen in Table 10, of the 159 students who enrolled in the OHS program, 143 (or 90%) of them were accepted into dental school with 106 of those students (74.13%) entering the BU Goldman School of Dental Medicine (BUGSDM).

Table 9: Breakdown of OHS Enrollees, Program Graduates and Admission to Dental School from 2006-2015.

<table>
<thead>
<tr>
<th>Number of Enrollees</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total OHS enrollees</td>
<td>N/A</td>
</tr>
<tr>
<td>Accepted to any dental school</td>
<td>143</td>
</tr>
<tr>
<td>Accepted to BU School of Dental Medicine</td>
<td>106</td>
</tr>
</tbody>
</table>
Another statistic of interest was whether students had applied previously to dental school and were denied. For those students where this piece of data was available it was found that as many as 50% of OHS graduates had applied at least once (sometimes two or three times) before to dental school (Table 11). Additionally, the fact that just 2.11% of students who applied more than once were denied following completion of the OHS master’s program speaks to the overall success of the program.

Table 10: Many OHS Enrollees Previously Applied to Dental School. For those students where this information was available, n=94, shown is the number and percent who had never applied prior to enrolling in the OHS program verses those enrollees who had applied at least once prior.

<table>
<thead>
<tr>
<th>Number of Application Cycles</th>
<th>1</th>
<th>2 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>46 / 94</td>
<td>48.9%</td>
<td>48 / 94 (51.1%)</td>
</tr>
</tbody>
</table>

Comparison of Academic Parameters as Predictors

The most important data for the purposes of this paper centered on pre-admission criteria for OHS students. As detailed in Table 12 and summarized in Table 13, students accepted to dental school, whether GSDM or another school nationally, had higher OHS - GPAs than those who were denied admission. They also performed better on DATs. Compared to all DMD students, the Accepted OHS students had slightly lower credentials in all three (UGPA, DAT and OHS-GPA) categories.
Table 11: Summary of Admission and OHS Academic Data. Shown is the undergraduate grade point average (GPA), the OHS GPA while in the program as well as the best dental admission test score (DAT) for the academic average for all OHS enrollees who completed the program. Data is presented as mean ± standard deviation for the year 2006-2015.

<table>
<thead>
<tr>
<th>Mean ± SD</th>
<th>All 2006-15' (N=159)</th>
<th>DMD 06 (N=6)</th>
<th>DMD 07 (N=13)</th>
<th>DMD 08 (N=9)</th>
<th>DMD 09 (N=23)</th>
<th>DMD 10 (N=15)</th>
<th>DMD 11 (N=7)</th>
<th>DMD 12 (N=9)</th>
<th>DMD 13 (N=19)</th>
<th>DMD 14 (N=20)</th>
<th>DMD 15 (N=19)</th>
<th>No admission (N=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate GPA</td>
<td>3.06 ± 0.28</td>
<td>2.87 ± 0.17</td>
<td>3.08 ± 0.27</td>
<td>2.84 ± 0.28</td>
<td>3.17 ± 0.26</td>
<td>2.99 ± 0.22</td>
<td>3.21 ± 0.34</td>
<td>3.11 ± 0.24</td>
<td>2.92 ± 0.32</td>
<td>3.12 ± 0.23</td>
<td>3.18 ± 0.19</td>
<td>3.05 ± 0.41</td>
</tr>
<tr>
<td>OHS GPA</td>
<td>3.45 ± 0.35</td>
<td>3.48 ± 0.22</td>
<td>3.35 ± 0.32</td>
<td>3.11 ± 0.31</td>
<td>3.46 ± 0.23</td>
<td>3.63 ± 0.33</td>
<td>3.52 ± 0.45</td>
<td>3.61 ± 0.30</td>
<td>3.52 ± 0.27</td>
<td>3.64 ± 0.24</td>
<td>3.55 ± 0.26</td>
<td>2.92 ± 0.33</td>
</tr>
<tr>
<td>DAT Academic Average</td>
<td>18.23 ± 2.12</td>
<td>18.67 ± 2.07</td>
<td>17.15 ± 1.68</td>
<td>16.56 ± 2.01</td>
<td>17.39 ± 1.27</td>
<td>17.4 ± 1.72</td>
<td>18.17 ± 1.47</td>
<td>18.2 ± 2.49</td>
<td>19.11 ± 2.13</td>
<td>19.30 ± 1.98</td>
<td>19.74 ± 2.21</td>
<td>17.23 ± 1.83</td>
</tr>
</tbody>
</table>
A total of 4 students withdrew or were dismissed from the 106 students matriculating to BU’s dental school. One student withdrew to transfer for personal reasons, while 3 were dismissed due to poor academics (Table 12).

