

# Research

## Motivations and Challenges Towards Research Activities Among Undergraduate Dental Hygiene Students

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### Abstract

**Purpose:** Research is integral to dental hygiene practice, graduate education, and the advancement of the dental hygiene profession. The purpose of this study was to identify the motivations and challenges toward participation in research activities as perceived by undergraduate dental hygiene students.

**Methods:** A nonprobability sample of undergraduate dental hygiene students from across the United States was used for this cross-sectional, electronic survey. Inclusion criteria were students entering their final year of their dental hygiene education program. Descriptive and inferential statistics were used to analyze the data.

**Results:** A total of 333 respondents met the inclusion criteria ( $n=313$ ). The most frequently cited motivations for participation in research were a good method to contribute to patient care, to improve understanding of medical/academic terms, an interest in developing transferable skills, and a necessary competency a future clinical career. The most frequently cited barriers were lack of time, lack of funds to conduct research projects, lack of formal research courses in curriculum and a lack of interest in research. Significant relationships were found between participation in research activities and education in research ( $p<.001$ ) and the type of dental hygiene degree program and participation in research activities ( $p<.01$ ). Students with previous research experience were significantly more likely to be encouraged by previous participation in research experiences than students without previous research experience ( $p<.01$ ).

**Conclusion:** Understanding the perceived motivations and challenges for research among undergraduate dental hygiene students, can help direct efforts to foster interest and overcome barriers to pursuing future research activities.

**Keywords:** dental hygiene education, dental hygiene students, dental hygiene research, graduate education, evidence-based research

This manuscript supports the NDHRA area **Professional development: education** (educational models).

Submitted for publication: 5/14/18; accepted: 4/26/19

### Introduction

Research is integral to dental hygiene practice, graduate education, and the advancement of the dental hygiene profession. As biomedical scientific knowledge and technological advances improve the delivery of patient care, it becomes critical that dental hygiene students gain the skills to critically appraise and utilize high quality research to guide their clinical decision-making process. Concurrently, research specific to the dental hygiene discipline is necessary for the advancement of the profession.<sup>1</sup> However, anxiety regarding thesis research has been cited as one of the top barriers to pursuing graduate education among practicing dental hygienists.<sup>2</sup> Understanding the motivations and challenges regarding the research process among undergraduate dental

hygiene students may help overcome the barriers to the pursue graduate education and advance the profession.

The curricular research requirement as outlined in Committee on Dental Accreditation (CODA) standard 2-22, states that dental hygiene “graduates must be competent in the evaluation of current scientific literature”, which encompasses life-long learning and evidence-based practice.<sup>3</sup> In dental hygiene practice, evidence-based decision making is defined as the systematic process combining the use of the best available scientific evidence, along with the clinician’s judgment and expertise, the patient’s preferences, and the patient’s clinical circumstance.<sup>4</sup> In undergraduate dental hygiene education, this standard emphasizes the clinical application of research

and not the generation of new knowledge acquired through participation in novel research activities.<sup>5</sup>

Predocctoral dental programs in various countries have incorporated research opportunities within the dental curriculum. Although challenges existed with their compulsory research experiences, South African dental students were shown to have gained an understanding of the scientific literature, support from their research mentors, and interest to continue further research studies.<sup>6</sup> By allowing Swedish dental students to select their topics and identify the practical applications of their research findings, the students maintained interest and motivation in gaining a deeper understanding of their research topics.<sup>7</sup> In a Turkish dental program, participation in a voluntary Student Research Club (SRC) led to higher GPA's, increased acceptance into PhD programs, and student transitions into academia.<sup>8</sup> Participants in the Student Research Program (SRP) at a dental program in the United States were more shown to be more likely to complete specialty training and pursue full-time educators roles.<sup>9</sup> Despite the positive outcomes demonstrated from research participation, many barriers exist in engaging in research.<sup>10</sup>

Fear of thesis research has been identified as one of the top five barriers to pursuing graduate education for dental hygienists.<sup>2</sup> In addition, Smith et al. found that a lack of motivation as one of the top challenges to pursuing graduate education.<sup>11</sup> If dental hygiene undergraduate students are not exposed to, or receive opportunities to conduct original research, this cycle of fear and a lack of motivation may persist in graduate education.<sup>12</sup> Insight into the perceived influential factors and the perceived barriers toward participation in original research in undergraduate dental hygiene programs is needed to increase the pursuit of future research activities. The purpose of this study was to identify the motivations and challenges toward participation in research activities as perceived by undergraduate dental hygiene students.

