

# A Comparative Study of Practice, Perception, and Attitude of Undergraduate Healthcare Students towards Toothbrush Selection, Maintenance and Replacement in RAS Al-Khaimah, United Arab Emirates

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## ABSTRACT

**Aim:** Oral hygiene is one of the most significant lifestyle-related determinants of well-being. Health sciences undergraduate students are not only future healthcare providers but also educators of society in maintaining the overall general health. The aim of the study was to assess the practice, perception, and attitude of healthcare students in RAS Al-Khaimah toward toothbrush selection, maintenance, and replacement.

**Materials and methods:** A prospective cross-sectional study was conducted among medicine, dentistry, pharmacy, and nursing undergraduate students. The data on demography, practice, perception, and attitude was collected using a self-administered structured questionnaire. It was evaluated using the Chi-square test and Spearman's rho test.

**Results:** Out of 318 participating students of both genders, medicine (26.4%), dentistry (25.7%), pharmacy (35.8%), and nursing (12.0%) students showed satisfactory practice (51.8%) and perception (77.3%) of toothbrush selection, maintenance, and replacement. A significant difference ( $p = 0.000$ ) in attitude was observed across the different disciplines.

**Conclusion:** The study group demonstrated a satisfactory level of understanding regarding the selection, maintenance and replacement of toothbrush to ensure oral care and hygiene. Educating the health sciences students during their undergraduate studies with more general health topics such as oral hygiene is of utmost need, and community engagements, interdisciplinary learning approaches and curriculum updates can help to achieve this.

**Clinical significance:** This study draws the attention for the inclusion of health-related topics in the curriculum that may impact on community health and education.

**Keywords:** Attitudes, Health sciences students, Noncommunicable diseases, Perception, Practice, Toothbrush, United Arab Emirates

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## INTRODUCTION

Global Oral Health Status Report (2022) by the World Health Organization (WHO) estimates that about 3.5 billion people worldwide suffer from oral diseases, with three out of every four of these persons living in middle-income countries.<sup>1</sup> Untreated oral illnesses and disorders affect the quality of life as they have a severe impact on the overall health. In addition, they also have a major influence on the various psychological aspects of life, which include self-confidence, well-being, and the ability of social interaction.<sup>2-4</sup> Caries of the deciduous and permanent teeth, tooth cavities, periodontal disease, cancers of the lip and oral cavity, and edentulism are some of the most common conditions that influence our oral health.<sup>5</sup>

The most effective method for preventing dental caries and periodontitis is to maintain healthy oral status and eliminate dental plaque by frequent and adequate mechanical cleaning of the teeth using the correct toothbrush. The American Dental Association (ADA) recommends using fluoride toothpaste and a soft-bristled toothbrush to brush teeth twice a day for 2 minutes each time. Depending on the preference of individuals, both electric and manual toothbrushes are excellent in removing oral

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plaque. Toothbrushes should not be shared and should be cleaned thoroughly with water to remove any residual toothpaste and dirt, and allowed to dry naturally by storing them separately in upright position to avoid the growth of undesirable germs and the cross-contamination. If the bristles are worn, they should be replaced every 3–4 months or earlier.<sup>6,7</sup> Inadequate toothbrush maintenance and storage may have a significant impact on disease transmission and infection risk among individuals.<sup>8–10</sup>

One of the primary public health objectives in the United Arab Emirates (UAE) is to improve the nation’s oral health status through the accessibility of oral healthcare services and dental public health programs.<sup>11,12</sup> However, despite the significant advancements in providing oral healthcare, research shows that dental caries continues to be a public health issue in UAE, especially among children and adolescents.<sup>13–15</sup>