**Table 12: Pre-Admission Statistics for OHS Students.** Shown are the GPA, DAT (best academic average) and OHS GPA for all of OHS graduates applying to dental school (Total) and those Admitted and Denied Admission to Dental School. * Indicates statistical significance p<0.05.

<table>
<thead>
<tr>
<th></th>
<th>Total OHS Graduates (n=159)</th>
<th>OHS Graduates Accepted to any dental school (n=143)</th>
<th>OHS Graduates Accepted to BUGSDM (n=106)</th>
<th>OHS Graduates Denied Admission to any dental school (n=16)</th>
<th>OHS Graduates Denied for Poor Academics (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. UGPA</td>
<td>3.062 ±0.282</td>
<td>3.1 ± 0.269</td>
<td>3.060 ± 0.273</td>
<td>3.066 ± 0.420</td>
<td>3.063±0.384</td>
</tr>
<tr>
<td>Avg. Best DAT</td>
<td>18.284 ± 2.088</td>
<td>18.380 ± 2.089</td>
<td>18.17 ± 2.035</td>
<td>17.231 ± 1.833*</td>
<td>15</td>
</tr>
<tr>
<td>Avg. OHS GPA</td>
<td>3.448 ± 0.351</td>
<td>3.501 ± 0.301</td>
<td>3.450 ± 0.295</td>
<td>2.914 ±0.336*</td>
<td>3.26±0.294</td>
</tr>
</tbody>
</table>

To assess whether these differences between students accepted to dental school versus those who were not accepted were significant, unpaired T-tests with a 95% confidence interval were performed. The three categories assessed were UGPA, DAT academic average and OHS GPA; values of students accepted to dental school were compared to those students denied admission (Table 13).
Table 13: T-Test Comparison of Significance of Pre-application Statistics for Acceptance to Dental School. OHS graduates successful in gaining admission to dental school (n=106) verses those who did not gain admissions (n=16) or those dismissed from dental school due to poor academics (n=3) is shown. Significant is indicated by * p<0.05.

<table>
<thead>
<tr>
<th>T-Test Comparison</th>
<th>p Value</th>
<th>P Value for those dismissed (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. UGPA Accepted vs. Denied Admission</td>
<td>0.6706</td>
<td>0.989</td>
</tr>
<tr>
<td>Avg. OHS GPA Accepted vs. Denied Admission</td>
<td>&lt;0.0001*</td>
<td>0.192</td>
</tr>
<tr>
<td>Avg. Best DAT Accepted vs. Denied Admission</td>
<td>0.0365*</td>
<td>0.007*</td>
</tr>
</tbody>
</table>

Perhaps not surprisingly, the average OHS GPA of those accepted compared to those denied admission to dental school was statistically significant (p<0.0001) (Table 13). Additionally DAT, measured as the academic average, was also significant (p=0.0365). Average UGPA was not determined to be a significant predictive factor (p=0.6706).

When comparing these results with those students that were dismissed from the dental for poor academics one sees that the most critical factor was a weak DAT score (Tables 12-13).

Dental School Academic Performance

Table 14 below uses paired T-tests to compare the academic performance of OHS graduates who matriculated to BU’s Goldman School of Dental Medicine to traditional
BU DMD students who did not complete a credential-enhancing post-baccalaureate master’s program. The four students that withdrew or were dismissed from the 106 students matriculating to BU’s dental school are not included here.

DMD year 1 (DMD-1) GPA and DMD year 2 (DMD-2) GPAs for the traditional cohort (DMD) was compared to OHS graduates cohort (OHS-DMD) and indicates that there was no significant difference between dental school GPAs in Year 1 suggesting that OHS alumni who enter dental school are equally well-prepared academically as DMD students. However in Year 2, the OHS students did not perform quite as well ($p = 0.043$) (Table 1).

### Table 14: Comparison of Cumulative GPA for DMD Years 1 and 2 between OHS Graduates versus Traditional Students in Dental School (OHS students from 2006-2015). Statistical significance = $p<0.05$.