## Methods

This study was given a status of exempt by the Institutional Review Board of The Ohio State University (2017E0446). A quantitative, cross-sectional survey research design was used on a non-probability sample of undergraduate dental hygiene students attending entry-level dental hygiene programs in the United States. Inclusion criteria were final-year, undergraduate dental hygiene students; first-year undergraduate dental hygiene students were excluded due limited knowledge and exposure to undergraduate research activities.

The survey consisted of demographic and attitudinal questions modeled after two existing surveys that measured

medical student attitudes towards research.<sup>13,14</sup> Both authors granted permission to modify questions to apply to dental hygiene students. The survey consisted of 42 questions: 8 demographic questions including a question regarding participation in undergraduate research; 16 items regarding research motivations; and 18 questions regarding research barriers. Motivating factors influencing attitudes regarding research were evaluated by the students' responses to 16 Likert-style rating scale statements; barriers affecting student attitudes were evaluated by responses to a total of 18 Likert-style rating scale statements. The following Likert-style rating scale was used: 1. strongly disagree, 2. disagree, 3. neutral, 4. agree, and 5. strongly agree.

Both of the original surveys had been tested for validity and reliability.<sup>13,14</sup> The revised survey was reviewed by a panel of dental hygiene educators and students. No changes were made to the survey based on the feedback from the panel. A web-based software system, Qualtrics®, Inc. (Provo, UT), was used to create and administer the online survey.

An invitation to participate e-mail was sent to 228 undergraduate dental hygiene program directors in August 2017. Program director contact information was obtained from the American Dental Hygienists' Association and the individual dental hygiene program websites, program directors without publicly available contact information were not sent invitations to participate in the survey. Therefore, the sample represents a non-probability sample. Program directors were informed that they would receive two separate e-mails: one for informational purposes and the other to forward directly to their final-year, dental hygiene students. A set of reminder emails were sent after two weeks. The survey remained open for a total of 28 days. Participants were provided with information regarding the purpose, risks, benefits, data privacy, and confidentiality of their responses prior to beginning the survey. Respondents had the opportunity to opt-in for a drawing of two gift cards as an incentive to participate.

Descriptive statistics were used to identify the most common motivations and challenges toward participation in research experiences among undergraduate dental hygiene students. Chi-squared tests of independence were used to determine relationships between participation in research experiences and dental hygiene students' characteristics (gender, GPA, research interest, education in research, degree pursuing). Mann Whitney *U*-tests were conducted to determine any differences in the motivations and barriers to research among dental hygiene students with and without prior research experiences.

## Results

A total of 456 surveys were returned and responses from 361 were analyzed (n=361) for a completion rate of 79.1%. Ninety-five surveys were excluded because respondents were identified as first-year dental hygiene students or the respondents completed less than half of the survey. Since the program directors were not asked to provide the number of final year students in their programs, a response rate could not be calculated. According to the 2016-2017 Survey of Allied Dental Education Programs, there were approximately 8,107 dental hygiene students in their final year.<sup>15</sup> Most respondents were female (98.4%), self-reported greater than 3.0 GPA (95.8%), expressed interest in research (72.2%), had taken a research course (48.2%), were enrolled in an associate degree program (54.9%), and had not participated in undergraduate research activities (57.5%).

Chi-squared tests of independence were used to determine relationships between participation in undergraduate research activities and dental hygiene students' characteristics (gender, GPA, research interest, education in research, degree pursuing). No significant relationships were found between participation in undergraduate research activities and gender ( $\chi^2(2)=4.326$ ,  $p>.05$ ), GPA ( $\chi^2(1)=0.090$ ,  $p>.05$ ), and research interest ( $\chi^2(3)=1.663$ ,  $p>.05$ ). Significant relationships were found between participation in undergraduate research activities and education in research ( $\chi^2(2)=22.276$ ,  $p<.001$ ) and the type of degree being pursued ( $\chi^2(2)=12.826$ ,  $p<.01$ ). Students who had not taken a research course and were enrolled in associate dental hygiene programs were less likely to have participated in undergraduate research activities than students in bachelor programs and students who took or were currently taking a research

course. Respondent demographics and relationships in regards to participation in undergraduate research are shown in Table I.