Various research studies have been published in the literature on the oral hygiene knowledge, awareness, and attitudes of university healthcare student populations in the Arab world<sup>16–19</sup> and non-Arab countries.<sup>20–23</sup> However, despite a large amount of research supporting the link between oral health and the occurrence of a majority of noncommunicable diseases (NCDs), oral health knowledge, practice, perception and attitude among health providers remains weak. In addition, the majority of the studies regarding oral hygiene practices and knowledge have been conducted among dental students and little information was obtained on other healthcare sciences students. The health sciences undergraduate students being the future healthcare service providers are responsible for the overall community health, hence, this study was restricted to the medical and health sciences students. In addition, the outcomes of the study may guide the faculty to design the curriculum in order to develop the required competencies for the future healthcare providers. Therefore, our study was designed to assess and compare the oral hygiene practice, perception, and attitude of different healthcare sciences students of RAK Medical and Health Sciences University toward the appropriate toothbrush selection, maintenance, and replacement.

## MATERIALS AND METHODS

### Study Sample and Design

This prospective cross-sectional convenience sampling study was conducted among medicine, dentistry, pharmacy, and nursing students of RAK Medical and Health Sciences University, RAS Al-Khaimah, UAE. All adult male and female university students from 18 years old and above who provided consent were included in the study, while former graduated students and postgraduate students were excluded from participation in this study. The minimum sample size of 282 was calculated based on a study population of 1,050 students using Raosoft® software by selecting a margin of error of 5%, a confidence interval of 95%, and a response distribution of 50%. A questionnaire based on knowledge–attitude–practice (KAP) model was prepared by modifications from literature.<sup>24</sup> Prior to data collection they were validated and pretested in a pilot study with a subset of 21 students who were not included in the main study. The research project was approved by RAKMHSU Research and Ethics Committee (RAKMHSU-REC-015-2019-F-P).

The questionnaire was prepared in English and was distributed randomly to undergraduate students of all the academic years, and they were asked to answer the questionnaires voluntarily after signing the consent form. Data from students who responded to the survey was gathered over a period of 3 months between September 19, 2022 and November 21, 2022.

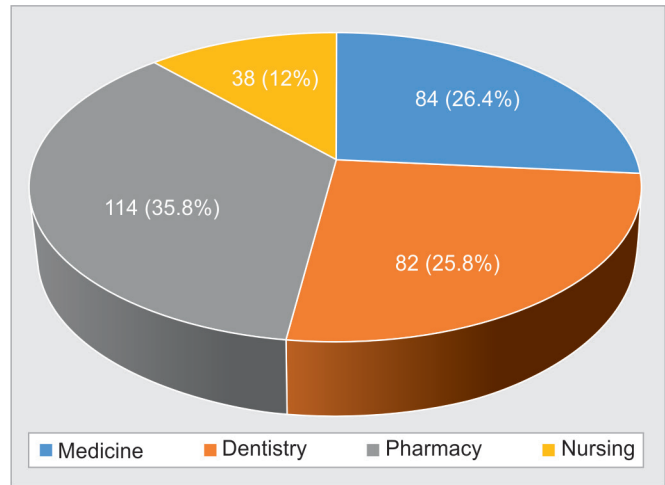


Fig.1: Pie chart showing the study population of different colleges of the university

All information given by the participants was strictly confidential, protected, and was used for this particular research only. The questionnaire consisted of sociodemographic and 16 multiple responses questions under four sections. It included:

- Personal information (gender, marital status, age, nationality, degree, and year of study).
- Eight questions on the practice of toothbrush selection, maintenance and replacement, and practice of toothbrushing.
- Four questions on the perception of toothbrushing, replacement, and maintenance of toothbrush.
- Four questions on the attitude of students on the usage, selection and storage of toothbrush, and attitude of students on the frequency/duration of toothbrushing.

To calculate the total score, for every practice and perception-based question, a score of 1 was given to the correct responses and 0 for the false responses. To compute the total score of attitudinal-based questions, the positive and negative responses were scored as +1 and –1, respectively.