<table>
<thead>
<tr>
<th></th>
<th>1st Yr GPA</th>
<th>P value</th>
<th>2nd Yr GPA</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHS-DMD (n=106)</td>
<td>3.453 ± 0.362</td>
<td>0.261108</td>
<td>3.290 ± 0.0259*</td>
<td>0.042717</td>
</tr>
<tr>
<td>All BUGSDM - DMD</td>
<td>3.44 ± 0.097</td>
<td></td>
<td>3.40 ± 0.052</td>
<td></td>
</tr>
</tbody>
</table>

When evaluating national dental board exams (NDBE) Part 1 fail rates, BUGSDM traditional DMD students passed the boards on their first attempt at a statistically significant rate better than OHS DMD-1 students ($p=0.024$) (Table 15). The
OHS students performed similarly on their second attempts compared to traditional students (p=0.12, Table 15).

**Table 15: Comparison of OHS Students versus Traditional Students at BU Dental School on NDBE (National Dental Board Exam) Part 1 Fail Rates.** Students took the Part 1 Boards either the summer following Year 1 or the shortly after the fall semester in Year 2.

<table>
<thead>
<tr>
<th></th>
<th>1st Time NBDE Fail Rate</th>
<th>P value</th>
<th>2nd Time NBDE Fail Rate</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All DMD including OHS</td>
<td>8.3% + 4.78*</td>
<td>0.024181</td>
<td>22.7% + 13.9</td>
<td>0.12008</td>
</tr>
<tr>
<td>DMD excluding OHS</td>
<td>7.4% + 5.1</td>
<td></td>
<td>18.98% + 10.5</td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

The major goal of this paper was to evaluate how successful the M.S. in Oral Health Sciences program has been thus far based on their success assisting students in building their credentials for dental school admission. Secondly, we wanted to confirm that successful matriculation had translated into academic success in dental school. To do this, we first had to determine which specific admission factors (UGPA, DAT scores and OHS GPA) were positive predictors of successful matriculation to dental school. We had to examine whether students who participated in the OHS program were on equal footing academically with traditional DMD students in years 1 and 2 of dental school and on NBDE examinations. We were successfully able to demonstrate that OHS GPA was a statistically significant factor/predictor of admission to dental school and that OHS students were not at a significant disadvantage in dental school compared to their traditional dental classmates.

The original premise behind enrichment programs, the OHS program included, was to increase URM enrollment and lay out a path for students to enrich their applications before entrance to dental school. Based on results from the OHS program alone, it is clear that BU has succeeded with this initiative (Table 5). A total of 90 percent of the students who have enrolled and graduated from the Oral Health Science program have gone on to enter dental school. Interestingly, only 7.5 percent of the students who completed the program did not enter dental school, with only 2.5 percent withdrawing or failing to finish. Students from URMs have made up 26.4 percent of the
matriculating DMD students to BU Dental (Tables 4 and 5), a large improvement over the initial percentage of minority students who entered dental school before these types of programs started, as mentioned previously. However, it seems clear that though the 26.4 percent URM enrollment in OHS is encouraging, there is always room for improvement especially in areas of the country where students from underrepresented minorities make up a smaller percentage of the total population (i.e. the Northeast). This only adds to the need for programs such as the MS in Oral Health Sciences to continue to drum up interest and continue the success it has demonstrated thus far.

Additional interesting demographic data was evenly split of male to female enrollment (80 to 79 students, respectively) with multiple ethnicities being represented among the matriculating students, which speaks to the effectiveness of the OHS program in drawing in a diverse student population over the past 10 years (Tables 4 and 5). In terms of dental schools attended, the OHS program proved to be a successful pipeline program for its parent school, BUGSDM: As many as 74% of the students matriculating to the OHS Program were accepted to GSDM (Tables 6 and 7). This shows how useful the OHS Program has been for BUGSDM as it has allowed them to diversify and take in “homegrown” students.

There was approximately a 50/50 split of students who had previously applied versus those who had never applied to dental school prior to the OHS program (Table 8). The data obtained was incomplete so there could be no significance determined directly, this is an interesting area to focus on for future research with a more expansive data set.
Studying the pre-admission criteria (Table 10), a distinction was apparent where students who entered dental school had better overall DAT (best academic average) scores, UGPAs and OHS GPAs, which is to be expected and what we had initially assumed. Interestingly enough, students who matriculated to BUGSDM from OHS had lower numbers in each category compared to the overall 4-year traditional cohort who entered dental school, which may indicate that some of the students with stronger credentials attended other dental schools.

To test to see if there were significant differences between students who were accepted/rejected into dental school in our three categories, we performed three 95% confidence interval T-tests, which are detailed in the Results section in Table 11. The results showed that both the OHS GPA (p<0.0001) and DAT scores (p=0.0365) were statistically significant factors or predictors. UGPA was not significant (p=0.6706); showing that success in the OHS program is very vital and can overshadow any shortcomings seen in a student’s UGPA.