Respondents' perceived motivations toward participation in research activities are shown in Table II. The top four motivations were: "good method to contribute to patient care" (n=328/352, 93.2%); "improve understanding of medical/academic terms" (n=311/360, 86.4%); "interest to develop transferable skills" (n=300/354, 84.7%); and "necessary competency for my future clinical career" (n=284/354, 80.2%).

Mann Whitney *U*-tests were conducted to determine any differences in the research motivations among dental hygiene students with and without prior research experiences (Table II). Students with previous undergraduate research experience were significantly more likely to perceive encouragement from previous participation in UR experiences ( $M=142.54$ ) than students without previous undergraduate research experience ( $M=172.97$ ,  $p<.01$ ).

Respondents' perceived barriers towards participation in research activities are shown in Table III. The top four barriers cited were: "lack of time" (n=286/344, 83.1%); "lack of funds to conduct research projects" (n=174/342, 50.9%); "lack of formal research courses in curriculum" (n=152/345, 44.1%); and "lack of interest in research" (n=148/340, 43.5%).

**Table I. Relationships between demographic characteristics of survey respondents and participation in research experiences (n=313)**

Variables	Participation in research experiences (n=133)	No participation in research experiences (n=180)	p-value*
<b>Gender</b>			<b>p&gt;.05</b>
Male	0	4	
Female	132	176	
Non-conforming	1	0	
<b>GPA</b>			<b>p&gt;.05</b>
≥3.0/4.0	128	172	
<3.0/4.0	5	8	
<b>Research interest</b>			<b>p&gt;.05</b>
Very interested	16	27	
Somewhat interested	82	101	
Somewhat not interested	25	33	
Not interested	10	19	
<b>Education in research</b>			<b>p&lt;.001‡</b>
Course taken	76	75	
Course not taken	12	56	
Currently enrolled	45	48	
<b>Degree pursuing</b>			<b>p&lt;.01‡</b>
Bachelor degree	73	62	
Associate degree	58	114	
Certificate	2	3	

\* Chi-squared tests were used to determine relationships between participation in research experiences and dental hygiene students' characteristics (gender, GPA, research interest, education in research, degree pursuing)

‡ Statistical significance, p-value <.01

**Table II. Perceived motivations toward participation in research experiences.**

Motivations toward research experiences	All Respondents						Respondents with research experiences Mean rank (n)	Respondents without research experiences Mean rank (n)	p-value ***
	Disagree % (n)*	Neutral % (n)*	Agree % (n)*	n	M**	IQR			
Good method to contribute to patient care	3.1% (11)	3.7% (13)	93.2% (328)	352	4.0	4.0-5.0	149.35 (131)	159.15 (178)	.282
Improve understanding of medical/academic subjects	6.1% (22)	7.5% (27)	86.4% (311)	360	4.0	4.0-5.0	150.53 (132)	160.88 (180)	.57
Interest to develop transferable skills	4.5% (16)	10.7% (38)	84.7% (300)	354	4.0	4.0-5.0	149.76 (132)	159.76 (178)	.280
Necessary competency for my future clinical career	5.4% (19)	14.4% (51)	80.2% (284)	354	4.0	4.0-5.0	161.98 (132)	150.70 (178)	.223
Develop transferable skills e.g., communication skills	6.7% (24)	13.4% (48)	79.9% (286)	358	4.0	4.0-5.0	150.35 (132)	160.17 (179)	.299
Specific research field or medical topic	9.8% (35)	20.9% (75)	69.3% (248)	358	4.0	3.0-4.0	153.61 (131)	156.89 (179)	.727
Improve curriculum vitae (CV)	8.2% (29)	23.4% (83)	68.4% (242)	354	4.0	3.0-4.0	155.89 (130)	152.61 (177)	.730
Facilitate entry to a graduate program	18.6% (66)	20.9% (74)	60.5% (214)	354	4.0	3.0-4.0	153.36 (131)	156.21 (178)	.773
Good method to fulfill leisure time	18.1% (64)	22.9% (81)	59.0% (209)	354	4.0	3.0-4.0	153.06 (132)	157.31 (178)	.667
Motivation from parents/faculty/senior students involved in scientific research	16.4% (58)	25.1% (89)	58.5% (207)	354	4.0	3.0-4.0	163.53 (131)	148.72 (178)	.128
Facilitate entry into competitive residency training programs	16.2% (58)	25.8% (92)	58.0% (207)	357	4.0	3.0-4.0	159.77 (132)	153.22 (179)	.506
Develop research competencies	23.1% (83)	29.2% (105)	47.8% (172)	360	3.0	3.0-4.0	155.5 (133)	158.09 (180)	.794
Encouragement from previous participation in research experiences	22.3% (79)	35.2% (125)	42.5% (151)	355	3.0	3.0-4.0	172.97 (132)	142.54 (178)	<b>.002‡</b>
Present research findings in scientific meetings	32.5% (115)	26.0% (92)	41.5% (147)	354	3.0	2.0-4.0	159.23 (132)	151.84 (177)	.457
Commence a research-focused career	33.3% (118)	27.1% (96)	39.5% (140)	354	3.0	2.0-4.0	159.08 (132)	152.85 (178)	.532
Publish articles in peer-reviewed journals	41.2% (146)	22.3% (79)	36.4% (129)	354	3.0	2.0-4.0	155.3 (132)	154.78 (177)	.958