### Statistical Analysis

The data were entered in Microsoft Excel v 16 spreadsheet and subsequently processed for the statistical analysis by the Statistical Package for Social Sciences (SPSS) version 27.0 (IBM Corp., Armonk, New York, USA). Demographic information, scores, and percentages of the data collected are summarized using descriptive statistics. The statistical association of categorical variables was assessed using Spearman’s Rho rank correlation and Pearson correlation (Chi-square test). A *p*-value less than 0.05 was considered statistically significant.

## RESULTS

The survey was completed by 318 undergraduate students who belonged to medicine (84, 26.4%), dentistry (82, 25.8%), pharmacy 114, 35.8%), and nursing (38, 12.0%). Figures 1 and 2 represent the demographic data of the respondents. Among the entire cohort, 237 (74.5%) were females and 81 (25.5%) students were male. The difference in the responses to questions was evaluated statistically between academic disciplines and gender categories.

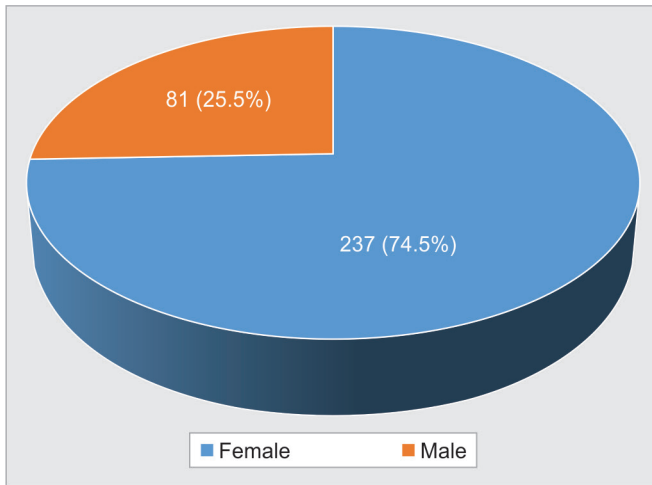


Fig. 2: Pie chart showing the gender of the study population

### Responses to Practice-related Questions

The distribution of respondents to the practice-related questions as per discipline, entire cohort, and gender is depicted in Table S1.

#### Practice of Toothbrush Selection

The majority of the students (97.4–91.7%) use a manual toothbrush, and there is no statistical difference ( $p = 0.622$ ) among the students of different disciplines. Although the battery-operated toothbrush was used by more female students (6.3%) than male students (4.5%), however, there was no statistical difference ( $p = 0.648$ ). As regards the type of bristle, a significant association was observed with the disciplines ( $p = 0.022$ ). In general, 62.9% of the entire cohort used medium bristles followed by 35.5% of soft and 1.6% of hard bristles. A similar trend was found among students of different disciplines and genders. There was no statistical difference between the selection of a type of bristles by female and male students ( $p = 0.171$ ).

Table 1: Descriptive statistics for toothbrush-related practice, perception, and attitudes among the students

Variables (range)	Entire cohort (N = 318)		Medicine (N = 84)		Dentistry (N = 82)		Pharmacy (N = 114)		Nursing (N = 38)		Test results* $\chi^2$ (p)
	Mean $\pm$ SD	%	Mean $\pm$ SD	%	Mean $\pm$ SD	%	Mean $\pm$ SD	%	Mean $\pm$ SD	%	
Practice (0–8)	4.12 $\pm$ 1.195	51.8	3.77 $\pm$ 1.045	48.9	4.33 $\pm$ 1.267	54.1	4.28 $\pm$ 1.216	53.5	3.92 $\pm$ 1.124	50.0	24.309 (0.145)
Perception (0–4)	3.10 $\pm$ 0.926	77.3	3.21 $\pm$ 0.851	80.3	2.94 $\pm$ 0.894	73.5	3.15 $\pm$ 0.980	78.7	3.03 $\pm$ 1.409	75.6	17.933 (0.118)
Attitude (–4 – +4)	1.14 $\pm$ 2.497	64.2	–2.07 $\pm$ 2.29	75.8	–0.93 $\pm$ 3.745	61.5	–0.65 $\pm$ 3.84	58.1	–0.26 $\pm$ 3.80	62.5	34.872 (0.000)