Following the examination of the preadmission statistics, the focus shifted to examining whether OHS students were on a level playing field in dental school compared to their traditional 4 year undergraduate counterparts. From the data (Table 14), in terms of GPA in the first and second years of dental school, both cohorts were very similar, with the traditional students being slightly better both years. When compared using a paired T-test, there was a statistically significant difference in Year two between the two groups (p=0.043) but not Year one (p=0.261), suggesting that OHS students are less
equipped after the first year. The students matriculating to BU dental school after OHS have a decreased course load in Year 1 owing to the fact that they take some DMD courses during their time in OHS and do not have to repeat them; i.e. they earn advanced standing. This likely allows them to focus more on other courses in the curriculum during Year one. In Year 2 when they are given a full course load, they performed slightly worse. Further testing is needed in this regard especially reviewing performance in years 3 and 4. Initial data suggests that after Year 2 the OHS-DMD recover and perform equally as well as DMD students (2010 OHS Task Force, unpublished), possibly with a greater OHS sample size.

The passing rate on the NBDE board exams was also examined via paired T-test. The results show that traditional DMD students had a significantly better pass rate than the OHS students on the first attempt at the examination ($p=0.024181$) while the second attempt showed no significance between the groups (Table 15). Overall, it seems clear that OHS students are generally on par and able to compete with traditional DMD students and that the OHS program does have considerable success in preparing students for the rigors of dental school.

Further examination of the data shows a couple of fascinating trends. There has been a large increase in the number of applications from 41 in the first application cycle in 2005 to a high of 160 in 2012, with 154 in 2015 as well. This shows that the program is becoming much more popular and that the data behind the success of the program is
driving more people to apply if they feel they need a credential enhancing program to prove themselves academically competitive for dental school.

Furthermore, the strength of the students who enrolled in and completed the OHS programs has also been on full display during each subsequent application cycle. DAT, UGPA and OHS GPA have generally risen over the past 10 years, showcasing both the competitiveness of the applicants and the success of the OHS Program as a whole.

There were multiple areas of weakness encountered during the compilation of the data for this paper and its subsequent completion. First and foremost, various pieces of data could not be collected due to a number of students either failing to disclose information on Admission or failing to reply to anonymous surveys sent to them to gain more information about their journeys following the OHS program. Finding out whether students had previously applied or if they had applied more than once after OHS proved difficult as this data was not collected at the beginning of the Program and has begun to be collected now. Additionally, it was not possible to obtain 1st and 2nd year GPAs from students who did not matriculate to BUGSDM because we only had access to data given by the Boston University. Sample size itself also proved to be a problem as more students in the study would be greatly helpful for all statistical analyses performed, especially with such a small cohort not being successful.

Though the examination of OHS data involved numerous layers, there are multiple areas where further analysis can take place and be improved. First and foremost, gaining a larger sample size and repeating this analysis in a few years may show a
stronger trend in dental school GPAs or NBDE examinations. Also, this project leaves considerable opportunity for more advanced statistical analyses to be undertaken, preferably done with a larger sample size to show contrasts in the data. Though we utilized ANOVA for the DMD comparisons with the dismissed student data, it could be useful to employ other statistical approaches as our data set grows. Adding more analyses of post-OHS academic trends can show just how effective OHS is as a program.

**Conclusion**

Finally, the overarching conclusion of this paper is that the OHS program has been extremely successful in providing students, who may have underachieved early in their educational journey, an avenue for gaining admission to dental school through credential enhancing. OHS can be considered a model program and will no doubt be emulated by both dental and other pre-professional schools alike.
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VITA

MAJED MOHAMMAD ABBAS

54 Crawford St., Watertown, MA 02472
1992
617-959-1594 mabbas@bu.edu

Education

• M.S. in Medical Sciences from Boston University School of Medicine, Boston, MA - Expected May 2016
• B.A. in Biochemistry and Molecular Biology from Boston University, Boston, MA – May 2014

Research Experience

• Dr. Teresa Davies, Boston University School of Medicine, Boston, MA: September 2013 - Present
  o Responsible for data collection, spreadsheet entry, literature research, statistical calculations
  o Research centers on the Oral Health Sciences (OHS) program at Boston University School of Medicine where demographic and academic data collected from 2006-2015 cohorts of students in the OHS program used to determine program effectiveness in admitting students to dental school and success in Dental School
  o Specific factors examined: DAT score, Undergraduate GPA, and OHS program GPA, NBDE (boards) pass/fail rates and dental school GPAs
  o Statistics completed include T-tests, ANOVA, mean, standard deviation and percentages
  o Data and analysis used as part of Master’s Thesis along with insight from previous publications