\* Responses were based on a 5-point Likert-scale and were grouped into three categories: Agree (5-strongly agree and 4-agree), Neutral (3-neutral) and Disagree (2-disagree, 1-strongly disagree).

\*\* The calculations for the median and IQR were based on the 5-point Likert rating scale.

\*\*\* Two-tailed Mann Whitney U-tests were used to compare the median 5-point Likert-scale responses between respondents with and without research experiences.

‡ Statistical significance, p-value <.01

**Table III. Perceived barriers toward participation in research experiences**

Barriers toward research experiences	All Respondents						Respondents with research experiences Mean rank (n)	Respondents without research experiences Mean rank (n)	p-value***
	Disagree % (n)*	Neutral % (n)*	Agree % (n)*	n	M**	IQR			
Lack of time	7.0% (24)	9.9% (34)	83.1% (286)	344	4.0	4.0-5.0	146.68 (126)	152.42 (173)	.529
Lack of funds to conduct research projects	16.4% (56)	32.7% (112)	50.9% (174)	342	4.0	3.0-4.0	149.19 (126)	150.59 (173)	.886
Lack of formal research courses in curriculum	25.8% (89)	30.1% (104)	44.1% (152)	345	3.0	2.0-4.0	127.36 (126)	167.26 (174)	<.001‡
Lack of interest in research	27.9% (95)	28.5% (97)	43.5% (148)	340	3.0	2.0-4.0	149.85 (126)	150.11 (173)	.979
Lack of research mentors	31.7% (109)	27.9% (96)	40.4% (139)	344	3.0	2.0-4.0	134.06 (126)	162.40 (174)	.004‡
Lack of effective Undergraduate Research Committee	25.9% (89)	37.3% (128)	36.7% (126)	343	3.0	2.0-4.0	138.02 (126)	158.72 (173)	.032‡
Lack of support to participate in research activities	31.2% (106)	35.9% (122)	32.9% (112)	340	3.0	2.0-4.0	142.29 (126)	155.62 (173)	.171
Lack of on-campus basic science research laboratories	33.5% (115)	35.3% (121)	31.2% (107)	343	3.0	2.0-4.0	141.56 (126)	156.15 (173)	.135
Lack of research opportunities	38.2% (128)	34.6% (116)	27.2% (91)	335	3.0	2.0-4.0	144.77 (124)	152.03 (173)	.454
I hate the scientific complexity of research	48.5% (163)	27.1% (91)	24.4% (82)	336	3.0	2.0-3.0	158.71 (124)	142.04 (173)	.088
Lack of effective team work with research mentors and/or co-authors	38.9% (131)	38.0% (128)	23.1% (78)	337	3.0	2.0-3.0	148.36 (125)	150.32 (173)	.839
Lack of research publishing in peer-reviewed journals	39.1% (133)	42.6% (145)	18.2% (62)	340	3.0	2.0-3.0	150.43 (126)	149.69 (173)	.938
Lack of research presentation in local/international scientific conferences	34.4% (117)	47.9% (163)	17.6% (60)	340	3.0	2.0-3.0	147.18 (126)	152.05 (173)	.604
Lack of “credited authorship” when I participate in research projects	36.2% (123)	48.2% (164)	15.6% (53)	340	3.0	2.0-3.0	142.35 (126)	155.58 (173)	.159
I had previous bad research experience(s) with projects/ mentors/ co-authors	60.0% (201)	28.7% (96)	11.3% (38)	335	2.0	2.0-3.0	155.57 (124)	143.40 (172)	.206
Lack of finding same-gender research mentor	52.4% (178)	37.4% (127)	10.3% (35)	340	2.0	2.0-3.0	147.19 (126)	152.05 (173)	.612
Research is NOT important for clinical careers	80.0% (268)	15.2% (51)	4.8% (16)	335	2.0	1.0-2.0	153.19 (123)	145.16 (173)	.391
I’m afraid from sexual harassment in research environments	81.4% (272)	16.5% (55)	2.1% (7)	334	1.0	1.0-2.0	158.49 (124)	141.30 (172)	.059