\*Pearson correlation, significant  $p < 0.05$

### Descriptive Statistics for Toothbrush-related Practice, Perception, and Attitudes

The total execution rate of right practice toward toothbrush selection, maintenance, replacement, and brushing teeth among university students was 4.12 (51.8%; 95% CI 3.99, 4.25). Dentistry students (4.33; 54.1%; 95% CI 4.06, 4.6) executed better practices toward toothbrushes compared with the pharmacy (4.28; 53.5%; 95% CI 4.06–4.5), nursing (3.92; 50.0%; 95% CI 3.56–4.28), and medicine (3.77; 48.9%; 95% CI 3.55, 3.99) students (Table 1). The total perception of toothbrush selection, maintenance, replacement, and brushing teeth among university students was 3.10 (77.3%; 95% CI 3.0, 3.2). The total perception of medicine students (3.21; 80.3%; 95% CI 3.03, 3.39) was the highest followed by the pharmacy (3.15; 78.7%; 95% CI 2.97, 3.33), nursing (3.03; 75.6%; 95% CI 2.58, 3.48), and dentistry (2.94; 73.5%; 95% CI 2.75, 3.13) students. The total holding rate of attitudes of students toward the duration of toothbrush use and seek the advice of dental professionals regarding selection, storage of toothbrushes, and frequency/duration of toothbrushing were 1.14 (64.2%; 95% CI 1.41, 0.866). The medicine students showed the lowest negative attitude (–2.07; 75.8%; 95% CI: –2.560, –1.580) followed by dentistry (–0.93; 61.5%; 95% CI: –1.743, –0.117), pharmacy (–0.65; 58.1%; 95% CI: –1.355, –0.055), and nursing (–0.26; 62.5%; 95% CI: –1.468, 0.948) students. The overall average attitude score was lower than that of practice, and perception.

### Correlation Analysis among Latent Variables

There were positive correlations between toothbrush selection, maintenance, replacement, and teeth brushing-related practice and perception ( $r = 0.036$ ,  $p = 0.517$ ) and a negative correlation for attitude ( $r = -0.139$ ,  $p = 0.013$ ) of the health sciences university students. The results are shown in Table 2.

Table 2: Correlation analysis among latent variables

	Practice $r$ (p)	Perception $r$ (p)	Attitude $r$ (p)
Practice	1.000		
Perception	0.036 (0.517)	1.000	
Attitude	–0.139 (0.013)	–0.132 (0.018)	1.000

Spearman's rank correlation, significant  $p < 0.05$  (two-tailed)

#### Practice of Brushing Tooth

Regarding the frequency of toothbrushing during the day, the association with disciplines was statistically significant ( $p = 0.021$ ). The brushing frequency of twice a day was higher among nursing (81.6%), dentistry (72.0%), and medicine (71.4%) students, while the frequency of three times or more was higher among pharmacy (22.8%), and dentistry (14.6%) as compared with other disciplines. A statistically insignificant association was found among the genders regarding the frequency of toothbrushing during the day ( $p = 0.069$ ). The time required for brushing teeth was insignificantly different in male and female students as well as in different disciplines ( $p > 0.05$ ). The overall time required for brushing 2–3 minutes and more was 47.2% of students.

#### Practice of Toothbrush Maintenance

Regarding the procedure for cleaning a toothbrush, the difference in the habits was significant across disciplines ( $p = 0.005$ ). The proportion of students from pharmacy (60.5%), dentistry (57.3%) and medicine (50%) mainly follow rinsing with cold water as compared with nursing (34.2%). No significant difference was between the female and male students regarding the practice of cleaning the toothbrush after its use ( $p = 0.671$ ). The storage pattern of toothbrushes differed significantly across disciplines ( $p = 0.007$ ).