• McCall Lab, Boston University, Boston, MA: January 2013 - August 2014
  o Working closely with an experienced graduate student and the principal investigator, Kim McCall.
  o Working on multiple projects in conjunction with the principal investigator/graduate student with input on direction of research.
  o Research focuses on the mechanisms of cell death and cell clearance using Drosophila as the model organism and studying cell death in the brain and ovaries.
  o Learning and applying various techniques related to research being conducted including but not limited to: RNAi screening, qPCR, PCR, RNA extraction from Drosophila ovaries, spectroscopy and fluorescent imaging, among other techniques used across various projects
Various projects included:

- RNAi screening to examine whether genome-wide loss of function in certain genes would allow determination of the role of said gene in the organism.
- qPCR analysis in order to quantitatively classify gene expression changes in certain mutant (genetically altered) flies.
- Determination of the role of the *lace* gene in fruit flies and whether rescuing flies with defective phenotypes is possible with sphingolipid diets.

Related Publications: Second author on manuscript in preparation -
- Jenkins, V.K., Abbas, M. and McCall, K. “Snail family genes are required to maintain ovarian somatic stem cell identity in Drosophila.”

**Volunteer Experience**

- **Health Leads, Boston Medical Center, Boston, MA: September 2013 - May 2015**
  1) Student Advocate (September 2013 – August 2014)
    - Aided patients that need help with basic needs to be healthy, such as food, utilities and housing, by referring them to different resources that can help them overcome such obstacles during weekly phone calls and desk shifts at the hospital.
    - Worked in conjunction with doctors, nurses and other advocates to deliver quality information and help to any and all clients.
  2) Team Coordinator (September 2014 – May 2015)
    - Mentor/train new advocates and aid them in their day to day roles as patient advocates
    - Work closely with the Project Manager and other Coordinators and leadership team members to develop and run advocate development sessions, trainings, support groups and general day to day activities
    - Provide desk coverage as an advocate when needed

- **Nourish International, Boston University, Boston, MA: January 2013 - May 2014**
  - Helped raise money for/organize a trip to the Dominican Republic to build a general store at an elementary school to teach the adults and children basic math skills and hygiene.
  - Helped organize fundraisers in collaboration with group leaders.

- **Emergency Department Volunteer, Massachusetts General Hospital, Boston, MA: December 2012 - June 2014**
  - Volunteered in Radiology Department, focused on patient care, comfort and transport throughout the Emergency Department.

- **Physician Shadowing, St. Elizabeth’s Medical Center, Brighton, MA: August 2011**
  - Under Dr. Abbas Zaidi, an internist, observed duties of primary care physician and helped the doctor when appropriate.

- **Coffee Trader, Arsenal Mall, Watertown, MA: January 2003 - Present**
- Family owned and operated café
- Managerial/Cashier duties, food prep, and cleaning

Work Experience

- **Program Fellow, Health Leads, Boston Medical Center, Boston, MA: October 2015 – Present**
  - Aiding Jessie Odegard in day-to-day management of Health Leads program at Boston Medical Center
  - Managing advocates who volunteer at Health Leads in order to ensure they are performing their duties well and to ensure they are in compliance with all hospital regulations
  - Staffing the Health Leads desk whenever necessary to ensure it remains open for patients to obtain the resources they need
  - Consulting on difficult patient cases and offering general assistance to all advocates as needed
  - Occasional duties outside of my job such as traveling on behalf of Health Leads to Cleveland, Ohio to aid with interviewing prospective advocates and helping open a new Health Leads program at University Hospitals in Cleveland.

- **Medical Scribe, Dr. Richard Hochman, Beth Israel Healthcare Center, Chelsea, MA: August 2015 - September 2015**
  - Transcribing complete interactions between doctor and patient
  - Maintaining confidentiality of all information seen and heard during doctor-patient interactions and in entire medical practice

- **Lab Assistant, McCall Lab, Boston University, Boston, MA: September 2012 - August 2013**
  - Maintained fly stocks and solutions, ordered and organization the lab, and maintained general lab cleanliness

- **Lab Assistant, Chemistry Department, Boston University, Boston, MA – September 2011 - May 2012**
  - Organized, cleaned and set up teaching labs

- **Summer Tennis Instructor, Watertown Recreation Department, Watertown, MA: Summer 2007 - Summer 2011**
  - Taught children ages 7 – 17 about the rules, etiquette and game play of tennis
  - Led and assisted in organized games, drills and other activities along with other instructors and lead instructor