\* Responses were based on a 5-point Likert-scale and were grouped into three categories: Agree (5-strongly agree and 4-agree), Neutral (3-neutral) and Disagree (2-disagree, 1-strongly disagree).

\*\* The calculations for the median and IQR were based on the 5-point Likert rating scale.

\*\*\* Two-tailed Mann Whitney U-test were used to compare the median 5-point Likert-scale responses between respondents with and without research experiences.

‡ Statistical significance, p-value <.01



Mann Whitney *U*-tests were conducted to determine any differences in the research barriers among dental hygiene students with and without prior research experiences (Table III). Students without previous research experience ( $M=127.36$ ) were significantly more likely than students with previous research experience to lack formal research courses in their curriculum ( $M=167.26$ ,  $p<.001$ ). Students without previous research experience ( $M=134.06$ ) were significantly more likely than students with previous undergraduate research experience to lack research mentors ( $M=162.40$ ,  $p<.01$ ). Students without previous research experience ( $M=138.02$ ) were significantly more likely than students with previous undergraduate research experience to lack effective undergraduate research committees ( $M=158.72$ ,  $p<.05$ ).

## Discussion

The purpose of this study was to identify the motivations and challenges toward participation in research activities perceived by undergraduate dental hygiene students. Regarding perceived motivations, connections with clinical practice and transferable skills were rated highest. Students with previous research experience were significantly more likely than those without any experience to receive encouragement from previous participation in research experiences. In regards to research challenges, lack of time was cited by all respondents, regardless of whether they had research experience or not. Students without previous research experience were significantly more likely than students with experience to perceive the lack of formal research courses in their curriculum, lack research mentors, and lack effective undergraduate research committees as barriers.

Less than half of the respondents (42%) had participated in undergraduate research activities. This percentage is lower than the 63% of dental students who reported participation in undergraduate research activities prior to matriculation into dental school<sup>16</sup> and slightly higher than the percentage of medical students who participated in undergraduate research in the United Kingdom (38%)<sup>17</sup> and Portugal (39%).<sup>18</sup> Outside of the U.S., dental and medical education is often completed at the baccalaureate level whereas dental and medical education in the U.S. is completed at the post-baccalaureate level. Students in the U.S. have more opportunities for research experiences prior to entry in dental or medical school. In addition, prospective applicants of professional graduate programs tend to engage in research activities to bolster their applications, which may not be as prevalent worldwide.

No significant relationships were found between gender, GPA, or research interest and participation or non-participation in research activities. Since the dental hygiene profession is predominately female, it was not surprising that most of the survey respondents were female. In this study, 1.3% of respondents were male, which is less than the 2.9% of male dental hygienists reported by the US Department of Labor.<sup>19</sup> This contrasts the existing worldwide gender bias for higher percentages of males to be involved in research activities.<sup>14</sup> Due to the lack of similar numbers of female and male respondents in this study and the general dental hygiene profession, it remains difficult to compare the data from the present study to previous research demonstrating a higher percentage of males than females involved in research activities.<sup>15</sup> Although increased participation in research activities among high achievers versus low achievers has been shown,<sup>14,18</sup> nearly all of respondents in the present study reported greater than 3.0 GPA. Over two-thirds of respondents reported to be interested in research regardless of past participation or non-participation in research activities. This may indicate that merely participation in research activities may not influence an overarching interest in research. Future research using qualitative research designs should explore this phenomenon.