However, the practice of storage insignificantly differed between the female and male students ( $p = 0.784$ ).

#### *Practice of Toothbrush Replacement*

The practice of changing toothbrushes after recovering from illness was insignificantly different across the different disciplines and also in female and male students ( $p > 0.05$ ). Overall, 42.5% of the entire cohort do not follow the practice of changing the toothbrush after recovering from an illness compared with 35.8% of students who change and 21.7% who change sometimes. Regarding the replacement of a toothbrush with a new one, the reasons differed significantly across disciplines ( $p = 0.002$ ) and female and male students ( $p = 0.006$ ). The reasons for replacement were nearly similar for dentistry and pharmacy students and differed from those for medicine and nursing students. However, rough bristles (33.6%) and slayed/bend (27.4%) were the main reasons for changing the toothbrush for the entire cohort.

#### **Responses to Perception-based Questions**

The distribution of respondents to the perception-based questions as per discipline, entire cohort, and gender is depicted in Table S2.

#### *Perception of Toothbrush Knowledge*

The majority of students (78.3%) knew that the toothbrush gets contaminated after using it regularly; however, 5.3% of students did not agree to that and 16.4% of students were not sure if the regular use of toothbrushes results in contamination. A similar trend was evident with students of different disciplines and genders. The perception of students of different disciplines differed insignificantly ( $p = 0.061$ ) whereas that of female and male students differed significantly ( $p = 0.000$ ). The majority of the respondents from the pharmacy (46.5%) medicine (45.2%), and dentistry (43.9%) believed that the contamination occurs due to the external environment, while other students of dentistry (42.7%) and nursing students (31.6%) believed that it could be due to oral cavity microbes. The knowledge about the source of toothbrush contamination differed insignificantly across disciplines ( $p = 0.527$ ). Compared with the male students (38.3%), the female students (45.1%) believed the external environment is a major reason for toothbrush contamination than the oral cavity microbes ( $p = 0.564$ ). Regarding students' perception of the effect of contaminated toothbrushes on general health, it differed insignificantly across disciplines ( $p = 0.455$ ) as well as gender (0.191). The majority of the students (85.2%) believed that contaminated toothbrushes can affect general health.

#### *Perception of Toothbrush Replacement*

Regarding the necessity of toothbrush replacement, the perception of students differed insignificantly across disciplines ( $p = 0.337$ ), where 79.9% of students agreed to the replacement. Their perception differed significantly among the female and male students ( $p = 0.049$ ).

#### *Perception of Toothbrush Maintenance*

The perception about disinfecting the toothbrush also showed insignificant differences across disciplines ( $p = 0.070$ ) and among genders ( $p = 0.528$ ). The pharmacy students (75.4%) felt the necessity to disinfect their toothbrushes followed by medicine (67.9%), nursing (63.1%), and dentistry (53.6%) students. About 30.5% of dentistry students were not sure of the necessity to

disinfect the toothbrush. The responses of the female and male students were almost similar.

#### **Responses to Attitude-based Questions**

The distribution of respondents to the attitude-based questions as per discipline, entire cohort, and gender is depicted in Table S3.

#### *Attitude of Usage of Toothbrush*

Regarding the duration of usage of a toothbrush, there was a statistically significant difference in the usage times across disciplines ( $p = 0.013$ ). The proportion of students using the toothbrush for 3 months or less was 83.7% of entire cohort. The association between the duration of toothbrush usage and gender was also statistically significant ( $p = 0.049$ ). The proportion of males using a toothbrush for 2 months (34.6%) was higher than females (19.4%), while the proportion of females using a brush for 3 or more months (48.5%) was higher than males (39.5%). In other words, the duration of toothbrush usage is longer among females as compared with males.

#### *Attitude to the Selection of Toothbrush*

Regarding seeking advice for the selection of a toothbrush according to dental need, there was a significant association with disciplines ( $p = 0.014$ ). The students from medicine (22.3%) and nursing (39.5%) sought the least advice as compared with other disciplines. The proportion of male students seeking advice regarding the selection of a toothbrush according to dental need was significantly more in males (59.3%) as compared with females (42.2%) ( $p = 0.008$ ).

#### *Attitude of Frequency/Duration of Toothbrushing*

Seeking advice regarding frequency/duration of brushing also showed a significant association across disciplines ( $p = 0.003$ ). The students from medicine (28.6%) sought the least advice as compared with other disciplines. The proportion of male students seeking advice regarding frequency/duration of brushing was significantly higher (59.3%) than that of females (40.1%) ( $p = 0.003$ ).

#### *Attitude toward the Storage a Toothbrush*

Similarly, seeking advice regarding the storage of a toothbrush after use showed significant differences across disciplines ( $p < 0.0001$ ). The students of dentistry (17.1%) and medicine (8.3%) sought the least advice as compared with others. The proportion of male students seeking advice regarding frequency/duration of brushing was insignificantly higher (25.9%) than that of females (20.3%) ( $p = 0.258$ ).

## **DISCUSSION**

Healthcare students are the community's future oral and general health opinion leaders. They serve as role models of a healthy lifestyle and their views about healthcare reflect both their grasp of the importance of disease control and their involvement in the primary prevention of illnesses. Therefore, they can play a critical role in changing their community's health-related attitudes and behaviors and promote the right practice toward toothbrush selection, maintenance, storage, and replacement after use, which may have an impact on the oral and overall health of society. Yet, there was no study that compares the practice, perception, and attitude of undergraduate multidisciplinary healthcare students in the UAE.

This study revealed that the health sciences students had non-significant differences in practices ( $p = 0.145$ ) and perception ( $p = 0.118$ ) related to oral hygiene, toothbrush care, and usage. However, they differed in their attitude. A varied response was observed regarding the practices-related questions about the type of toothbrush used, frequency, and duration of brushing. About 54.1% of dentistry students executed better practices, which is similar to the findings from another study, reporting a relatively higher level of practice among dental students.<sup>25</sup> This may be due to the growing knowledge of dental professionals on the importance of excellent oral health and the focus on preventative measures, which is attributed to their specialty educational background that leads them to pay close attention to the issue related to toothbrush and oral hygiene. Most of the participants in this study reported using a manual toothbrush (94%) with medium bristles (62.9%) for cleaning their teeth. Similarly, according to the study by Tadin A et al., 980 (90.1%) participants used manual toothbrush to clean their teeth, while 436 (40.1%) used medium bristles.<sup>26</sup> Majority of the nursing students (81.6%) in our study brushed their teeth twice a day, followed by dental students (72%). On the other hand, a study conducted in Iran reported 36.9% of nursing students practiced the same frequency of brushing their teeth.<sup>24</sup> The same study showed that health sciences students preferred to brush their teeth for 2–3 minutes and wash their toothbrushes with cold water. Similarly, the students in our study cleaned their toothbrushes with cold water. However, they preferred to brush their teeth for 1–2 minutes. The current study revealed that among the health sciences students, medical students (61.9%) preferred to keep their toothbrushes inside the bathroom with uncovered heads, while 57.9% of pharmacy students preferred to cover the heads of their toothbrushes, and only a few health sciences students (5%) kept their brushes outside the washroom with no head cover. Earlier studies showed that exposure of toothbrushes that were placed in closed containers to contaminated surfaces produced greater bacterial counts and moisturized environment suitable for a longer bacterial survival rate than in the toothbrushes that were kept uncovered.<sup>27,28</sup> Majority of the respondents in our study did not change their toothbrushes after recovering from illnesses and only 35.8% of students changed their toothbrushes after recovery. The students preferred to change their toothbrushes when the bristles became rough (33.6%). Previous studies showed that participants replaced their toothbrushes when bristles frayed since they trap and retain more microorganisms.<sup>9,29</sup> Overall, the students in our study did not demonstrate differences in practices based on gender, except for changing the toothbrushes.