Significant differences were found between education in research or degree program and participation or non-participation in research activities. Of the respondents with research experiences, almost all had taken or were currently enrolled in a research course and over half of the respondents were enrolled in a bachelor-degree program. Of the respondents without any research experience, about two-thirds had taken or were currently enrolled in a research course and about two-thirds were enrolled in an associate-degree program. This may indicate that a formal research course within the dental hygiene curriculum may promote a general interest in engaging or participation in research activities. However, the lack of statistical difference in research interest between the students with and without actual research experiences indicates that participation in research does not significantly increase the extent of interest already experienced by the non-participants. With more formalized research courses, students enrolled in bachelor-degree programs may be more likely to participate in research activities. The trend in undergraduate education in the sciences is moving towards the incorporation of course-based research projects to increase active learning and expose students to different aspects of the research process.<sup>20</sup> For this study, it was unknown whether dental hygiene students had course-based research projects. CODA standards for both dental and dental hygiene students, require the curricula

to emphasize the application of research in evidence-based practice. However, emphasizing evidence-based practice as part of the research course content may not prepare students for research activities. Despite taking designated research courses, dental students perceived they felt inadequate in their understanding of biostatistics and research methodology.<sup>16</sup>

Patient care and the transfer of skills were indicated most highly in regards to respondents' perceived motivations towards research activities. Involvement in clinical research studies may allow students to have a better understanding of the relevance of their research work as dental hygiene professionals. Students with previous research experience were significantly more likely to perceive encouragement from their participation, than students without previous research experience, to be a motivating factor. The literature has shown that previous participation in research activities has been directly linked to positive outlook on scientific research in general and increased likelihood to pursue research activities in the future.<sup>14,21-23</sup> Boyd et al. identified fear of thesis research as a barrier to graduate education among dental hygienists;<sup>2</sup> however, increased participation in undergraduate research activities may help overcome this barrier. In addition, undergraduate students with research experiences are more likely to receive encouragement from faculty mentors to pursue future research and graduate education. Faculty members play an important role in identifying students with the potential for advanced education and in mentoring them through the process.

In regards to perceived challenges towards research experiences, respondents without previous research experience were significantly more likely to lack a formal research course in their curriculum, lack research mentors, and lack effective undergraduate research committees as compared to students with previous research experience. Current accreditation standards require dental hygiene programs to prepare dental hygienists to be able to evaluate scientific literature and evidence-based practice.<sup>3</sup> A formal research methods course is less likely to be included in the dental hygiene curriculum of an associate degree program; research concepts and terminology are more likely to be included in a community dental/oral health course.<sup>15</sup> Associate-degree dental hygiene programs faculty may lack research mentoring experience and the academic reward structure does not incentivize mentoring or training undergraduate researchers.<sup>24,25</sup>

This study had several limitations. The topic of undergraduate research may have elicited a response bias from students in baccalaureate degree programs. Greater numbers of students in baccalaureate programs may have responded due to a greater interest in research and a selection bias of

baccalaureate degree program directors may have existed based on the publicly available contact information. The response rate was relatively low compared to the estimated current enrollment of final-year dental hygiene students, limiting the generalizability of the results. Undergraduate research activities were not explicitly defined, therefore the interpretation of the term was dependent upon the survey respondent. Research activities may have been interpreted as searching the literature, literature reviews, critical analysis of research articles, or participation in an original research project. Future studies on this topic should include an explicit statement of the intended definition. Due to the timing of the survey at the beginning of the academic year, attitudes of students engaged in undergraduate research activities over the course of the academic year were not considered. There may have been self-reporting bias, inherent in survey research. Closed-ended questions may also have limited the responses.

## Conclusion

Dental hygiene programs should engage students with opportunities to support the perceived student interest associated with research activities. Formal research courses in the dental hygiene curriculum, research mentors, and effective undergraduate research committees are needed to overcome the challenges to conducting research. Dental hygiene programs should focus on identifying students with research interests, match students with faculty research mentors, and provide financial resources to support research interests as well as overcome the challenges associated with research activities and graduate education. Future studies should include qualitative methods to better understand dental hygiene student attitudes as well as the motivations and barriers of dental hygiene faculty in regards to mentoring research activities among undergraduate dental hygiene students.

## Acknowledgments

The authors would like to thank The Ohio State University, Division of Dental Hygiene for their continued research support and The Ohio State University, College of Dentistry, Student Research Program for awarding the student scholarship and providing the travel funds to present the research findings.

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