On assessing the perception of the healthcare students in our study, the majority of the students who demonstrated good perception about toothbrush contamination and the importance of disinfection, belonged to the pharmacy, where 83.3% of pharmacy students found it necessary to regularly replace the toothbrushes and 75.4% were aware of the importance of disinfecting the toothbrushes. In addition, 46.5% of pharmacy students reported the external environment as a major source of toothbrush contamination, followed by dental students who reported oral cavity microbes as the source of contamination. On the other hand, 88.1% of medical and 79.2% of dental students were aware of the contamination of toothbrush after regular use, and 89.5% of nursing students were aware of the effect of toothbrush contamination on general health. However, no statistically significant difference was found among the health sciences students.

Our findings for attitude-related questionnaire revealed that dental students (39%) followed the guidelines of ADA regarding the use of the same toothbrush for a period of 3 months. However, regarding seeking dental professional advice for the selection of toothbrush, frequency of brushing and storage of toothbrush after use, medical students showed the highest willingness (75.8%) among the health sciences students. Overall, female students showed better attitudes as compared with male students. The findings of the present study support the results of study findings from Saudi Arabia that female students considerably outperform their male counterparts in terms of oral health attitudes and behavior.<sup>30</sup>

Our study is in accordance with previous studies showed that healthcare students demonstrated variable knowledge, awareness, practice, and attitude regarding oral health and toothbrush storage and maintenance.<sup>31–33</sup> Therefore, increasing their knowledge of oral health will be important for their future responsibilities as advisors, service providers, and health sciences experts to their communities. In addition, research studies showed the importance of interprofessional education and training in enhancing health outcomes by enabling effective collaborations among the various healthcare sciences sectors which allows educators to work together and deliver authentic learning experiences for healthcare students who will be professionally working together in the future with the goal of improving patient care.<sup>34–36</sup>

Interdisciplinary educated and trained medical and health sciences students are needed to address the global health problem of NCDs, such as diabetes and cardiovascular diseases and their link to oral diseases. They can be trained on the risk factors to avoid oral disorders, numerous oral symptoms of diabetes, early detection of symptoms for prompt referrals to oral health experts and the management of periodontitis, diabetes, cardiovascular diseases, chronic respiratory diseases and cancer since there is a well-established association between these diseases, especially in groups with health inequalities and limited access to dental and healthcare.<sup>37,38</sup>

The current study has a few limitations. One of them is that the study was conducted at only one university in one of the seven emirates of the UAE. Additionally, due to the cross-sectional nature of this study, a causal conclusion could not be established. Data were also gathered by self-administered questionnaires, which could have impacted the accuracy of the findings since there was no objective assessment of students' oral health.

## CONCLUSION

Health sciences undergraduate students are the future healthcare providers who play a critical role in community education and general health promotion. It is obligatory for them to have a basic understanding of oral health and hygiene so that they will serve better for the overall well-being of society. This study demonstrated the satisfactory and positive correlation between the cohort as well as genders related to the practice, perception, and negative correlation for the attitude toward toothbrush selection, maintenance, and replacement. The present study emphasized the further need for providing oral health-related topics in the curriculum of undergraduate health sciences students through the different means of educational, community, and interprofessional activities. This may help in cultivating the overall oral health-related knowledge, attitude, perception, and practice of future healthcare providers.

## Clinical Significance

A satisfactory level of understanding regarding the selection, maintenance, and replacement of toothbrush was demonstrated by the undergraduate health sciences students. However, the inclusion of such health-related topics in the curriculum may improve further knowledge, attitude, perception of future healthcare providers, and overall impact on community health.

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## SUPPLEMENTARY MATERIALS

All the supplementary materials are available online on the website of [www.thejcdp.com](http://www.thejcdp.com)

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